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Knowledge management as second level management

Evidence from a survey

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von

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Abstract

This article deals with the question: What enables organizations to manage knowledge transfer? We present principal-agent theory as a foundation to explain barriers of knowledge transfer. We show mechanisms which can solve the principal-agent problem by means of network, organizational, and motivational characteristics. Thereafter, we give some empirical evidence from a survey with medical doctors. The results show that network characteristics in form of direct channels for interaction, organizational characteristics, and intrinsic motivation can support knowledge transfer. These three factors are part of a 'second level management'.

Keywords: knowledge transfer, knowledge management theory

Introduction

Modern organizations need knowledge to produce goods or services. In order to create and distribute knowledge it must be transferred between employees as producers of knowledge. Our main research question is to explore how knowledge transfer can be supported. We will show how knowledge transfer can be managed.

Knowledge transfer is a multilevel phenomenon and can be realized on the individual, intra-organizational, or inter-organizational level. In alignment with Argote and Ingram (2000) Inkpen and Tsang (2005) define knowledge transfer as a process through which one unit is affected by the experience of another unit. On the individual level units are organizational members, in the case of intra-organizational level units are business units, and on the inter-organizational level units are organizations. "Knowledge transfer manifests itself through changes in knowledge or performance of the recipient unit" (Inkpen and Tsang, 2005: 149). This definition bases on Szulanski's communication model of best practise transfer: "Transfers of best practice are thus seen as dyadic exchanges of organizational knowledge between a source and a recipient unit in which the

identity of the recipient matters” (Szulanski 1996: 28). In alignment with Hedberg (1981: 6) who stated “Organizations have no other brains and senses than those of their members” we assume that even if organizations transfer knowledge on the intra- or inter-organizational level, processes of knowledge transfer always include the individual level. Therefore, we will focus on the individual level.

In recent years many assumptions about supporting factors of knowledge transfer and barriers of intra-and inter-organizational knowledge transfer appeared in literature. All in all three main factors are emphasized: (1) knowledge characteristics, (2) organizational characteristics, and (3) network characteristics (Easterby-Smith et al. 2008; van Wijk et al. 2008).

(1) The first factor contains several characteristics of knowledge: knowledge *ambiguity* (Szulanski et al. 2004; Levin and Cross 2004), *stickiness* (von Hippel 1994; Szulanski 1996), *complexity* (Simonin 2004), and *codified* knowledge in routines (Argote and Darr 2000). Ambiguity describes the uncertainty, what the underlying knowledge components and sources are and how they interact. Stickiness is defined as the “incremental expenditure required to transfer that unit of information to a specified locus in a form usable by a given information seeker. When this expenditure is low, information stickiness is low; when it is high, stickiness is high” (von Hippel 1994: 430). Knowledge that is embedded in routines is easier to transfer than knowledge that is not codified (Argote and Darr 2000) or is embedded in experts’ work contexts (Hsiao et al. 2006). Knowledge transfer by routines must balance leveraging current knowledge with developing new knowledge (Collinson and Wilson 2006).

(2) Organizational characteristics that influence knowledge transfer are *personnel movement* (Gruenfeld et al. 2000, Almeida and Kogut 1999), *absorptive capacity* (Cohen and Levinthal 1990, Jansen et al. 2005), and *size* (Gupta and Govindarajan 2000).

(3) Network characteristics are *number of relations* (Gupta and Govindarajan 2000; Hansen 1999), *pattern of relations* (Cook et al. 1993), *trust* (Szulanski et al. 2002, 2004), *tie strengths* (Hansen 1999), and *shared visions* (Lane et al. 2001).

Most of these factors are tested in a meta-analytic review by van Wijk et al. (2008) and a lot of supporting factors are detected. Nevertheless, the ability of knowledge transfer is analyzed, sometimes also the volition or motivation, but seldom the combination of ability and volition. Therefore, we will emphasize the combination of ability and volition as supporting factors of knowledge transfer.

It is necessary that employees on the individual level are motivated to transfer knowledge when they have opportunities for transferring. And the other way round, it is necessary that they have leeway to transfer knowledge when they are motivated. We will focus in this article on both: organizational ability of knowledge transfer and motivational volition and test our assumptions with the help of a survey regarding knowledge transfer in German Hospitals.

The basic problem with knowledge transfer is the 'invisibility' of knowledge: It is very difficult to assess for an outsider how much someone else knows. This information asymmetry makes it very difficult to control knowledge transfer directly. This situation is very similar to the original problem of the principal agent theory (Eisenhardt 1989).

In the following we model knowledge transfer as a principal agent problem and develop our hypotheses about requirements for knowledge transfer. The empirical evidence from our research project among doctors we conducted 2006 in 11 hospitals in Germany leads us to relevant prerequisites for knowledge transfer.

Knowledge transfer as a principal agent problem

For the development of our hypotheses we need some theoretical underpinning for knowledge transfer on the individual level. For that reason we follow a

definition of knowledge transfer which is modeled as a principal agent problem. Principal-Agent-Theory assumes rational, profit maximize actors (Jensen and Meckling 1976; Eisenhardt 1989). The starting point is a 'worst case scenario', i.e. the absence of social rules or any form of government. The consequence is that all agents maximize their utility. In organizations two types of actors can be distinguished: principals and agents. Principals are the proprietors of a company, agents the managers of the company. The approach is also used for every relationship between superiors (principals) and subordinates (agents). The basic assumption of the Principal-Agent-Theory is the asymmetric information between principal and agent: Agents know much more about their own achievement potential than the principal. And they use this information asymmetry for maximizing their own profit while they are shirking, that means they reduce their effort for a given amount of incentives. Three agency problems – all from the principal's point of view – are discussed in the literature (Arrow 1985): hidden characteristics, hidden action, and hidden knowledge. Hidden characteristics describe the unknown qualification of the agent before the agent will be hired. Hidden action describes the unknown effort for the agent to achieve targets. Hidden knowledge is the unknown relevant knowledge an agent possess. Hidden knowledge (also described as moral hazard) can be used to analyze knowledge transfer. The principal cannot monitor the knowledge of the agent: Does the agent transfer all his or her knowledge or does he or she hold some knowledge back?

Standard solutions are monitoring, selective incentives, and punishment (Eisenhardt 1989). If the principal can motivate the agent with the help of selective incentives it is in the self interest of the agent not to shirk, even there is a not observable information asymmetry. In this case selective incentives will change the agent's individual payoff (Kollock 1998). In the literature a lot of examples for incentives, punishments, or forces in the case of knowledge transfer are mentioned (Osterloh and Frey 2000, Wilkesmann and Rascher 2005).

Nevertheless, in case of knowledge transfer, the solution by selective incentives is limited because it is very difficult to monitor and reward knowledge transfer by a superior (Osterloh and Frey 2000; Frey and Osterloh 2002). In general we can say that establishing a hierarchy is not a very successful solution in this case. This is due to the fact that unobservable knowledge cannot be monitored or rewarded by the monitoring and sanction capacity of the hierarchy (Miller 1992). Therefore, we have to find other solutions for the hidden knowledge problem regarding knowledge transfer.

Alternative solutions describe strategies which change the individual payoffs by creating new network characteristics, organizational characteristics (see above), or motivational characteristics changing the utilities. All these solutions have in common that there are no direct interventions for principals to support knowledge transfer among his or her agents. Principals can only manage constraints which mean they can only arrange the frameworks under which their agents operate and not dictate their actions.

Nevertheless, the advantage of this approach is that government mechanism can be detected to overcome this worst case scenario, even though this mechanism existed already in 'real life' social situations. Medical diagnosis is an intellectually complex task and it is also a product of a complex social process involving agents who vary in their status and their area of expertise. If a team of doctors for example treats a patient in a hospital, obtaining knowledge that could specify the cause of a patient's symptoms is a complex task. A diagnosis is not only cognitively complex task, it is also socially complex (Cicourel 1990). On one side every doctors is expert for one aspect and therefore relevant for curing the patient. On the other side every doctor has a lot of other patients and is interested in reducing his or her effort.

Network characteristics

As above mentioned the number and pattern of relations can change the utility of the transfer situation (Gupta and Govindarajan 2000; Hansen 1999; Cook et al.

1993). Number of relations to other firms or units increases the likelihood that relevant knowledge can be accessed. The pattern of relations characterise the exchange relations and the distance to the knowledge source. Knowledge transfer is greater when direct social contact exists (Baum and Berta 1999). Hansen (1999) combines network theory and the notion of complex knowledge. Weak ties between organizational units help a team searching for useful knowledge in other organizational units but impede transferring complex knowledge. Trust is important because the knowledge source has to be perceived as reliable otherwise knowledge transfer will be hampered (Szulanski et al. 2002). The network structure of the transfer relationship is a main constraint. The network structure (positive or negative connections) and the distance of each point in the network from the source point affect the distribution of an exchange good (Cook et al. 1993; Yamagishi et al. 1988), which is in our case knowledge. The more direct the relationship is and the more alternative sources are available, the less difficult the exchange is.

In large networks like organizations, people exchange their knowledge through different channels. On one side, hospitals set up regular meetings like ward rounds or case conferences, and on the other side they establish informal opportunities like coffee breaks. Furthermore, additional interaction channels exist like the internet and databases which may increase knowledge transfer. Direct channels are defined as vis-à-vis interaction without a middle-man. It can be computer mediated or face-to-face interaction. Indirect channels are positive connected interaction relations where an agent has only a relationship to another agent via a third person. Especially in the case of the internet and databases the network structure is characterized as an all-channel network and therefore resources like knowledge are conveniently available. We summarize these findings to our first hypothesis:

Hypothesis 1: The more an agent uses direct network channels, the more knowledge will be transferred.

In this case the principal monitors not directly the behavior of the agents. He or she only manages abilities, e.g. providing interaction channels and opportunities of interaction, and changes choice opportunities of the agent.

Organizational Characteristics

Organizational characteristics can change the utility of knowledge transfer. For example, when members move from one group to another it is possible that they transfer tacit as well as explicit knowledge (Berry and Broadbent 1987). Another factor is *absorptive capacity* which describes the ability to recognize, assimilate and apply new external knowledge (Cohen and Levinthal 1990; Jansen et al. 2005). Another important variable is the *size* of the unit or organization (Gupta and Govindarajan 2000).

We will focus on the joint perception of the organizational situation. Most of the agents will not shirk if all actors perceive the situation within the framework of a joint social value orientation. In organizations joint value orientations are subsumed under the term of organizational culture. The research question is what type of organizational culture can change the utilities of employees so that they are enabled to transfer their knowledge.

Culture is also a constraint for social control (Ouchi 1979: 838). According to Ouchi social agreements, shared values, and beliefs are relevant prerequisites for knowledge transfer. An organizational culture that involves norms for cooperation and for helping each other makes knowledge transfer more probable than hierarchical cultures in which agents compete with each other to win their principal's favor.

Cultural aspects, especially involvement and consistency are important for knowledge transfer (Zárraga and Bonache 2005; Ngoc 2005). Involvement in organizational culture leads to commitment to their work on the agent's side because agents perceive that they can influence work relevant decisions (Fey and Denison 2000). This perception supports knowledge transfer because agents feel important, if they notice that their information will be important for other

agents. Involvement consists of the dimensions empowerment, team orientation, and capability development. We predict that team orientation is the most important cultural factor for knowledge transfer. If all agents are oriented towards the team goal, knowledge transfer is not considered to be a problem because the agents already replaced their own goals with the team's objectives.

Consistency means to share core values and to commit to a clear agreement on how to handle matters in the organization. This is important because "(B)behavior is rooted in a set of core values, and leaders and followers are skilled at reaching agreement even when there are diverse points of view" (Fey and Denison 2000: 7). Consistency is also a crucial factor for the success of knowledge transfer because it makes organizational surroundings more predictable and therefore more secure. In our survey we decided to use only these two scales. One reason is that they were tested in recent studies (Zárraga and Bonache 2005; Ngoc 2005). The other reason is that we did not use the other two dimensions (adaptability and mission) because they did not seem to add insight in overcoming the principal-agent problem. Mission seems to be more about the management set goals and not the lived ones. Adaptability with organizational learning as a sub-dimension is similar to knowledge transfer and does not contribute another independent explanation on how to promote knowledge transfer.

An agent in an organization needs time to learn to behave like the normatively integrated agents. Tenure is assumed to correlate positively with normative and cultural socialization (Cicourel 1990; Rollag 2004). To depict this learning process we control for organizational tenure.

An organizational culture with high team orientation and consistency changes the utilities of the employees so that shirking is overcome. Therefore, our second hypothesis is:

Hypothesis 2: The higher the team orientation and consistency in an organizational culture are the more knowledge will be transferred.

Motivational Characteristics

The behavior of agents is not only influenced by the ability to transfer knowledge, but also influenced by changing the motivational structure. If agents are intrinsically motivated (Heckhausen 1991; Ryan and Deci 2000), shirking does not appear (Frey and Osterloh 2002; Osterloh and Frey 2000; Frey 1997; Wilkesmann and Rascher 2002). Principals can arrange working situations which are jointly perceived among agents as intrinsically motivating to support knowledge transfer. If agents are intrinsically motivated, they share their knowledge because they enjoy working together. Therefore, the strategic use of their knowledge is not part of their options. They do not calculate how to derive a profit from their cooperation (for evidence see Wilkesmann and Rascher 2005; Tummers et al. 2006). McLure, Wasko and Faraj (2005) found a weak correlation between intrinsic motivation and knowledge sharing. Wilkesmann and Rascher (2005) though, provided a stronger empirical evidence for intrinsic motivation as a factor to overcome the shirking position in a knowledge transfer situation. They investigated a database which was an interactive knowledge management tool, intended to show global available information from the focal areas marketing and sales. The database was, however, more than only a document management system. It was developed to be used as an interactive medium for daily work. The analyzed database served also the purposes of finding necessary experts world-wide. The database's most frequently used function was the urgent request. Hereby all employees received some extrinsic rewards, if they participated, i.e. providing answers and posting requests. The most powerful motivating factor was not the extrinsic reward but their intrinsic motivation. Therefore, our third hypothesis is:

Hypothesis 3: The higher the intrinsic motivation of an agent is the more knowledge the agent will transfer.

The Survey

Hospitals serve as our scenario to test the principal-agent framework. They need knowledge based team work to assure the health of the patient: their jointly produced good. To test our hypotheses we focus on knowledge transfer in hospitals as a specific kind of organization. Most research on hospitals consists of qualitative research (e.g. Hindmarsh and Pilnick 2002), while quantitative studies on the organizational field of hospitals (e.g. Aiken and Patrician 2000) are few and far between. With the rich qualitative background, we chose a quantitative approach, enriched with qualitative methods like focused interviews and group discussions which are not reported here.

The Sample

From all hospitals in North Rhine-Westphalia (Germany) 11 hospitals took part in our quantitative survey which we conducted from February to May 2006. We cannot readily say why hospitals took part in the survey or not. What we can say is which types of self-selection bias may or may not apply. In our sample are hospitals in various phases of re-structuring, i.e. before, during, and after. We cannot know how those phases are distributed in the hospital population but since we have all types covered, it may not be a serious problem. Since it is normally not known to hospitals if they 'excel' in the key factors of our survey (e.g. intrinsic motivation, teamwork, knowledge transfer etc.) in relation to other hospitals it is not probable to have a bias there. Even if there is a bias in our survey regarding these factors, it would not pose a problem in the regression analysis, because those variables are controlled for. Biggest influence in partaking in the survey seems to be the personal decision of the management. We do not assume that managers with this kind of mindset correlate strong with the kind hospital they are in. At least we think it would take them long to change those factors, since these can only be changed indirectly, as apart of a second level management.

We distributed 667 questionnaires for our quantitative investigation and 192 usable questionnaires were returned, which represents 28.7% rate of return. The mean age of doctors is 40.8 years. The average tenure is 6.8 years and 55% of the responding doctors are male. The distribution of age, sex, and the size of the hospitals reflects the situation in hospitals in North Rhine-Westphalia (Germany) and is therefore representative in this respect.

The dependent variable

We assess knowledge transfer (Nonaka et al. 2006; von Krogh et al. 2000) by using 7 self developed items (table 1), each measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The items show how and in which direction knowledge transfer is accomplished. We use principal component analysis to see if we can reduce the number of variables and build scales. Two latent variables were detected, which we call ‘providing knowledge’ and ‘obtaining knowledge’. The factors are defined by an eigenvalue greater than one, according to the Kaiser-criterion. An orthogonal rotation following the varimax method with Kaiser-normalization makes it easier to interpret the factors (q.v. table 1). With a KMO-value of 0.762 and an explained variance of 73.25% the factors are distinguished.

Table 1: Principal component analysis with varimax-rotation ‘knowledge transfer’

<i>Items ‘knowledge transfer’</i>	<i>factor 1</i>	<i>factor 2</i>	<i>alpha</i>
I show colleagues special procedures so that they can learn them.	0.937	0.055	providing knowledge 0.898
I support colleagues’ efforts to gain work experience.	0.893	0.152	
Colleagues learn a lot by watching me on the job.	0.899	0.018	
I learn a lot by observing colleagues doing their job.	0.034	0.784	obtaining knowledge 0.822
I turn to colleagues for advice regarding special procedures so that I learn them.	0.114	0.8	
Colleagues support my efforts to gain work experience.	0.008	0.836	
I learn a lot by asking colleagues.	0.006	0.98	

The factors describe situations of face-to-face interaction, where knowledge is transferred. Both scales 'providing knowledge' (alpha =.898) and 'obtaining knowledge' (alpha =.822) are highly reliable. Both scales range from 1 (not providing/obtaining knowledge) to 5 (providing/obtaining a lot of knowledge) and are used as dependent variables in our regression models. Respondents did not distinguish between the tacit knowledge and explicit knowledge items. The directions of knowledge transfer seemed to be more important.

This is – from a theoretical point of view – an interesting finding since principal-agent theory would suggest that offered knowledge will automatically be taken. This means that mechanisms and constraints promoting knowledge transfer should not be different for providing and obtaining knowledge because the assumption is that knowledge transfer is one action; knowledge is either transferred or not. Thus, there should not be a difference in our data. The principal component analysis shows that knowledge transfer is clearly divided into two different actions: the taking and giving of knowledge. We will come back to this in our conclusion.

The independent variables

Our *first hypothesis* – the more an agent uses direct network channels, the more knowledge will be transferred – is tested by four channels, where agents can interact directly without a middleman. Following Denison and Mishra (1995) and Ngoc (2005), we chose two of their items as examples for communication channels and adapted them to our research field. Those two are: 'I participate in all important meetings held in my hospital.' and 'I usually take opportunities to discuss work related things in my work break with colleagues.', measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Additionally we asked how frequent the internet or databases were used (both were coded: 0 = not using, 1 = using once a week, 2 = using thrice a week, 3 = using once a day, 4 = using several times per day).

For the *second hypothesis* – the higher the team orientation and consistency in

an organizational culture are the more knowledge will be transferred – we also draw on the work of Denison and Mishra (1995), Ngoc (2005), and additionally Zárraga and Bonache (2005). To quantify team orientation we used the items ‘Teams of my occupational group (doctors among themselves) are the primary building blocks of this hospital’, ‘Interdisciplinary teams of (doctors and nursing staff) are the primary building blocks of this hospital’, ‘Cooperation and collaboration across functional roles (nursing staff <-> doctors) are actively encouraged in this hospital’, and ‘Working in this ward is like being part of a team’; measured on a five-point Likert scale. The first item is used to measure ‘intra-professional’ team orientation, while the other three items combined into a scale ($\alpha = .687$) measure ‘inter-professional’ team orientation.

The ‘consistency’ dimension is measured by two items: ‘The managers in this hospital ‘practice what they preach’ (correspondence) and ‘We seldom have trouble reaching agreement on key issues’ (problem solving). Additionally, in accordance with Rollag (2004), we assume that knowledge transfer will increase with tenure.

The leverage of intrinsic motivation on knowledge transfer, our *third hypothesis*, is measured by a four item scale. The items are: ‘I’m proud about doing a good job’, ‘I feel comfortable if I’m doing a good job’, ‘I feel sad and unlucky if I realize that I didn’t work well’, and ‘My job is joyful’. The intrinsic motivation scale is acceptably reliable with $\alpha = .714$ (the items were developed by the authors).

Apart from these hypothesis-driven independent variables we also included a gender-variable to check for gender-sensitivity in knowledge transfer. A table with mean, standard deviation, and correlation of our variables is added to the appendix.

Empirical Results

Theory and data suggest a linear relationship, so we used OLS-regression analyses to test our hypotheses. Since we have no assumptions of ‘providing knowledge’ and ‘obtaining knowledge’ affecting each other we use two separate models. Also there is no significant relationship if these scales were entered in the respective models as independent variables, which is not surprising due to the scales being based on a main component analysis (see above). Table 2 shows the results of the regression models. The shown effects are presented as standardized beta-coefficients and therefore comparable in their relative strength.

The adjusted r^2 shows that the general fit of our models is greater for providing than for obtaining knowledge. Both models explain over 20% of variance (nearly 30% for knowledge providing), which is quite good, since we tried to derive our variables from theory to test hypotheses. Even if other models would fit the data better, resulting in a higher r^2 , it would not add to the understanding of the antecedents of knowledge transfer.

There are no multicollinearity problems (vif is always smaller than 2) in our models. We have some signs of heteroscedacity (i.e significant Breusch/Pagan test, while White’s test is not significant) but only for the knowledge providing model; there we use robust standard errors.

Table 2: Regression. Providing and obtaining knowledge for doctors on structural and motivational solutions.

N=192	providing	obtaining
meetings	0.155*	- 0.034
breaks	0.059	0.183*
internet use	0.193**	0.06
database use	- 0.049	0.14*
intrinsic motivation	0.233**	0.149*
inter-professional team orientation	0.124	0.076
intra-professional team orientation	0.192**	0.033
correspondence	- 0.087	0.125+
problem solving	0.05	0.16*
tenure	0.267**	- 0.111
gender (0: female, 1: male)	0.051	- 0.115
adj. r ²	0.296	0.215

** $p < 0.01$ * $p < 0.05$ + $p < 0.1$

The more intensive direct channels for interaction are used within organizations the more knowledge will be transferred (hypothesis 1), is supported. We find positive and significant effects for the interaction channels. Obtaining knowledge is affected by different channels than providing knowledge. While meetings and the use of the internet promote providing knowledge, the more informal channel of 'breaks' and the 'database use' have a positive effect on obtaining knowledge. The internet is known as medium where one can reach a lot of people with low costs to do so, whereas databases are associated with the expectation of finding answers to pointed questions. Participating in formal meetings supports knowledge providing because it also is a low cost option to reach many people. The more informal occasion of breaks support obtaining knowledge. Very often the informal context can be adapted more easily to individual needs and problems.

We find support for hypothesis 2: the higher the team orientation and

consistency in an organizational culture are the more knowledge will be transferred. If doctors perceive a high inter-professional team orientation, it enhances knowledge providing. Correspondence and problem solving have some effects on obtaining knowledge. As predicted, with longer tenure, more knowledge is provided. Knowledge obtaining, however, is not associated with tenure or team orientation.

Our findings support hypothesis 3: intrinsic motivation instigates knowledge transfer. Intrinsic motivation always shows strong positive effects on knowledge transfer and is the only variable which shows an effect on both: knowledge providing and knowledge obtaining.

The control variable gender does not show a significant effect on knowledge transfer.

To sum up, the most important factors for doctors to provide knowledge are: meetings and internet use (H1), team orientation (H2), knowing their surroundings (tenure, H2) and intrinsic motivation (H3). To obtain knowledge for doctors the following solutions work best: Informal backgrounds like work breaks and database access (H1), intrinsic motivation (H3), as well as an aspect of consistency in organizational culture (H2).

Conclusion

In the case of knowledge transfer superiors cannot overcome the hidden knowledge (asymmetry) directly because they cannot monitor and reward knowledge transfer. For our case the hidden knowledge problem among agents is more relevant than the hidden knowledge problem between the principal and the agent. Among agents exists asymmetric information, too. Even peers can not evaluate if another peer is shirking, e.g. holds knowledge back, since they do not know what the peer learned in his or her whole life, and also peers can not observe knowledge in the brains of other peers. Here too, the basic assumption is a 'worst case scenario': The peers have no joint history. For

managing knowledge transfer among agents principals have only the opportunity to manage constraints or frameworks of their subordinates' choices. One consequence is that this given framework by superiors affects knowledge among agents in a positive way, too. We call this 'second level management'. Knowledge transfer can be supported by creating new structures but not by monitoring and punishing agents.

Furthermore, the results of our survey show that knowledge transfer on the individual level involves two directions – providing and obtaining knowledge – which are differently affected by second level management. In addition our results support the importance of intrinsic motivation for knowledge transfer (Osterloh and Frey 2000). In accordance with Szulanski et al. (2002), Baum and Berta (1999), and Shaw (1964), the organizational context has to enable transfer by providing direct channels where agents can exchange their knowledge directly and without a middleman as well as providing an appropriate organizational culture.

The empirical insights from our survey show that knowledge transfer is – as predicted by our installment of principal agent theory – instigated by intrinsic motivation, intensive use of direct communication channels, and an enabling organizational culture. Against our assumptions, knowledge that is offered is not automatically transferred. We can see that upon closer inspection, no model supports the same set of variables. With the exception intrinsic motivation, obtaining knowledge and providing knowledge draw on different sources. Providing and obtaining knowledge are pushed by different factors of the same dimensions: While 'knowledge providing' increases with a more intensive use of the internet and attending formal work meetings, knowledge obtaining strives with database use and work-related conversation in breaks. More knowledge will be provided, if a high team orientation exists, while general problem solving capacity furthers the obtaining of knowledge.

Our survey discovers limits of the principal-agent theory which does not account for two separate actions, i.e. providing and obtaining of knowledge.

When a third actor is added to a group of agents we can see which additional problems arise and how to handle them. The problem between principal and agent is still the knowledge asymmetry but it is not the work an agent has to do for the principal directly but the transfer of knowledge to another agent who works for the same principal. There a second problem arises: Why should (or could) the second agent learn something from the first one? Problems here include trust, absorptive capability etc. (Szulanski et al. 2002; Jansen et al. 2005; Cohen and Levinthal 1990).

Practical consequences for managers from our survey could include the following challenges: Create channels for interaction and pay attention to organizational culture and work environment. Build 'stages' for knowledge providing, where those who share their knowledge can get their praise but also create those little opportunities in the daily workflow which allow for pointed questions and clarifying, perhaps without the eyes and ears of *all* other co-workers.

All these structures describe a 'second level management', i.e. management can only supply opportunities where people can provide and obtain knowledge. Management can create constraints that support knowledge transfer but employees or members of organizations have to act. Managers cannot directly monitor, reward, or punish the transfer of knowledge. Knowledge work has to be managed at a second level. Managers need to treat employees as the most valuable assets the organization offers because organizational culture and intrinsic motivation are vulnerable factors. It is easier to undermine them than to build them up.

To prove if our findings can be generalized, it is necessary to conduct additional research. The survey only sheds light on the situation in German hospitals. Other organizations and countries with different organizational structures and cultures must be included before a general principal-agent based theory of knowledge transfer can be written.

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Appendix

Table 3: Correlation matrix

Doctors (n=192)	mean	sd	providing knowledge	obtaining knowledge	meetings	breaks	internet use	databank use	inter professional team orientation	intra professional team orientation	correspondence	problem solving	tenure	intrinsic motivation
providing knowledge	3.75	0.95	1											
obtaining knowledge	3.36	0.89	0.150*	1										
meetings	3.48	1.14	0.219*	0.104	1									
breaks	3.61	1.1	0.254*	0.250*	0.274*	1								
internet use	1.97	1.46	0.277*	0.118	-0.015	0.138+	1							
databank use	1.8	1.33	0.002	0.171*	0.025	0.005	0.251*	1						
inter professional team orientation	3.704	0.82	0.207*	0.254*	0.303*	0.143*	0.000	0.003	1					
intra professional team orientation	2.99	1.169	0.272*	0.236*	0.022	0.301*	0.176*	0.221*	0.147*	1				
correspondence	2.5	1.144	0.026	0.22**	0.143*	0.011	-0.069	-0.062	0.394*	0.213*	1			
problem solving	2.91	1.115	0.23**	0.322*	0.129*	0.247*	0.207*	0.038	0.299*	0.253*	0.24*	1		
tenure	6.78	6.72	0.232*	-0.231*	0.000	-0.020	-0.033	-0.175*	-0.119*	-0.085	-0.096+	-0.11+	1	
intrinsic motivation	4.02	0.68	0.324*	0.291*	0.074	0.172*	0.118	-0.038	0.232*	0.177*	0.112+	0.268*	-0.069	1
gender	f: 44.27 %	m: 55.73 %	0.153*	-0.112	-0.067	0.050	0.360*	0.088	-0.112+	0.068	-0.074	0.081	0.169*	-0.050

+ $p < 0.1$ * $p < 0.05$ ** $p < 0.01$; two tailed tests

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