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Editors

New Developments in the Theory of Networks

Franchising, Alliances
and Cooperatives

Editors

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Organization of Knowledge Transfer in Clusters: A Knowledge-Based View

Marijana Srećković and Josef Windsperger

Abstract In this paper, we develop a knowledge-based view on the organization of knowledge transfer in clusters. Starting from the information richness theory, we argue that tacitness of the partners' knowledge determines the information richness of the knowledge transfer mechanisms in clusters. We examine the following hypotheses: (a) If the cluster partners' knowledge is characterized by a low degree of tacitness, knowledge transfer mechanisms with a lower degree of information richness (e.g. email, intranet, documents, newsgroups) are used; (b) if the cluster partners' knowledge is characterized by a high degree of tacitness, knowledge transfer mechanisms with a higher degree of information richness (e.g. seminars, workshops, formal meetings) are used. We test these hypotheses by using data from the Green Building Cluster of Lower Austria. Using complexity, teachability and codifiability as measures for tacitness of the cluster partners' knowledge, the empirical results from Green Building Cluster in Austria partly support these hypotheses. Our results indicate that an increase in teachable knowledge results in the use of more knowledge transfer mechanisms with a lower degree of information richness, and an increase in complex, but articulable knowledge results in the use of more knowledge transfer mechanisms with a higher degree of information richness. In addition, we show that trust positively influences the use of all modes of knowledge transfer.

1 Introduction

Clusters are networks of firms in related industries within a given region (Porter 1998, 2000; Malmberg and Maskell 2002). The success of clustering depends on the complementarity of resources and capabilities of the cluster firms (Araújo et al. 2003; Windsperger 2006). Thus, firms will gain competitive advantage when the knowledge transfer is efficiently organized between the cluster partners (Maskell

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and Malmberg 1999; Calantone et al. 2002). In previous years, a large number of researchers in organization theory and management have examined knowledge transfer within and across organizational boundaries using the information (media) richness theory and the knowledge-based view of a firm. The first attempt was to answer the question of how to reduce ambiguity in order to facilitate the transfer of information, using the information richness theory (Daft and Lengel 1986; Russ et al. 1990; Dennis and Kinney 1998; Sheer and Chen 2004). The knowledge-based view of the firm (Barney 1991; Kogut and Zander 1992, 1993; Nonaka et al. 1996; Conner and Prahalad 1996; Grant 1996; Nickerson and Zenger 2004) argues that gaining competitive advantage by setting up networks requires effective mechanisms to facilitate interorganizational transfer of tacit and explicit knowledge (Zander and Kogut 1995; Inkpen 1996; Håkanson 2005).

In this paper, we develop a knowledge-based view on the choice of the knowledge transfer mechanism in clusters that integrates results from the information richness theory. We argue that the information richness theory offers a criteria ('information richness') to differentiate knowledge transfer mechanisms according to their information processing (or knowledge transfer) capacity. In clusters, knowledge transfer mechanisms with a relatively higher degree of information richness include seminars, workshops, conference meetings, visits and video conferences. Knowledge transfer mechanisms with a relatively lower degree of information richness include written documents, fax, email, intra- and internet and other electronic media. According to the knowledge-based theory, tacitness of partner knowledge determines the degree of information richness of the knowledge transfer mechanisms. The thesis of our paper is: The higher the degree of tacitness of the partners' knowledge, the more knowledge transfer mechanisms with a higher degree of information richness should be used to facilitate an efficient knowledge transfer between the cluster partners.

The paper is organized as follows: Section 2 reviews the relevant literature related to knowledge transfer in networks. In Section 3, we develop the knowledge-based view of knowledge transfer mechanisms and derive testable hypotheses. Finally, in Section 4 we test these hypotheses using data from the Green Building Cluster of Lower Austria.

2   Literature Review

Research on information and knowledge transfer in organizations started with the information richness theory in the 1980s (Daft and Macintosh 1981; Daft and Lengel 1984, 1986; Trevino et al. 1987; Daft et al. 1987; Russ et al. 1990; Sheer and Chen 2004). Recent studies extend this view to new electronic communication media (Lim and Benbasat 2000; Buchel and Raub 2001; Sexton et al. 2003; Vickery et al. 2004). According to this view, effective information and knowledge transfer requires a fit between task ambiguity/equivocality and 'richness' of the communication media. 'Information richness (IR)' consists of four attributes of the communication

mechanism: feedback capability, availability of multiple cues (voice, body, gestures, words), language variety, and personal focus (emotions, feelings). The more of these attributes a mechanism possesses, the higher the degree of IR, and the greater its capacity to handle ambiguity and hence its transfer capacity. Communication media with a relatively higher degree of IR refer to face-to-face interactions and team-based mechanisms (meetings, trainings, seminars, workshops, visits, video conferencing), while communication media with a lower degree of IR refer to written documents, such as manuals, reports, data bases, written instructions and electronic media.

Since the 1990s, many researchers in the field of the knowledge-based view of the firm have examined the problem of internal and inter-organizational knowledge transfer (Kogut and Zander 1992; Nonaka 1994; Szulanski 1995, 2000; Simonin 1999a, b; Argote 1999; Albino et al. 1999; Ancori et al. 2000; Argote et al. 2003; Bresnen et al. 2003; Nonaka et al. 2003; Gertler 2003; Jensen and Szulanski 2007; Szulanski and Jensen 2006; Haas and Hansen 2007; van Wijk et al. 2008; Paswan and Wittmann 2009). Starting from Polanyi's knowledge concept (Polanyi 1962), they investigated knowledge transfer in organizations and networks. According to the knowledge-based view of the firm, tacitness varies positively with the difficulty of knowledge transfer. However, most of this literature does not investigate the relationship between knowledge attributes and knowledge transfer mechanisms. Inkpen (1996), Inkpen and Dinur (1998) and Hong and Nguyen (2009) are exemptions. They go further by analyzing the relationship between knowledge characteristics and knowledge transfer mechanisms in multinational corporations. However, they do not develop a more general approach that explains the relationship between knowledge types and knowledge transfer mechanisms in networks. Furthermore, although a large number of cluster studies have been published in organization economics and management in the last decade, the problem of the organization of knowledge transfer between cluster partners remains largely unexplored.

To sum up, the existing literature has the following deficits: Firstly, it does not offer a theoretical framework for the explanation of the knowledge transfer mechanisms in inter-organizational relations, and secondly, it does not develop and test hypotheses about the design of knowledge transfer mechanisms in clusters. Starting from this gap, the objective of our paper is to develop a knowledge-based view on the choice of knowledge transfer mechanisms in clusters. Our main contribution to the literature is to combine the knowledge-based view with the information richness theory to explain the organization of knowledge transfer in cluster relationships. Furthermore, our study utilizes primary data from the Green Building Cluster of Lower Austria, which enables us to examine the factors influencing the choice of knowledge transfer mechanisms.

3   The Design of Knowledge Transfer Mechanisms in Clusters

According to the knowledge-based theory of the firm, the firm is a bundle of resources and capabilities that consists of a system of organizational routines for the creation and transfer of knowledge (Nonaka 1994; Grant 1996; Antonelli 1999;

Zach 1999). This view focuses both on explicit and tacit knowledge that must be created, processed and transferred. Tacit knowledge is the origin of competitive advantage, because it is highly personal, hard to formalize and, therefore, difficult to imitate (Nonaka et al. 1996). Derived from this knowledge-based view, we use the term knowledge transfer mechanisms for organizational routines that enable the transfer of explicit and tacit knowledge (Pedersen et al. 2003; Inkpen 2008; Jasimuddin 2007).

Which factors influence the choice of knowledge transfer mechanisms in networks? According to the knowledge-based view, the characteristic relevant for the determination of efficient knowledge transfer mechanisms is the degree of tacitness of knowledge. If the knowledge is explicit and thus codifiable, knowledge can be efficiently transferred by using knowledge transfer mechanisms with a lower degree of information richness (IR). If the knowledge is tacit and difficult to codify, higher-IR-transfer mechanisms are needed to process and transfer the less codifiable component of knowledge. This is compatible with Teece's view (Teece 1985, p 229): "Tacit knowledge is extremely difficult to transfer with-out...teaching, demonstration and participation". As tacitness of knowledge increases by degree, a larger knowledge transfer capacity and hence more higher-IR-knowledge transfer mechanisms are required for an efficient knowledge transfer. In addition, Berry and Broadbent (1987), Argote (1999) and Almeida and Kogut (1999) argue that high-IR-mechanisms facilitate both the transfer of tacit and explicit knowledge because of the complementarity between tacit and explicit knowledge (Roberts 2000).

To summarize the knowledge-based view on the choice of knowledge transfer mechanisms, we can state the following proposition: The higher (lower) the degree of tacitness of the partner-specific knowledge, the more knowledge transfer mechanisms with a higher (lower) degree of IR are needed to facilitate an efficient knowledge transfer between the partners.

Now we apply this approach to the organization of knowledge transfer in clusters. We start with an example of comparing three knowledge situations and ask the question which knowledge transfer mechanisms should be used (see Fig. 1).

First, we assume that the cluster partner's knowledge is codified in reports, manuals and databases. With a low tacitness-component, the knowledge can be easily transferred by using lower-IR-mechanisms (for example, postal mailings, fax, intranet, chat, online forum, newsgroups, email) (see FIT I in Fig. 1). *Second*, we assume that a large part of the partner-specific knowledge is tacit. In this case, most of the partner-specific knowledge and organizational capabilities reside within persons and groups of the cluster firms. With a high tacitness-component, the partner knowledge can be only transferred by using more higher-IR-mechanisms (for example, seminars, workshops, committees, meetings, video conferences) (see FIT II in Fig. 1).

If these alignment conditions are not fulfilled, the following inefficiencies may arise (Russ et al. 1990): (a) MISFIT I: If the partner-specific knowledge is mainly tacit, the knowledge cannot be efficiently transferred by using low-IR mechanisms. In this case, cluster partners are unable to understand and adequately apply the high

LOW-IR: Postal mailings, documents, fax, email, intranet, chat, online forum, newsgroups
HIGH-IR: Seminars, workshops, committees, meetings, video conferences
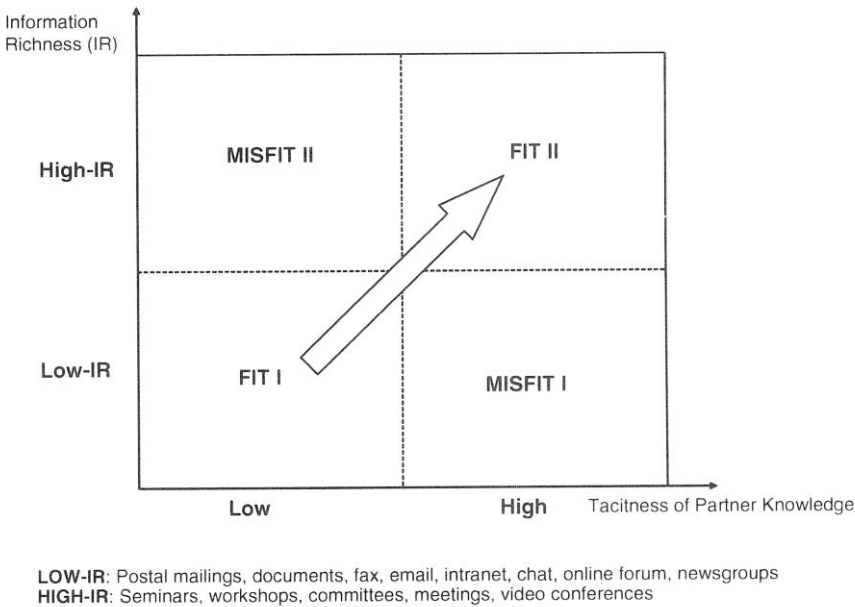
Fig. 1 Relationship between knowledge transfer mechanisms and knowledge attributes

tacitness-component of the other partner's knowledge, because it is based on organizational capabilities of employees and groups of the other partner's firm. (b) MISFIT II: If the partner knowledge is codifiable, it is not efficiently transferred by using high-IR mechanisms. Although high-IR-mechanisms facilitate the transfer of codifiable knowledge, it is not efficient because high knowledge transfer costs arise due to the high set-up costs of high-IR-mechanisms. In addition, due to behavioural uncertainty, the risk of information selection and manipulation increases under personal knowledge transfer mechanisms.

Third, we assume that the partner's knowledge is partly codifiable and partly tacit. Further, we assume that the explicit part is codified in manuals, reports, and databases, while additional partner-specific knowledge resides within managers, employees and teams at the cluster partner's firm. Although codified manuals, reports and databases exist, their utility for the cluster partners is relatively low because they cannot adequately apply the codified part of the partner-specific knowledge as this requires specific organizational capabilities. If, in this case, only lower-IR-knowledge transfer mechanisms are adopted, the partners are unable to adequately understand and apply the requisite partner-specific knowledge. Consequently, since a large part of the knowledge which is transferred to the partners is characterized by a higher degree of tacitness, low-IR-mechanisms are insufficient to facilitate the transfer of the requisite knowledge. In this case, both low- and high-IR-mechanisms are needed to efficiently transfer the partner-specific knowledge. Seminars, workshops and meetings would facilitate the transfer of the high

tacitness-component of knowledge and thereby also improve the understanding of the more explicit component of the partner knowledge.

As a result, the knowledge-based view on the organization of knowledge transfer in clusters can be summarized by the following hypotheses:

Hypothesis 1 (H1). *The use of knowledge transfer mechanisms with a higher degree of IR is positively related with the degree of tacitness of partner-specific knowledge.*

Hypothesis 2 (H2). *The use of knowledge transfer mechanisms with a lower degree of IR is negatively related with the degree of tacitness of partner-specific knowledge.*

4   Empirical Analysis

4.1   Sample and Data Collection

The empirical setting for testing these hypotheses is the Green Building Cluster of Lower Austria. This cluster is the new materials-independent economic hub for all areas of sustainable construction and living. It was established at the beginning of 2007, through a merger of the Wood Cluster of Lower Austria, founded in 2001, and the Green Building Cluster of Lower Austria, which was founded in 2003. The majority of the 175 partner companies are seated in Lower Austria, whereas a fewer number in the neighboring provinces and Salzburg. The main areas of focus of the Green Building Cluster of Lower Austria are (see http://www.ecoplus.at/ecoplus/cluster/beuc_en/BEUC_EN_R2.htm):

– Restoration and upgrading of older homes to low-energy home standards
– Living in comfort – healthy interior environments
– New multiple-level structures built to passive energy home standards

The cluster functions as a link between its partner companies and prospective clients (developers, municipalities, etc.) and its aim is to connect the existing national competencies in the area of sustainable building and living. The cluster management team is composed of architects and energy experts as well as professionals from the construction and interior furnishings industries. These experts are professionals involved in cooperative projects, R&D projects, and in general project management. They provide information, support and advice to the partner companies, regardless of the type of building product or construction style. Cluster partners profit from each other and work jointly on innovative and added-value oriented projects. This cross-linking of individual companies in the cluster makes it possible for the consumer to obtain a healthy, comfortable structure and equally suitable interior furnishings at an affordable price. Cluster management supports this networking by offering tailored consultation and qualification packages,

initiating and guiding innovative projects, and organizing joint presence on national and international markets.

We started our empirical work by obtaining the list of all network partners from ECOPLUS, a regional governmental institution in Lower Austria. ECOPLUS identified a total of 175 cluster firms in the Green Building Cluster in 2008. After several preliminary steps in the questionnaire development, including interviews with cluster partners at the Green Building Cluster of Lower Austria conference in St. Poelten, the final version of the questionnaire was sent out by postal mail and email to the general managers of the cluster companies in February 2008 and November 2008. General managers were judged to be the most suitable respondents, or key informants, as they are the top decision makers in the company regarding the organization of the knowledge transfer between the partner firms. Key informants should occupy roles that make them knowledgeable about the issues being researched (John and Reve 1982).The questionnaire took approximately 10 min to complete on the average. We received 48 completed responses – a response rate of 27.4%. The non-response bias was examined by investigating whether the results obtained from the analysis were driven by differences between the group of respondents and the group of non-respondents. Non-response bias was estimated by comparing early versus late respondents (Armstrong and Overton 1977), where late respondents serve as proxies for non-respondents. No significant differences emerged between the two groups of respondents. In addition, based on Podsakoff et al. (2003), we used Harman's single-factor test to examine whether a significant amount of common method variance exists in the data. After we conducted factor analysis on all items and extracted more than one factor with eigenvalues greater than one, we felt confident that common method variance is not a serious problem in our study.

4.2   Measurement

To test the hypotheses, the following variables are important: Information richness of knowledge transfer mechanisms, degree of tacitness of partner knowledge, and control variables (see Appendix).

4.2.1   Information Richness

Adapted from Daft and Lengel (1984) and Vickery et al. (2004), we differentiate the following knowledge transfer mechanisms in cluster relationships: Face-to-face (seminars, workshops, committees, formal and informal meetings); telephone and electronic media (emails, intra- and internet); written personal letters, formal documents and manuals; and numeric formal media (computer output). Face-to-face is the knowledge transfer mechanism with the highest information richness and numeric formal media with the lowest information richness. This hierarchy of

information richness is confirmed by empirical research (D'Ambra et al. 1998). Consistent with the information richness-hierarchy, we differentiate knowledge transfer mechanisms with a relatively higher degree of information richness (seminars and workshops, committees, formal and informal meetings, video conferences) and knowledge transfer mechanisms with a relatively lower degree of information richness (email, intra- and internet, chat discussions, online forum). Therefore, our study conceptualizes information richness in accordance with Daft and Lengel's approach. Information richness is measured by the extent to which the partner firms use email, documents, chat discussions, online forums, newsgroups, intranet, telephone, seminars, workshops, meetings, conferences and workshops, committees and videoconferences. The general managers were asked to rate the use of these knowledge transfer mechanisms on a seven-point scale. The higher the score, the higher is the company's use of a certain mechanism. Based on the information richness theory, we construct indicators for lower-IR-mechanisms (LIR) with intranet, chat discussions, online forum, newsgroups, email, internet, fax, formal letters and documents and for higher-IR-mechanisms (HIR) with seminars, workshops, committees, formal and informal meetings and video conferences (see Appendix).

4.2.2 Knowledge Characteristics

According to the knowledge-based view, tacitness of partner-specific knowledge determines the use of knowledge transfer mechanisms. Following Winter's taxonomy of knowledge (Winter 1987) and Kogut and Zander's argument (Kogut and Zander 1993; Zander and Kogut 1995), we use the following knowledge attributes to measure the latent construct of tacitness of knowledge: codifiability, teachability and complexity. Codifiability (COD) is the degree to which knowledge can be encoded and written down in manuals. When codifiability is high, the partner knowledge is considered more explicit. Teachability (TEACH) is the extent to which knowledge can be transferred through demonstration and participation. As Winter (1987), Teece (1985) and Håkanson (2007)point out, transfer of tacit knowledge, if possible at all, requires articulation (e. g. through demonstration and participation). Teachability is high when company knowledge can be taught to the cluster partner. However, if company knowledge cannot be taught due to its high degree of tacitness, the cluster partner cannot acquire and apply the requisite knowledge. For this reason, highly-tacit knowledge cannot be used and upgraded in cluster relationships. Kogut and Zander (1993, p 633) define complexity (COMPLEX) "as the number of critical and interacting elements embraced by an entity or activity". Similarly, Sorenson et al. (2006) define complexity in terms of the level of interdependence inherent in the subcomponents of a piece of knowledge (see Simonin 1999a, b). When the partner knowledge is more complex, it is considered more tacit. Applied to cluster relationships, complexity is high when the application of the partner knowledge requires a large number of heterogeneous, complicated and interdependent tasks, and when cluster partners have to master diverse

techniques in order to successfully apply the partner knowledge. To summarize, when the knowledge of the cluster firms is more codifiable, more teachable and less complex, it is considered less tacit.

Adapted from Zander and Kogut (1995), we use a battery of 14 items to measure codifiability, teachability and complexity of system-specific knowledge. We conducted a factor analysis to check for their dimensionality. The results of the factor analysis show that the items load on three factors referring to codifiability, teachability and complexity. Reliabilities of the final scales for COD, COMPLEX and TEACH pass the threshold of 0.7 (see Appendix).

4.2.3 Control Variables

Trust (TRUST): According to the relational view of governance (Dyer and Singh 1998; Poppo and Zenger 2002; Levin and Cross 2004; Gulati and Nickerson 2008; Mellewigt et al. 2007), trust may influence the use of knowledge transfer mechanisms in two ways: (a) Under the substitutability view, trust is a substitute for the use of formal knowledge transfer mechanisms (Gulati 1995; Yu et al. 2006). It mitigates the knowledge transfer hazards due to lower relational risk (Roberts 2000) and reduces the extent of formal knowledge transfer mechanisms (Lo and Lie 2008). Consequently, cluster companies are likely to use less HIR and more LIR when trust exists between the cluster partners, and use more HIR and less LIR when mistrust exists. (b) Under the complementarity view, trust overcomes communication barriers and facilitates knowledge sharing and increases the use of all knowledge transfer mechanisms (Seppänen et al. 2007; Blomqvist et al. 2005; Bohnet and Baytelman 2007; Liao 2009). Under a high level of trust, cluster partners use both more HIR and LIR because trust creates an incentive for intense and open communication. TRUST was measured with a four-items scale (see Appendix) (Cronbach alpha = 0.93).

SIZE: The number of employees is a proxy for the size of the firm. The larger the firm size, the more person-based HIR and the less information-based LIR are used.

4.3   Results

Table 1 presents the descriptive statistics for the sample in Lower Austria.

Table 1 Descriptive statistics		Mean	Std. deviation	N
	COD	1.9333	0.87843	48
	TEACH	2.3500	0.94125	48
	TRUST	3.4375	0.98641	48
	COMPLEX	2.6632	0.92476	48
	NUM_EMPLOYEES	30.21	54.950	48

Table 2 Correlations

	COD	TEACH	TRUST	COMPLEX	NUM_EMPLOYEES
COD	1				
TEACH	0.590	1			
TRUST	0.427	0.440	1		
COMPLEX	0.499	0.516	0.318	1	
NUM_EMPLOYEES	−0.051	0.265	0.050	0.179	1

To test hypotheses 1 and 2, we carry out a regression analysis. We conduct an OLS regression analysis with HIR and LIR as dependent variables, measuring the extent of the use of higher-IR-mechanisms and lower-IR-mechanisms. HIR refers to the use of seminars and workshops, committees, videoconferencing, formal and informal meetings between the cluster partners, and LIR refers to the use of intranet, chat discussions, newsgroups, internet, email, formal letters and documents. The general managers of the cluster companies were asked to rate the use of HIR and LIR on a seven-point scale. By averaging the scale values, we construct HIR- and LIR-indicators. The explanatory variables refer to complexity (COMPLEX), codifiability (COD) and teachability of knowledge (TEACH). Control variables refer to trust (TRUST) and the size of the companies (SIZE). Table 2 presents the correlations of the variables we use in the regression analysis. In addition, the variance inflation factors are well below the rule-of-thumb cut-off of 10 (Netter et. al. 1985). In summary, we do not find any collinearity indication.

4.3.1 Hypothesis 1: HIR

We estimate the following regression equation:

$$\text{HIR} = \alpha + \beta_1\text{TEACH} + \beta_2\text{COMPLEX} + \beta_3\text{COMPLEX} * \text{TEACH} + \beta_4\text{COD} + \beta_5\text{TRUST} + \beta_6\text{SIZE}.$$

According to the knowledge-based view, HIR varies positively with complexity (COMPLEX) and negatively with teachability (TEACH) and codifiability (COD). Additionally we include the interaction term TEACH*COMPLEX as the cluster partners are only able to transfer tacit knowledge if it is at least partly teachable (Winter 1987; Håkanson 2007). Furthermore, under the substitutability view, TRUST is negatively related with HIR, and under the complementarity view, TRUST is positively related with HIR. The larger the firm size, the more person-based HIR-knowledge transfer mechanisms are used. Table 3 reports the results of regression analysis for HIR. The coefficients of COMPLEX*TEACH is positive and significant. This is consistent with our hypothesis that an increase in tacit and articulable knowledge implies the use of more HIR. The coefficient of TRUST is

Table 3 Regression results for HIR

HIR	
Intercept	1.942*** (0.074)
COD	−0.063 (0.106)
TEACH	−0.032 (0.131)
COMPLEX	0.147 (0.127)
TRUST	0.310*** (0.086)
COMPLEX*TEACH	0.374** (0.184)
SIZE	−0.098 (0.083)
	F = 5.438
	Adj.R Square = 0.362
	N = 48

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$; values in parentheses are standard errors

Table 4 Regression results for LIR

LIR	
Intercept	1.355*** (0.322)
COD	−0.017 (0.122)
TEACH	0.321** (0.119)
COMPLEX	−0.161 (0.105)
TRUST	0.170* (0.092)
SIZE	−0.003* (0.002)
	F = 4.276
	Adj.R Square = 0.258
	N = 48

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$; values in parentheses are standard errors

highly significant supporting the complementarity view of trust. Trust facilitates knowledge sharing and increases the use of HIR (Seppänen et al. 2007). Conversely, the coefficients of teachability (TEACH), codifiability (COD) and SIZE are not significant.

4.3.2 Hypotheses 2: LIR

We estimate the following regression equation for LIR:

$$LIR = \alpha + \beta_1 TEACH + \beta_2 COMPLEX + \beta_3 COD + \beta_4 TRUST + \beta_5 SIZE$$

We expect that LIR varies positively with codifiability (COD) and teachability (TEACH) and negatively with complexity (COMPLEX). In addition, we expect TRUST is positively related with the use of LIR. The larger the size of the firms (SIZE), the more person-based HIR and less information-based LIR are used. Table 4 reports the results of the regression analysis for LIR. The coefficient of teachability

(TEACH) is positive and significant, which indicates that LIR supports the transfer of less tacit partner-specific knowledge. The coefficient of TRUST is slightly significant supporting the complementarity view of trust. Trust facilitates knowledge sharing and increases the use of both HIR and LIR. The coefficients of COMPLEX and COD are not significant. The negative coefficient of SIZE supports the view that the firms use less information-based LIR when the number of employees is large.

5   Discussion

In this paper, we have developed a knowledge-based view on the organization of knowledge transfer in cluster relationships. According to the knowledge-based view, the knowledge transfer between cluster partners is governed by more person-based HIR if the partner-specific knowledge is more tacit, and it is governed by more information-based LIR if the partner-specific knowledge is less tacit. Using complexity, teachability and codifiability as measures for tacitness of the cluster partners' knowledge, the empirical results from Green Building Cluster in Austria partly support these hypotheses. The results indicate that an increase in teachable knowledge results in the use of more LIR, and an increase in complex, but articulable knowledge results in the use of more HIR. Additionally, based on the relational view of governance, trust influences the organization of knowledge transfer between the cluster partners. Our data supports the complementarity view of trust: More trust facilitates information and knowledge sharing between the partners and hence increase the use of both LIR and HIR.

How does our approach extend the results in the literature? The major contribution of our study is the development of a knowledge-based view on the choice of knowledge transfer mechanisms in clusters. Our study utilizes primary data from the Green Building Cluster of Lower Austria enabling the estimation of factors the theory considers important to affect the organization of the knowledge transfer in clusters.

This study has some limitations: First, due to the small sample size the ability to generalize the results is limited. Further research analyzing data from other clusters with a larger number of cluster firms would help ascertain generalizability of our research results. Second, the measurement of the knowledge of the cluster partners is not without its own limitations. It is a first step to operationalize tacitness of knowledge by different knowledge attributes. Third, we have captured trust as a control variable at a rather general level. Conceptually, trust could take at least two forms (Lazzarini et al. 2008): Knowledge-based or belief-based trust related to the history of inter-organizational experience, and general trust related to the motivational characteristics of the partners. However, we did not differentiate between these two forms.

Appendix

Measures of Variables

Lower-IR-knowledge transfer mechanisms (LIR)	To what extent does the cluster company use knowledge transfer mechanisms with a lower degree of IR: (Intranet, chat discussions, online forum, newsgroups, email, fax, formal letters, existing documents) (1, no extent;. . .7, to a very large extent)
Higher-IR-knowledge transfer mechanisms (HIR)	To what extent does the cluster company use knowledge transfer mechanisms with a higher degree of IR: (Seminars, workshops, video conferences, committees, informal meetings, formal meetings) (1, no extent;. . .7, to a very large extent)
Complexity (COMPLEX) Coefficient alpha: 0.88	The general manager has to evaluate complexity on a 7 point scale (1,strongly disagree; . . .7, strongly agree):
	Complex 1: Cluster partners must master many diverse activities and tasks, in order to be able to apply the partner knowledge successfully
	Complex 2: The tasks and activities for the application of partner know-how are very difficult
	Complex 3: The tasks and activities for the application of the partner know-how are very heterogeneous
	Complex 4: The tasks and activities for the application of the partner know-how are very interdependent
	Complex 5: The partner know-how can be easily divided in separate tasks (reverse coded)
Teachability (TEACH) Coefficient alpha: 0.92	The general manager has to evaluate teachability on a 7 point scale (1, strongly disagree; . . .7, strongly agree):
	Teach 1: The cluster partners can easily learn the most important activities of the relationship through personal communication with employees of the partner firm
	Teach 2: The partners can easily learn the most important activities of the relationship through personal support provided by employees of the partner firm
	Teach 3: The employees of the cluster firms can master the new knowledge of the cluster partner through training
	Teach 4: Training to apply the new knowledge is a quick and easy job
	Teach 5: The cluster partners can easily learn the most important activities and tasks through job rotation between the cluster firms
Codifiability (COD) Coefficient alpha: 0.80	The general manager has to evaluate codifiability on a 7 point scale (1,strongly disagree; . . .7, strongly agree):
	Cod 1: Large parts of the business processes between the partner firms can be carried out by using information technology
	Cod 2: Critical parts of the business processes between the partners can be extensively documented in written form

(continued)

Trust (TRUST) Coefficient alpha: 0.93	The general manager has to evaluate trust on a 7 point scale (1, strongly disagree; …7, strongly agree):
	Trust 1: There is great trust between us and partners
	Trust 2: There is an atmosphere of openness and sincerity
	Trust 3: The mutual cooperation is on a partnership basis
	Trust 4: Information sharing between the partners exceeds the level stipulated in the contract
Firm size (SIZE)	Number of employees

References

Albino V, Garavelli AC, Schiuma G (1999) Knowledge transfer and inter-firm relationships in industrial districts: the role of the leader firm. Technovation 19(1):53–63

Almeida P, Kogut B, (1999) Localization of knowledge and the mobility of engineers in regional networks. Manag Sci 45(7):905–917

Ancori B, Bureth A, Cohendet P (2000) The economics of knowledge: the debate about codification and tacit knowledge. Ind Corp Change 9:255–287

Antonelli C (1999) The microdynamics of technological change. Routledge, London

Araújo L, Dubois A, Gadde LE (2003) The multiple boundaries of the firm. J Manag Stud 40 (5):1255–1277

Argote L (1999) Organizational learning: creating, retaining and transferring knowledge. Kluwer, Norwell, MA

Argote L, Ingram P (2000) Knowledge transfer: a basis for competitive advantage in firms. Organ Behav Hum Decis Processes 82(1):150–169

Argote L, McEvily B, Reagans R (2003) Managing knowledge in organizations: an integrative framework and review of emerging themes. Manag Sci 49(4):571–582

Armstrong JS, Overton TS (1977) Estimating non-response bias in mail surveys. J Market Res 14 (3):396–402

Barney J (1991) Firm resources and sustained competitive advantage. J Manag 17(1):99–120

Berry DC, Broadbent DE (1987) The combination of explicit and implicit learning processes in task control. Psychol Res 49(1):7–15

Blomqvist K, Hurmelinna P, Seppänen R (2005) Playing the collaboration game right – balancing trust and contracting. Technovation 25:497–504

Bohnet I, Baytelman Y (2007) Institutions and trust: implications for preferences, beliefs and behaviour. Rationality Soc 19:99–135

Bresman H, Birkinshaw J, Nobel R (1999) Knowledge transfer in international acquisitions. J Int Bus Stud 30(3):439–62

Bresnen M, Edelman L, Newell S, Scarbrough H, Swan J (2003) Social practices and the management of knowledge in project environments. Int J Proj Manag 21:157–166

Buchel B, Raub S (2001) Media choice and organizational learning. In: Dierkes M, Berthoin Antal A, Child J, Nonaka I (eds) Handbook of organizational learning and knowledge. Oxford University Press, New York, pp 518–534

Calatone RJ, Cavusgil ST, Zhao Y (2002) Learning orientation, firm innovation capability, and firm performance. Ind Mark Manag 24(4):277–284

Conner KR, Prahalad CK (1996) A resource-based theory of the firm: knowledge versus opportunism. Organ Sci 7(5):477–501

D'Ambra J, Rice RE, O'Connor M (1998) Computer-mediated communication and media preference: an investigation of the dimensionality of perceived task equivocality and media richness. Behav Inf Technol 17(3):164–174

Daft RL, Lengel RH (1984) Information richness: a new approach to managerial behavior and organizational design. In: Cummings LL, Staw BM (eds) Research in organizational behavior. JAI Press, Homewood, IL, pp 191–233

Daft RL, Lengel RH (1986) Organizational information requirements, media richness and structural design. Manag Sci 32(5):554–571

Daft RL, Macintosh NB (1981) A tentative exploration into the amount and equivocality of information processing in organizational work units. Adm Sci Q 26(2):207–224

Daft RL, Lengel RH, Trevino LK (1987) Message equivocality, media selection, and manager performance: implications for information systems. MIS Q 11(3):355–366

Dennis AR, Kinney ST (1998) Testing media richness theory in the new media: the effects of cues, feedback, and task equivocality. Inf Syst Res 9(3):256–274

Dyer JH, Chu W (2003) The determinants of trust in supplier-automake relationships in the U. S., Japan and Korea. J Int Bus Stud 31(2):259–285

Dyer JH, Singh H (1998) The relational view: cooperative strategy and sources of interorganizational competitive advantage. Acad Manag Rev 23(4):660–679

Gertler MS (2003) Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). J Econ Geogr 3(1):75–92

Grant RM (1996) Toward a knowledge-based theory of the firm. Strateg Manag J 17:109–122

Gulati R (1995) Does familarity breed trust? The implications of repeated ties for contractual choice in alliances. Acad Manag J 38(1):85–112

Gulati R, Nickerson JA (2008) Interorganizational trust, governance choice, and exchange performance. Organ Sci 19:688–708

Haas MR, MT Hansen (2007) Different knowledge, different benefits: toward a productivity perspective on knowledge sharing in organizations, Strateg Manag J 28(11):1133–1153

Håkanson L (2005) Epistemic communities and cluster dynamics: on the role of knowledge in industrial districts. Ind Innov 12(4):433–464

Håkanson L (2007) Creating knowledge: the power and logic of articulation. Ind Corp Change 16:51–88

Hong JFL, Nguyen TV (2009) Knowledge embeddedness and the transfer mechanisms in multinational corporations. J World Bus 44:347–356

Inkpen AC (1996) Creating knowledge through collaboration. Calif Manag Rev 39(1):123–140

Inkpen A (2008) Managing knowledge transfer in international alliances. Thunderbird Int Bus Rev 50(2):77

Inkpen AC, Dinur A (1998) Knowledge management processes and international joint ventures. Organ Sci 9(4):454–468

Jasimuddin SM (2007) Exploring knowledge transfer mechanisms: the case of a UK-based group within a high-tech global corporation. Int J Inf Manag 27:294–300

Jensen RJ, Szulanski G (2007) Template use and the effectiveness of knowledge transfer. Manag Sci 53(11):1716–1730

John G, Reve T (1982) The reliability and validity of key informant data from dyadic relationships in marketing channels. J Market Res 19(4):517–524

Kogut B, Zander U (1992) Knowledge in the firm, combinative capabilities and the replication of technology. Organ Sci 3:383–397

Kogut B, Zander U (1993) Knowledge of the firm and the evolutionary theory of the multinational corporation. J Int Bus Stud 24(4):625–645

Lazzarini SG, Miller GJ, Zenger TR (2008) Dealing with the paradox of embeddedness: the role of contracts and trust in facilitating movement out of committed relationships. Organ Sci 19:709–728

Levin DZ, Cross R (2004) The strength of weak ties you can trust: the mediating role of trust in effective knowledge transfer. Manag Sci 50:1477–1490

Liao TJ (2009) Cluster and performance in foreign firms: the role of resources, knowledge, and trust. Ind Market Manag 39(1):161–169

Lim KH, Benbasat I (2000) The effect of multimedia on perceived equivocality and perceived usefulness of information systems. MIS Q 24(3):449–471

Lo S, Lie T (2008) Selection of communication technologies – a perspective based on information richness theory and trust. Technovation 28:146–153

Malmberg A, Maskell P (2002) The elusive concept of localization economies: towards a knowledge based theory of spatial clustering. Environ Plann 34(3):429–449

Maskell P, Malmberg A (1999) Localised learning and industrial competitiveness. Cambridge J Econ 23(2):167–185

Mellwigt T, Madhok A, Weibel A (2007) Trust and formal contracts in interorganizational relationships – substitutes and complements. Managerial Decis Econ 28:833–847

Netter J, Wasserman W, Kutner MH (1985) Applied linear statistical models. Irwin, Homewood, IL

Nickerson J, Zenger T (2004) A knowledge-based theory of governance choice. Organ Sci 15:617–632

Nonaka I (1994) A dynamic theory of organizational knowledge creation. Organ Sci 5(1):14–37

Nonaka I, Takeuchi H, Katsuhiro U (1996) A theory of organizational knowledge creation. Int J Technol Manag 11(7–8):833–846

Nonaka I, Toyama R, Byosière P (2003) A theory of organizational knowledge creation: understanding the dynamic process of creating knowledge. In: Dierkes M, Berthoin Antal A, Child J, Nonaka I (eds) Handbook of organizational learning and knowledge. Oxford University Press, Oxford pp 491–517

Paswan AK, Wittmann CM (2009) Knowledge management and franchise system. Ind Market Manag 38:173–180

Pedersen T, Petersen B, Sharma D (2003) Knowledge transfer performance of multinational companies. Manag Int Rev 43(3):69–91

Podsakoff PM, MacKenzie SB, Podsakoff NP, Lee JY (2003) Common method biases in behavioral research: a critical review of the literature and recommended remedies. J Appl Psychol 88:879–903

Polanyi M (1962) Personal knowledge. Routledge and Kegan Paul, London

Poppo L, Zenger TR (2002) Do formal contracts and relational governance function as substitutes or complements? Strateg Manag J 23:90–118

Porter ME (1998) Clusters and the new economics of competition. Harv Bus Rev 76(6):77–90

Porter ME (2000) Location, competition, and economic development: local clusters in a global economy. Econ Dev Q 14(1):15–34

Roberts J (2000) From know-how to show-how: questioning the role of information and communication technologies in knowledge transfer. Technol Anal Strateg Manag 12(4):429–443

Russ GS, Daft RL, Lengel RH (1990) Media selection and managerial characteristics in organizational communications. Manag Commun Q 4(2):151–175

Seppänen R, Blomqvist K, Sundqvist S (2007) Measuring inter-organizational trust – a critical review of the empirical research in 1990–2003. Ind Market Manag 36:249–265

Sexton M, Ingirige B, Betts M (2003) Information technology-enabled knowledge sharing in multinational strategic alliances: media richness – task relevance fit. Working paper. http://itc.scix.net/paper w78–2003–294

Sheer VC, Chen L (2004) Improving media richness theory: a study of interaction goals, message valence, and task complexity in manager-subordinate communication. Manag Commun Q 11(1):76–93

Simonin BL (1999a) Ambiguity and the process of knowledge transfer in strategic alliances. Strateg Manag J 20(7):595–623

Simonin B L (1999b) Transfer of marketing know-how in international strategic alliances: an empirical investigation of the role and antecedents of knowledge ambiguity. J Int Bus Stud 30(3):463–490

Sorenson O, Rivkin JW, Fleming L (2006) Complexity, networks and knowledge flow. Res Policy 35:994–1017

Szulanski G (1995) Unpacking stickiness: an empirical investigation of the barriers to transfer best practice inside the firm. Acad Manag J (Best Papers Proceedings):437–441

Szulanski G (2000) The process of knowledge transfer: a diachronic analysis of stickiness. Organ Behav Hum Decis Processes 82(1):9–27

Szulanski G, Jensen RJ (2006) Presumptive adaptation and the effectiveness of knowledge transfer. Strateg Manag J 27(10):937–957

Teece DJ (1985) Multinational enterprise, internal governance and industrial organization. Am Econ Rev 75(2):233–238

Trevino LK, Lengel RK, Daft RL (1987) Media symbolism, media richness and media choice in organizations. Commun Res 14(5):553–574

Vickery SK, Droge C, Stank TP, Goldsby TJ, Markland RE (2004) The performance implications of media richness in a business-to-business service environment: direct versus indirect effects. Manag Sci 50(8):1106–1119

Van Wijk, Jansen JP, Lyles MA (2008) Inter- and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences. J Manag Stud 45:830–853

Windsperger J (2006) A resource-based view of competitive advantage of cities: headquarter advantages of Vienna in CEE, SEE J Econ Bus 2:20–31

Winter SG (1987) Knowledge and competence as strategic assets. In: Teece DJ (ed) The competitive challenge – strategies for industrial innovation and renewal, Ballinger, Cambridge, MA, pp 159–184

Yu C-MJ, Liao TJ, Lin ZD (2006) Formal governance mechanisms, relational governance mechanisms, and transaction-specific investments in supplier-manufacturer relationships. Ind Market Manag 35:128–139

Zach MH (1999) Developing a knowledge strategy. Calif Manag Rev 41(3):125–145

Zander U, Kogut B (1995) Knowledge and the speed of transfer and imitation of organizational capabilities: an empirical test. Organ Sci 6(1):76–92