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## **Individual positioning in Innovation Networks: on the role of individual motivation**

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### **Abstract**

Explanations of knowledge sharing in organizations emphasize either personality variables such as motivation or network-related structural variables such as centrality. Little empirical research examines how these two types of variables are in fact related: how do extrinsic and intrinsic motivation explain the position that an employee entertains in a knowledge sharing network within an organization. This study examines how motivation - extrinsic (expected organizational rewards, reciprocal benefits) and intrinsic (knowledge self-efficacy, enjoyment in helping others) ? might explain how employees may be more centrally located in the knowledge transfer network or might be engaged more in inter-unit knowledge transfer. Analyzing data from a survey at a large European multinational, this study shows that intrinsic motivation does not explain an individual's favorable position in a knowledge transfer network. Contrary to expectation, extrinsic motivation is not conducive to closeness centrality, and neither does it stimulate inter-unit knowledge transfer. Sheer number of relations predicts inter-unit knowledge transfer relations. These findings underpin recent appeals for further research on the influence of structural social network characteristics in organization research and provide strategic guidance for intra-organizational structural compositions by means of innovation policy directed at the individual level.

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# Individual positioning in innovation networks: on the role of individual motivation

## **Abstract**

Explanations of knowledge sharing in organizations emphasize either personality variables such as motivation or network-related structural variables such as centrality. Little empirical research examines how these two types of variables are in fact related: how do extrinsic and intrinsic motivation explain the position that an employee entertains in a knowledge sharing network within an organization? Much can be gained from a better understanding of how, empirically, psychological variables and an organization's network interrelate (Kalish & Robbins 2006; Moch, 1980; Teigland & Wasko, 2009). This paper integrates the structural characteristics known to be implicated in knowledge transfer typical focused on in the social network literature with two motivational perspectives commonly identified in the organization literature. This study examines how motivation - extrinsic (expected organizational rewards, reciprocal benefits) and intrinsic (knowledge self-efficacy, enjoyment in helping others) – might explain how employees may be more centrally located in the knowledge transfer network or might be engaged more in inter-unit knowledge transfer. Analyzing data from a survey at a large European multinational, this study, counter-intuitively, shows that intrinsic motivation does not explain an individual's favorable position in a knowledge transfer network. Contrary to expectation, extrinsic motivation is not conducive to closeness centrality, and neither does it stimulate inter-unit knowledge transfer. Sheer number of relations predicts inter-unit knowledge transfer relations. These findings underpin recent appeals for further research on the influence of structural social network characteristics in organization research and provide strategic guidance for intra-organizational structural compositions by means of innovation policy directed at the individual level.

## 1. Introduction

As firms find themselves in increasingly competitive markets and realize that they must be more innovative (Grant 1996), the importance of knowledge transfer within their company is increasingly recognized. Knowledge may be spread throughout the organization and not be available where it might best be put to use. Transfer of knowledge within the organization to gain competitive advantage has thus received considerable attention in the literature (Grant, 1996; Teece *et al.*, 1997; Moorman & Miner, 1998; Hansen, 1999). Scholars have emphasized that effective transfer of knowledge between employees within an organization indeed increases the creativity and innovativeness of that same organization (Tushman, 1977; Ghoshal & Bartlett, 1988; Amabile *et al.*, 1996; Moorman & Miner, 1998; Kanter, 1983; Hargadon, 1998; Perry-Smith & Shalley, 2003). HRM policy, if properly conceived, can help stimulate knowledge transfer. Effectively orchestrating knowledge transfer to stimulate innovative outcomes requires further attention in the field of HRM, however (Jackson *et al.*, 2006).

As pointed out by Foss (2007) organizations could influence individual actions to help accomplish favorable outcomes for the organization as a whole. Such orchestration starts with an understanding of both what the individual motives to transfer knowledge are, as well as, structurally, with whom individuals may be expected to exchange knowledge. The latter is determined by an individual's position in the knowledge transfer network of an organization. The relationship between network structure and individual motivation has been receiving some attention over the last decade (Kadushin, 2002, Kalish & Robins 2006). The number of different issues addressed in this new literature remains rather limited, however, and data at the level of individuals in a firm is rare. Studies have only started to touch upon the effect of individual psychological differences on network structures (Klein *et al.* 2004). The question as to how individual differences predispose actors to position themselves in a network of relations still has not received a persuasive answer as a result. As Mehra *et al.* (2001) note, social network researchers seldom discuss the effects of individual psychological differences on network structure and particularly not in the context of knowledge transfer. Likewise, HR researchers seem only sporadically to apply social network theory in their studies (with the notable exception of Minbaeva *et al.*, 2003; Kaše, Paauwe & Zupan, 2009). Although personality characteristics have occasionally been linked to network position (a.o. Kalish & Robins, 2006, Klein *et al.* 2004, Oh & Kilduff 2008, en Burt *et al.* 2000), motivation has not been investigated (with Foss *et al.* 2009 as a notable exception). Motivation has been linked to knowledge sharing (a.o. Wasko and Faraj 2000; Kankanhalli, Tan & Wei, 2005; Quigley, Tesluk, Locke & Bartol, 2007), but these studies ignore the network perspective. This study explicitly investigates the way in which motivation and position in a (knowledge transfer) network interrelate.

In this paper, we use the broadly accepted psychological construct of intrinsic and extrinsic motivation (Osterloh & Frey, 2000) to examine whether individuals with certain predispositions are more centrally located than others in a knowledge transfer network or more engaged in inter-unit knowledge transfer. A central position for individuals in a network, for instance, is conclusively shown to contribute

significantly to beneficial outcomes including to knowledge transfer in particular (Nerkar & Paruchuri, 2005). We also determine how motivation relates to inter-unit knowledge transfer, the kind of knowledge transfer that is believed to contribute to innovation. By relating network structure elements to motivational variables, this paper thus contributes significantly to the understanding of knowledge transfer within organizations and potentially benefits innovation policies aimed at increasing employee participation.

## 2. Knowledge Transfer within Organization: centrality and motivation

Finding the person within a multi-unit organization who possesses the knowledge that one is looking for may be difficult (Szulanski, 2003; Hansen, 1999; Hansen & Haas, 2001). The relative autonomy of units within a multi-unit organization structure can create a lack of awareness of each other's activities on an individual and a unit level, possibly limiting knowledge-transfer. Within a unit that specializes in a certain knowledge field, knowledge may be of the tacit kind. The advantage of the tacit nature of knowledge is that imitation by competitors is relatively difficult (Nonaka & Takeuchi, 1995), but at the same time the tacitness of the knowledge requires a high degree of personal contact to disperse it throughout a company (Teece, 1998; Hansen, 1999). As an individual's absorptive capacity originates from earlier experiences and depends on the social, professional and hierarchical context within an organization (Cohen & Levinthal, 1990), this capacity may be limited or biased.

There have been a number of recent calls to focus on the specific role of the individual in leveraging knowledge transfer (Felin & Hesterly, 2007). While the literature on networks has been very helpful in highlighting the role of informal interpersonal ties as a basis for knowledge transfer (e.g. Granovetter, 1973; Hansen, 1999), the *actual* process through which organizational knowledge is transferred has been relatively under-explored in the literature (Schulz, 2003; Reagans & McEvily, 2003). In this paper we focus on the social network characteristics known to stimulate knowledge transfer within an organization and study how individual motivation helps explain how individuals will be thus positioned. More specifically we look at the network characteristics typically attributed to benefit knowledge transfer, such as individual network centrality and number of inter unit ties an individual maintains (Friedman, 1979; Ibarra, 1993; Tsai, 2002; Nerkar & Paruchuri, 2005; Teigland & Wasko, 2009; Mäkelä & Brewster, 2009).

Individual **motivation** is indicated as the primary trigger for knowledge transfer (Osterloh & Frey, 2000; Lin, 2007) and as key determinant of successful or appropriate behavior in organization in general (Deci & Ryan, 1987). Several prior studies explored conceptual (Bartol & Srivastava, 2002; Damodaran & Olpher, 2000) or qualitative approaches (Weir & Hutchings, 2005; Yang, 2004) to study the motivators fundamental to knowledge sharing behavior. Motivation positively influences the amount of knowledge transferred (Gupta & Govindarajan, 2000; Tsang, 2002), and conversely lack of motivation in accepting knowledge leads to 'stickiness' or difficulties in the transfer process (Szulanski, 1995). Motivation is central to learning and lack of motivation can hinder knowledge transfer (Perez-Nordfelt, 2008). In line with Osterloh & Frey, 2000; Vallerand., 2000; Lin, 2007) we

identify two broad classes of motivation – extrinsic and intrinsic motivation. Extrinsic motivation focuses on the goal-driven reasons, e.g. rewards or benefits earned when performing an activity (Osterloh & Frey, 2000). Intrinsic motivation indicates the pleasure and inherent satisfaction derived from a specific activity (Deci, 1975). Both forms have been found to influence individual intentions regarding an activity as well as their actual behaviors (Davis *et al.*, 1992; Lin, 2007). As a result of their predispositions, individuals shape their immediate network environment by (failing to) establish relations (Mäkelä & Brewster, 2009; Argote & Ingram, 2000).

Sharing knowledge may be extrinsically motivated as the consequence of such behavior is expected to lead to benefits for the employee initiating in this activity (Osterloh & Frey, 2000; Kankanhalli *et al.*, 2005). In case of extrinsic motivation the sharing of knowledge will continue as long as the expected benefits equal or exceed the cost of participating in the exchange. Consequently when the benefits do not longer exceed the costs involved the exchange will stop (Kelly & Thibaut, 1978). In this context the benefits comprise of receiving organizational recognition and rewards or the obligation of other colleagues to reciprocate the action (Ko, Kirsch & King, 2005). Costs typically relate to effort, such as time spent, mental effort, preparation and so on (Lin, 2007). On the other hand, engaging in the exchange of knowledge for its own sake, or for the pleasure and satisfaction derived from the experience one is intrinsic motivated (Deci, 1975; Lin, 2007).

The sharing of knowledge can in itself be fulfilling for employees as it increases their own knowledge level or degree of confidence in their ability to provide knowledge that is useful to the organization (Constant, Sproull & Kiesler, 1996). Previous research on altruism has demonstrated that people enjoy helping others and knowledge exchange can be perceived as an example of such an act (Baumeister, 1982). As such, intrinsic motivation has been attributed to explaining human behavior in various contexts (Vallerand, 2000), among which is also the exchange of knowledge (Osterloh & Frey, 2000; Lin, 2007). As such we follow the reasoning that knowledge self-efficacy and enjoyment in helping others can be viewed as employees' intrinsic salient beliefs to explain knowledge sharing behaviors (Lin, 2007).

Existing research has taken **centrality** as the most important indicator of an individual's position in a network, and has given unequivocal indication that it contributes to innovation by the focal actor. Centrally located individuals in network are more likely to have contributed to the development of relevant knowledge, both at present as well as in the past (Sparrowe *et al.* 2001; Wasserman & Faust 1994). Furthermore, centrally positioned individuals receive information and insights from many others (Brass 1984) and are found to be more innovative than less centrally positioned individuals (Ibarra 1993). Not only because their position provides them with the advantage of collecting and spreading existing information more rapidly, but also because this position provides them with the opportunity to recombine existing ideas and knowledge in a novel way, stimulating creativity (Burt 2004; Sparrowe *et al.* 2001).

**Centrality** and **motivation** may, however, be empirically connected. The contribution to knowledge transfer, attributed to an individual's motivation, may stem from his or her position in the network, or vice versa. Linking motivation to the network characteristics may increase our understanding of intra-organizational knowledge transfer. Research on creativity has found that people will be most creative when they are primarily intrinsically motivated, rather than extrinsically motivated by expected evaluation, surveillance, dictates from superiors, or the promise of rewards (Amabile, 1997; Teigland 2009). Knowledge workers tend to be highly intrinsically motivated and often value knowledge generation for its own sake (Mudambi *et al.*, 2007).

Moch (1980) observes that a positive relation exists between social integration and intrinsic motivation. Social integration yields commitment and the incorporation into networks of work relationships increases the likelihood that motivation will be imminent. In contrast, the isolate is unlikely to obtain frequent and evident social rewards for effective performance. Furthermore Katz (1964) observed that those who are well integrated into networks of social relationships at work will be more likely to participate in decision making, see clearly how they contribute to group performance, and share in the rewards of group accomplishment. Social integration may not mean that an individual is directly connected to all other colleagues, however. He or she may be able to reach others indirectly. Teigland (2009) extended this notion to cooperation patterns in a multinational corporation setting and in a similar vein found that individuals who maintain more social relationships with their peers throughout the organization will be more vital in the overall knowledge flows across the organization and take on central positions in the organization's advice network (see also Nerkar & Paruchuri, 2005). This notion of social involvement is conceptually linked with network centrality, and in particular with closeness centrality. Closeness centrality is based on geodesic distance in the network and can be viewed as the efficiency of an individual in spreading information to (receiving from) all other members of the network. The larger the closeness centrality of an employee, the shorter the average distance from that individual to any other employee in the network, and thus the better positioned the individual is in dispersing information to other employees (Wasserman & Faust, 1994). In this context closeness centrality is a predictor of the individual efficiency of obtaining information across all organizational units, as high closeness centrality enables him or her to reach more actors in less time. The degree to which an individual is favorably positioned in the knowledge sharing network is expected to be driven by intrinsic motivation. Hence we argue that intrinsic motivation is a useful predictor of (closeness) centrality in the knowledge sharing network.

***H1: The degree to which an individual holds a central position (closeness) in the knowledge exchange network is determined primarily by intrinsic motivation.***

### **Inter-Unit Relations and Motivation**

Aside from the benefits of network centrality to the individual employee, organizational knowledge sharing benefits from diversity of relations. The number of contacts outside one's own unit determines to a large extent the degree to which an individual has the potential to contribute to the innovative capacity of the organization (Tsai, 2002; Perry-Smith & Shalley, 2003). Spanning unit boundaries

provides access to diverse sources of knowledge to an individual and its organizational unit and is critical for organisational innovativeness (Burt, 2004). Participation in cross functional activity by individuals increases one's access to alternative views on a firm's existing strategy, goals, interests, time horizon, core values and emotional tone (Floyd & Lane, 2000) but also on basic complementary functional expertise. Also exposure to conflict and discussion as a result of different needs, objectives and interests between differentiated organizational units and hierarchical levels is believed to increase ambidexterity at the individual level (Mom *et al.*, 2009).

Sundgren *et al.* (2005) observed that information sharing requires self-initiated activities to fully benefit from the available pool of codified knowledge. Self-initiated activities are influential as they are primarily driven by intrinsic motivation (e.g. Deci & Ryan, 2000; Dhawan *et al.*, 2002). Earlier studies have found that when employees are endorsed to select and pursue their own projects, their personal and professional interests is the primary driver (Amabile, 1997). Furthermore intrinsic motivation is positively associated with creativity (e.g. Woodman *et al.*, 1993). It is reasonable to expect that intrinsic motivation will have the same positive effects on knowledge sharing as it has on other learning activities (Foss 2009). This is supported by scholars who have argued that intrinsic motivation promotes knowledge sharing (Cabrera *et al.*, 2006; Lin, 2007; Osterloh & Frey, 2000), but also creative behaviour (Amabile *et al.*, 1996) and learning capacity (Vallerand & Bissonnette, 1992; Vansteenkiste *et al.*, 2004).

Intrinsic motivation is commonly expected to improve knowledge sharing, (e.g., Bock, Zmud, Kim, & Lee, 2005; Burgess, 2005; Cabrera *et al.*, 2006; Lin, 2007; Quigley *et al.*, 2007). Nevertheless, a distinct differentiation between inter- and intra-unit knowledge transfer is not addressed in this research. This may be relevant as the motivational drivers for *inter-unit* knowledge transfer might be different from intra-unit knowledge transfer. Differentiating between inter- and intra-unit knowledge transfer is common to social network studies and has provided some interesting insights regarding social capital, value creation and innovation (Tsai & Ghoshal, 1998; Tsai, 2002; Paruchuri, 2009; Mäkelä, & Brewster, 2009). We therefore include this distinction in our study of how motivational antecedents affect position in and structure of the knowledge sharing network. The diversity of or cognitive distance between specialized knowledge developed in separate units is larger than within a unit. In addition, knowledge transfer across unit boundaries tends to involve relatively less well known others. Levels of trust may be lower. The result may be that more uncertainty is involved in inter-unit knowledge transfer when compared to intra-unit knowledge transfer. We propose that this increased uncertainty is the prime reason why inter-unit knowledge transfer may be responsive in particular to appeals to individuals' extrinsic motivation. A high risk - high yield environment that characterizes an innovation setting where inter-unit knowledge transfer with relatively less well known others is involved, might in particular be an environment where individuals motivated by immediate personal returns to knowledge exchange, such as career progression, status or financial rewards, will engage in knowledge transfer (Osterloh & Frey, 2000; Kankanhalli *et al.*, 2005; Lin, 2007). Therefore we pose the following hypothesis:

**H2: The number of inter-unit ties an individual holds in the knowledge exchange**

***network is determined primarily by extrinsic motivation.***

### **3. Method and Data**

*Organizational setting.* Recognizing the need of more empirical support for the theoretical findings to underscore the importance of inter-unit communication structures (Hansen & Haas, 2001), this paper draws upon empirical research collected at a large multinational company. Company ABC is a multinational electronics and engineering company headquartered in Europe. We study the Dutch subsidiary, which has been operating since the late 19<sup>th</sup> century and employs some 4000 employees.

Access to the company was negotiated through the senior new business development manager who operates directly under the supervision of the board of directors. The company is organized according to a unit structure with a high level of autonomy and responsibility for the separate units and the units are organized according to product-market segmentation. Recently, the company shifted its strategic insights from offering specific products towards offering 'total solutions' to its customers. As the company now aims at offering integrated and innovative solutions based on its technical competencies that cross unit boundaries, this heightens the relevance of internal knowledge exchange and the network that facilitates it. The unit structure constitutes a natural membership boundary (see Hansen, 1999), however, and it is therefore that employees, sorted by unit membership, form the object of analysis in this study of inter-unit transfer of knowledge. The selection of these units is carried-out based on the input gathered during several interviews with the senior new business development manager and the new business managers in the separate units. Through the senior new business development manager the commitment of the unit directors was sought and secured.

*Data collection process.* To test the formulated hypotheses, data on the social relations within the company was gathered, focusing on the inter-unit innovation network. We follow Farace *et al.* (1977) to define social networks as repetitive patterns of interaction among members of an organization. Data on the individual level of the innovative knowledge exchange network, hereafter referred to as the innovation network, is collected using semi-structured interviews with managers and other employees as well as by means of an ego centric network survey. The interviews served a two-fold purpose: first, to become familiar with the organizational setting and thus gain input for the proper design of the network survey and second, to determine the appropriate response group within the company. In social network studies the most pragmatic approach in an organizational setting is believed to be the survey methodology (Borgatti & Cross, 2003; Wasserman & Faust, 1994). This study uses snowball methodology as the basis for this survey. Snowball sampling is especially useful doing so when the population is not clear from the beginning ((Marsden, 1990, 2002; Wasserman & Faust, 1994), which is the case for both organisations studied here. Innovative concepts may arise from employees who are not part of a cross-unit team set up to stimulate innovation, for instance, or it may arise from interactions not mandated by management. Snowball sampling is based upon several rounds of surveying or interviewing where the first round helps to determine who will be approached as a respondent in the second round, and so on. The first round of snowball sampling can be totally at random but it can be also based on specific criteria (Rogers & Kincaid, 1981). To reduce the risk of

'isolates', i.e. isolated persons within the organization who do possess relevant knowledge to a particular subject, but who are being left out by the study due to the lack of accuracy of random sampling (Rogers & Kincaid, 1981), this study opted in a first round to target respondents selected in conjunction with new business development management.

The networks analyzed are egocentric networks, an approach commonly adopted for the purposes of this kind of research. The survey was first tested on a small sample of respondents whom had been personally informed of the purpose of the study to increase their level of cooperation. The final version of the survey was sent in three rounds. The names mentioned by this first round of respondents (9) formed the input of respondents for the second round (42), who named another round of respondents. Closure was reached after this third round of surveying. The full network studied consisted of 83 employees partaking in the knowledge sharing network, with a joint number of 122 individual knowledge transfer ties. The final overall response rate was 96 percent. Only 4% did not respond to the first mailing and the later three reminder mailings.

The invitation to participate in the survey was distributed by e-mail, accompanied by a personalized cover letter introducing the project and the hyperlink to the online survey to the respondent, signed by the senior new business development manager to improve response rates. An online survey was chosen to reduce the time needed to complete the questionnaire, thus improving response rates. We did not opt to fix the number of contacts throughout the survey by using a list of names provided by management or to indicate a limit to the number of possible contacts a respondent could list (Friedman & Podolny 1993). However, we did issue a guideline of naming six employees to make sure that only the most important contacts per employee were mentioned. To reduce ambiguity regarding the interpretation of the questions by the respondents, the network questions were formulated in the native language.

### ***Variables.***

For each of the employees partaking in the knowledge exchange network we collected input for each of the variables. The knowledge sharing network was measured by asking individual respondents with whom they initiate a discussion of new ideas, innovations and improvements regarding products and services their unit offered in the field of transportation (Borgatti & Cross, 2003; Cross & Prusak 2002; Rogers & Kincaid, 1981; Stephenson & Krebs 1993; Krebs 1999). Based on the network data gained via the ego centric survey, the dependent variables of closeness centrality and interunit ties were calculated, using Ucinet 6.0 (Borgatti *et al.*, 2002; Freeman, 1979).

***Dependent variables.*** *Closeness centrality* for the individual employee was calculated as the sum of its distances to any other employee, normalized by the maximum path length. As such closeness centrality of an individual in the intra-organisational network under study is the inverse of the average shortest-path distance from the individual employee to any other employee in the graph. It can be viewed as the efficiency of each individual in spreading information to all other individuals. The larger the closeness centrality of an employee, the shorter the average distance from that individual to any other employee in the network, and thus the better positioned the individual is in dispersing

information to other employees (Wasserman & Faust, 1994). In this study closeness centrality is preferable to degree centrality, as it does not take into account only direct connections among units but also indirect connections.

*Number of inter unit ties.* The number of inter unit ties was calculated based on the ego-centric network survey. This variable was constructed from the number of ties outside the unit that the individual employee was affiliated with, but inside the boundaries of the organization. The number of inter-unit ties was calculated for every employee as the total amount of communication across unit boundaries, counting each individual tie that was utilized in the knowledge exchange network the previous three month as one.

**Independent variables.** The independent variables *intrinsic and extrinsic motivation* were derived from the Work Preference inventory of Amabile (1994). The Work Preference Inventory (WPI) is specifically designed to assess individual differences in intrinsic and extrinsic motivational orientations (1994). The questions of the inventory are specifically aimed to assess the major elements of intrinsic motivation (self-determination, competence, task involvement, curiosity, enjoyment, and interest) and extrinsic motivation (concerns with competition, evaluation, recognition, money or other tangible incentives, and constraint by others). Drawing from a total repository of 30 propositions, Amabile points out that the to fit the context of the study we should match our findings accordingly. In this study we draw from 6 propositions on intrinsic motivation and 6 propositions on extrinsic motivation. These propositions were converted in 12 questions for the questionnaire, framed on 7 point Likert scales). The Cronbach alpha for the intrinsic motivation questions was 0.62, the Cronbach alpha for the extrinsic motivation questions was 0.58. For 33 percent of our respondents we were able to collect motivational data on both intrinsic as well as extrinsic motivational antecedents.

**Control variables.** Four variables were included as controls: *tenure* (in months), *gender*, *unit membership*, and *number of ties* per individual employee. We included tenure to control for the effect of time, as relations tend to develop throughout the years. Gender and unit membership were added to control for group affiliation effects and number of ties per individual employee was included to control for the effect of individual network size, particularly as this might affect the changes of inter unit ties to occur.

**Table 1: descriptive statistics**

		Means, Standard Deviations and Correlations								
	Variable	Mean	Std. Dev.	1	2	3	4	5	6	7
1	Gender	0.9259	0.26688							
2	Tenure	10.6667	6.32456	0.099						
3	Unit	2.2222	1.25064	-0.064	0.078					
4	Ties (#)	4.81	3.680	0.26	-0.087	-0.083				
5	Closeness centrality	835.44	1145.694	-0.692**	-0.27	-0.045	-0.182			
6	Intrinsic motivation	3.7346	0.48096	-0.059	-0.233	0.07	0.087	0.235		
7	Extrinsic motivation	2.9568	0.51597	0.302	0.288	0.214	0.181	-0.564**	0.124	
8	Inter-Unit ties	1.3704	2.15100	0.117	-0.05	0.083	0.636**	-0.05	0.08	0.246

\*\* Correlation significant at 0.01 level (2 tailed).

#### 4. Results

Descriptives are presented in table 1 and show the means, standard deviations, and zero-order correlations between the variables. These results were calculated based on the knowledge sharing network of company ABC and collected from the questionnaire outcomes.

Moving beyond these zero-order results, the multiple regression analyses summarized in Tables 2 represent the tests for both of our hypotheses. To make sure that the sample size did not lead to a violation of the normality assumption central to the ordinary least square procedure, we checked for non-normal distributions and examined the skewness and kurtosis of all the variables. The skewness and kurtosis showed no values greater than an absolute value of one (1) for each variable), suggesting reasonably normal distributions. Histograms for each variable were also examined, however, and these showed that most scales were moderately positively skewed, with floor effects evident for number of inter unit ties which appeared to violate the assumption of normality. Thus square root transformations of these scale was computed. The regression analyses were conducted using both the nontransformed and transformed scores and this was not found to make a statistically significant difference to the variance explained or to the regression coefficients. For simplicity, only the nontransformed scores are reported. Multiple linear regression analysis was employed to determine which of the motivational attributes predicts closeness centrality and number of inter-unit ties per employee in the knowledge sharing network. Homoscedasticity was examined via several scatterplots and these indicated reasonable consistency of spread through the distributions.

**Table 2: Hypotheses Testing<sup>a</sup>**

D.V.:	Closeness Centrality (H.1)			Inter-Unit Ties (H.2)		
I.V.:	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	---	---	---	---	---	---
Tenure	-0.201		-0.036	0.002		-0.040
Dept	-0.075		-0.003	0.134		0.103
Gender	<b>-0.669***</b>		<b>-0.551***</b>	0.046		-0.084
# Ties	-0.032		0.012	<b>0.659***</b>		<b>0.637***</b>
Intrinsic Motivation		0.309	0.245		0.050	-0.015
Extrinsic Motivation		<b>-0.603***</b>	<b>-0.419***</b>		0.240	0.147
Adjusted R <sup>2</sup>	0.440	0.364	0.588	0.320	0.015	0.273
F Stat.	6.117	8.432	7.195	4.059	.807	2.628

<sup>a</sup> Standardized coefficients. \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

The results of the multiple regression analyses, presented in Table 2, are remarkable. Contrary to expectation, intrinsic motivation does not help explain why an individual would be centrally located in the knowledge transfer network, close to others as potential sources of knowledge. Individuals who

are extrinsically motivated are actually significantly less likely to be located in the knowledge transfer network at close distance to potential other sources or recipients. Hypothesis 1 needs to be rejected. From among others the control variables we include, it is striking to see how women are less likely to be located in the network close to potential sources of knowledge.

Our second hypothesis looks at what explains the number of inter-unit ties an individual in the knowledge transfer network is engaged in. Inter-unit ties have been found in the past to contribute to innovation in particular. Contrary to expectation, neither intrinsic nor extrinsic motivation of individuals predicts their involvement in knowledge transfer across unit boundaries.<sup>1</sup> Our hypothesis 2 is not supported. Rather, it would seem, the mere fact that someone has a large number of contacts in general best leads to his involvement in cross-unit contacts as well.

## 5. Discussion and Conclusion

Centrality in the knowledge transfer network and inter-unit knowledge transfer ties are both known to allow individuals to contribute to innovation (Burt, 1992; Tsai, 2001). For this reason it is important to understand what explains their presence organizational communication patterns. Literature strongly suggests that individuals' motivation should be expected to be an important explanatory factor. In this paper of actual knowledge transfer in a multinational, rather than a controlled setting of an experiment in which students participate (Quigley *et al.* 2007), we find that individuals' motivation is implicated in these aspects of knowledge transfer in a different way than was expected. Intrinsic motivation does *not* play a role in determining both centrality in the knowledge transfer network nor in determining the number of inter-unit ties. The effect of extrinsic motivation is only there for centrality, and is a significantly negative one. A co-worker who is too obviously extrinsically motivated may not be central in the organization's knowledge transfer network. Further research, specifically looking at the longitudinal developments, should shed additional light on this issue.

Actors in a relatively large organization tend to be members of exogenously-defined sub-units, but this group membership has rarely been taken into account when empirically studying knowledge transfer thus far. A germane question from an innovation policy perspective then is to determine what makes individuals transfer relevant knowledge across unit boundaries. The expectation that such more risky behavior is motivated in particular by extrinsic motivation is not born out. The sheer number of ties that a person has is the important predictor we found. Motivation to transfer knowledge across unit boundaries might particularly involve a mixed bag of motives in an exchange that can involve ritualized behavior that is not captured by the motivation variables included here (Dolfsma *et al.* 2009; Ensign 2009). It might be more important for partners in knowledge transfer to have valuable knowledge to exchange than what motivates them to exchange (Ensign 2009, e.g. p. 103).

What our study suggests, we believe, is that the effect we may expect of people's motivation on knowledge transfer is conditional on the social (network) environment someone is embedded in. Others, such as Lin (2007), may not have sufficiently realized this or have not properly incorporated the mutually interdependent nature of actions and positions in a social environment (Teigland &

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<sup>1</sup> Analysis of contribution from motivation –extrinsic and intrinsic- to intra-unit knowledge transfer provides similar findings.

Wasko 2009). Including reciprocal benefits as an extrinsic motivator (Lin 2007; Kowal & Fortier 1999) might not adequately recognize the interdependencies and socially embedded exchange or transfer of knowledge over time (Ensign 2009). Despite the fact that further research is required, our findings thus provide strong indication that properly including the effects of the actor's social environment by analysing her social network changes results about how motivation affects knowledge transfer.

*Managerial implications.* The organization we studied is a large multinational and would resemble other such large firms. The full extent to which our findings are representative is difficult to determine, however. Social networks analysis is necessarily restricted to quantitatively studying single cases: social network analysis is highly demanding of the data required for proper analysis, and data across different firms cannot be aggregated. The social network literature has by now, however, generated a large number of studies covering a wide variety of topics that touch upon some of the findings for our paper. A large body of knowledge has in the meantime emerged that is robust and allows one to suggest managerial implications as well. The current study, integrating into the discussion on knowledge transfer in social networks the role of motivation, is no exception to this.

The most salient implication for innovation management is that motivation does not seem to be much implicated into knowledge transfer, especially for transfer across unit boundaries. Innovation policy may thus focus in particular on individuals' other characteristics such as skills (cf. Kaše *et al.* 2009). Individuals who are extrinsically motivated, however, will find themselves less well positioned to transfer knowledge especially within the boundaries of a unit. Whether playing into an actor's extrinsic motivation to entice them to engage in inter-unit knowledge transfer, off-setting the possible inclination not to be involved in that due to the uncertainties and personal costs involved, might however be necessary. Further research, specifically of a longitudinal kind, is required to explore this conclusion.

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