Embeddedness and Media Use in Networks of Practice

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1. Introduction

In this paper, we analyze the value of networks of practice in terms of their contribution in supporting the exchange of distributed knowledge. In explaining this value, we focus on the degree of *embeddedness* of these networks – both social embeddedness and embeddedness in practice. Since both forms of embeddedness can be assumed to be related to different modes of communication, we will seek explanations for both forms of embeddedness in media use.

In the history of knowledge management two generations can be distinguished: the first and the second generation (Huysman & De Wit 2004). The first generation of knowledge management literature, research, and practices were dominated by "technological determinism": knowledge was conceptualized as an object that could be stored, transferred and retrieved with the aid of information and communication technologies or ICTs. Both in practice and in academic research, this approach yielded somewhat disappointing results.

These disappointing results induced some writers to critically discuss the technological determinism that characterized this first generation (Hislop 2002; Ruggles 1998; Scarbrough & Swan 2001). It became accepted that knowledge is not simply an aggregate of information which can be decoupled from its context. It was argued that the most important dimension of knowledge was its tacit dimension which is socially embedded in the context in which it takes shape and creates meaning. Consequently, in-

creasing attention was given to the subjective, socially embedded nature of knowledge and the importance of practice in explaining issues of knowledge and organization (Blackler 1995; Brown & Duguid 1991; 2001; Cook & Brown 1999; Gherardi 2000; Orlikowski 2002; Wenger 2000), as well as of other modes of communication than ICT. In terms of social learning and practice, communities (or networks) were considered the most appropriate environments for knowledge creation and sharing to take place.

Translating these insights into practice, however, has proved to be difficult. After all, if knowledge sharing does not happen by means of imposing structures and tools but by rich social interaction and by immersion in practice (Hislop 2002; Tsoukas 1996), what can be done in order to manage this knowledge? Especially in distributed organizations where knowledge is highly dispersed, organizations are in need of methods to manage their distributed knowledge (Orlikowski 2002). The growing attention for networks and communities in the knowledge management literature has induced organizations to appropriate these social networks as tools to stimulate knowledge sharing. This managerial view leads to network determinism as the successor of technological determinism, which overlooks the importance of the *embeddedness* of networks as a determinant of their success. Given that communities and networks exist by virtue of a bottom-up drive, not because organizational managers want to implement them as organizational forms in a top-down fashion, network determinism might be a next trap that characterizes the second generation of knowledge management.

In this paper, we report a case study in an organization (TDO) that struggles with the problem of implementing and managing networks in order to manage its highly distributed knowledge. TDO is an international development organization, with its headquarters in the Netherlands. Over the years, TDO has developed from an organization of volunteers into a professional consultancy organization. Nowadays, TDO's aim is to develop the capacity of local organizations by providing advisory services. These activities are organized in five regions (Balkan, Latin-America, Asia, West-Central Africa and East and Southern Africa), representing about 30 countries.

A reorganization into a professional consultancy firm led to the (managerial) belief that knowledge was TDO's main asset and thus, learning from each other became more important. In order to meet these new challenges, the head office introduced knowledge networks in every region. Due to the distances and poor infrastructure in the regions, face-to-face meetings were held at best once a year, leaving electronic communication the main way to communicate. The main communication platform for the

networks are electronic discussion groups, where (e-mail) messages and documents can be shared and stored. Beside these discussion groups, network members also contact each other directly via e-mail and (infrequently) meet face-to-face.

With this case study our aim is to clarify the importance of *embeddedness* for knowledge networks. We will discuss two different forms of embeddedness: embeddedness in practice and social embeddedness and discuss the role of different modes of communication (or communication media) in the emergence of both forms of embeddedness. Based on a survey, interviews and observations we seek to answer two research questions:

RQ (1) What is the relationship between (a) embeddedness in practice and (b) social embeddedness of a network of practice on the one hand, and the perceived value of such a network on the other?

RQ (2). What is the relationship between the use of different communication media within a network of practice and the (a) embeddedness in practice and (b) social embeddedness of this network?

2. Theoretical Arguments

2.1 Knowledge Networks and Embeddedness

In the introduction to this paper, we used the terms communities of practice and networks of practice interchangeably, but they refer to different concepts - as we will clarify here.

A 'community of practice' refers to a group of people who are "informally bound together by shared expertise and passion for a joint enterprise" (Wenger 1998; Brown and Duguid 1991). Because of is ability to support tacit knowledge sharing, communities are often seen as the primary means for organizations to support practice based learning. Brown and Duguid (2001) distinguish such communities of practice from networks of practice, which they define as "loose epistemic groups", in which relationships are significantly looser than in communities. Most of the people within a network will not have frequent face-to-face contact – and yet they are capable of sharing a great deal of (tacit) knowledge (Brown & Duguid 2001, p. 205). Communities of practice (CoPs) are characterized by frequent face-to-face interactions in materially and historically bounded contexts (Lave 1988; Lave & Wenger 1991; Wenger, 1998). Communities thus have a local focus, which ensures the sharing of meaning and tacit

knowledge (Brown & Duguid 1991; Gherardi & Nicolini 2000; Sole & Huysman 2002). Networks of Practice (NoPs) do not have such a local focus, and are sometimes seen as means to connect different communities and transcend geographical distance (Brown & Duguid 2001; Pan & Leidner 2003; Vaast 2004; Wenger, McDermott, & Snyder 2002). Members of NoPs "share occupational activities", although they "do not interact regularly and do not experience the same work context" (Vaast 2004, p. 38).

Communities and networks, according to the practice-based perspective, are fully embedded in the context and thus cannot be decontextualized. This points towards the importance of the *embeddeness* of networks for their perceived value. This leads to our first research question:

RQ (1) What is the relationship between (a) embeddedness in practice and (b) social embeddedness of a network of practice on the one hand, and the perceived value of such a network on the other?

2.2 Embeddedness in Practice

In order for a network of practice to be of value, it needs be part of the daily activities of its members. In line with the practice based perspective on knowledge, we refer to this contextual nature of networks as *'embeddedness in practice'*. It is striking to see that this embeddedness in practice, although clearly linked to the practice prespective on knowledge, is rarely considered an important condition that influences the value of a network. Instead, trust, common identity, shared knowledge and values are usually considered important conditions (Ahuja & Carley 1999; Dyer & Nobeoka 2000; Moon & Sproull 2002; Orlikowski 2002). These sociocultural factors relate to social embeddedness, which we discuss in the next section.

Although, as discussed before, NoPs are frequently initiated top-down, as instruments to facilitate knowledge sharing, their true value lies in their ability to join people with shared practices and work interests. From this follows that members of such networks will primarily be interested in sharing knowledge when that knowledge concerns these shared practices and work interests – i.e., when the activities of the network are directly related to those practices and work interests. This leads to the following hypothesis:

Hypothesis 1 . Embeddedness of the activities in a network of practice in members' daily practices positively influences the value of the network.

2.3 Social Embeddedness

The literature on learning and knowledge sharing that emerged in reaction to the technologically deterministic views of the early years not only stressed the importance of practice, it also pointed out that learning is by definition social. In what Cook and Brown (1999) call the "epistemology of practice", knowledge is seen as socially constructed and embedded in the social context. Consequently, the characteristics of this social context are crucial; how employees are connected to one another in networks of social relations primarily determines to what extent and in what way they can draw upon and contribute knowledge (Smith, Collins & Clark 2005; Hansen, Mors & Løvås 2005).

Based on the literature on social and organizational networks, the concept of *social embeddedness* concerns the extent to which a network is characterized by stable relationships, created and routinized over time, in repeated and rich exchanges based on mutual interests, understanding and trust (Gulati 1998; 1999). Building on the work of Granovetter (1985), Gulati (1998) distinguishes two different perspectives on social embeddedness: relational embeddedness and structural embeddedness. Relational embeddedness stresses the role of direct cohesive ties as a mechanism for gaining valuable information and knowledge, ties that also lead to shared understandings and emulation of behavior. Structural embeddedness stresses the value of the structural positions that members have in a network (e.g., their centrality, weak and strong ties).

Social embeddedness can be assumed to positively influence the value of networks of practice through (1) providing access to people with relevant knowledge or relevant needs and questions (structural embeddedness), and (2) providing a common interest and an atmosphere of mutual trust and appreciation as well as a 'common know-how' which facilitates understanding of each others' knowledge (relational embeddedness) (Nahapiet & Ghoshal, 1998). This leads to the following hypothesis:

Hypothesis 2. The level of social embeddedness of a network of practice positively influences the value of the network

Social embeddedness and embeddedness in practice are interrelated and mutually reinforce each other. Given that knowledge usually has a large tacit dimension, is dispersed and contextually bound, the interaction needed to share knowledge is usually intensive (Hislop 2005). In other words, the learners will need to become 'insiders' of the social community in order to acquire its particular viewpoint (Lam 1997; Brown & Duguid 1991). We believe that social embeddedness and embeddedness in practice are interrelated, because using and developing knowledge in practice, or

learning by doing (Hislop 2005) will simultaneously involve social interaction and verse versa. Gherardi (2000) refers to this mutual influence as 'discursive practice'. This leads to our third hypothesis:

Hypothesis 3.Social embeddedness and embeddedness in practice mutually influence each other

2.4 Media Use and Embeddedness

The first and second generation of knowledge management that were discussed before are not only related to different views regarding the importance of embeddedness of networks of practice, they also represent different views concerning the importance of "rich" communication in knowledge sharing. Networks of practice are by definition geographically dispersed, and consequently, are characterized by rather intensive use of ICTs. Still, although NoPs are defined in terms of little face-to-face contact, many NoP members *do* also meet face-to-face. In other words, a range of different media is used for communication within NoPs, which raises the next research question:

RQ (2). What is the relationship between the use of different communication media within a network of practice and the (a) embeddedness in practice and (b) social embeddedness of this network?

Based on insights from traditional media choice theories such as Media Richness Theory (Daft & Lengel 1984; 1986), an impressive body of research addresses the question what the consequences are when certain media are used for certain tasks in certain organizational and social contexts. With regard to such effects, the lack of 'social cues' (such as tone of voice, facial expressions, gestures) in communication via ICT is often expected to negatively influence the social richness of this communication (Short, Williams & Christie 1976; Daft & Lengel 1984; 1986; Trevino, Daft & Lengel 1990). As a consequence, such communication is often assumed to lead to less identification with communication partners compared to a face-to-face setting, and consequently to less attention to common goals, practices and interests (Kiesler, Siegel & McGuire 1984; Sproull & Kiesler 1986). Based on such insights, we would expect ICT media to lead to less social embeddedness and embeddedness in practice than face-to-face communication.

Empirical results, however, contradict such assumptions (Carlson & Zmud 1999; Postmes, Spears & Lea 1998; Walther 1992; Walther & Burgoon 1992). Consequently, insights from Media Richness theory have long been surpassed by what Van den Hooff, Groot and De Jonge (2005) call

"situational theories" of media use. According to these theories, the fact that ICTs help overcome constraints in terms of time and distance is often much more important than their "appropriateness" for certain tasks, and the perception of this appropriateness changes with experience (Carlson & Zmud 1999; Markus 1994; Orlikowski 1992). Furthermore, theories such as those developed by Walther (1996) and Postmes, Spears and Lea (1998) argue that computer-mediated communication can even lead to communication with a richer level of social relationships than found in face-to-face conditions, and to more instead of less group feeling (or social embeddedness).

Since constraints of time and distance are important in Networks of Practice (as argued before), such insights are very relevant here. Still, for true social embeddedness and embeddedness in practice to occur, interpersonal interaction is crucial. Direct interaction creates trust, social identification, commitment to the group (Bos et al. 2002; Burgoon et al. 2003; Handy 1995; Jarvenpaa & Leidner, 1999 Roberts, 2000) – elements related to social embeddedness. As for embeddedness in practice, this is created by directly sharing practices, i.e. by collaborating. Such collaboration is better served by direct interactions in which problems are defined and clarified in mutual sensemaking, and in which coordinated efforts lead to solutions. As Lave and Wenger (1991) suggest, getting to know a practice takes place through adaptive learning through participation and interaction. Practices are interactively shaped through rich interactions between individuals within a work context.

Combined, these insights lead us to expect that face-to-face interaction will positively influence both social embeddedness and embeddedness in practice, and that for ICT, a distinction needs to be made between "private" media that facilitate direct interpersonal (one-to-one) interaction (albeit mediated by technology) such as e-mail, and those that have more of a "public" nature such as discussion groups. We expect that e-mail, being important in overcoming constraints of distance and time (Dimmick, Kline & Stafford 2000) and facilitating direct interaction, will have effects that are comparable to those of face-to-face interaction, i.e., a positive influence on both social embeddedness and embeddedness in practice. The fact that most people have quite some experience with e-mail by now, positively influences the likelihood that it will have similar effects to face-to-face. For discussion groups, we do expect a positive contribution to social embeddedness, because such groups can provide a clear insight into a community's norms and customs, as well as into the relevant subjects under discussion and who the experts are in certain areas. The lack of direct interaction, however, leads us to expect that such groups will not have a

contribution to embeddedness in practice. On the whole, this leads to the following three hypotheses:

Hypothesis 4. Use of face-to-face communication positively influences both (a) embeddedness in practice and (b) social embeddedness.

Hypothesis 5. Use of e-mail positively influences both (a) embeddedness in practice and (b) social embeddedness.

Hypothesis 6. Use of electronic discussion groups positively influences social embeddedness, but does not influence embeddedness in practice.
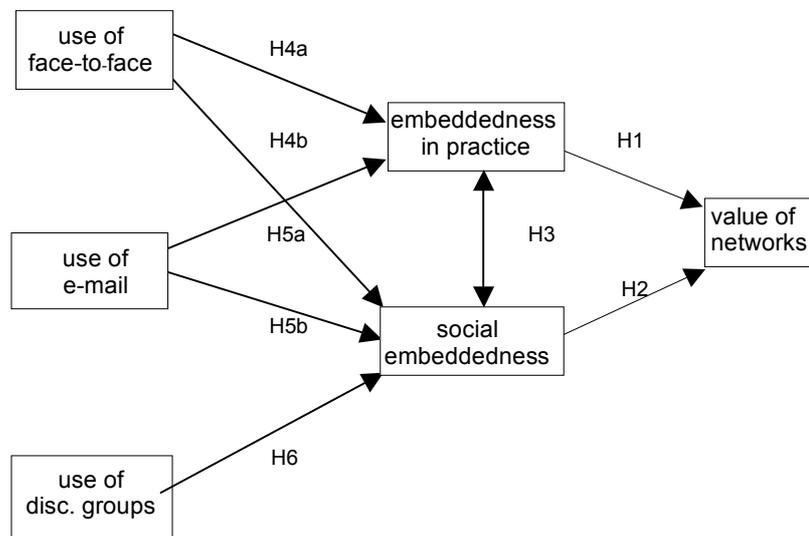

Fig. 1. Theoretical model.

All in all, these research questions and hypotheses lead to the theoretical model that is presented in figure 1. This model was the basis for an in-depth case study within an international developmental organization. In the next section, the methodological specifics of this case study will be discussed.

3. Method

By combining quantitative and qualitative methods, we gain a broad and at the same time thorough understanding of the processes underlying the use

and value of the networks that were active within the organization (TDO) under study. Semi-structured interviews were conducted with 35 different members of the organization all over the world – ranging from the board of directors to network leaders, from regional directors to network members. During a one week site visit to one of the regions, we made observations at TDOs local offices, visited a client NGO and acted as participant observers at several meetings, amongst others a network leaders meeting, a directors meeting and a social event. While staying at the same hotel as many TDO employees who visited the country for these TDO meetings, we were able to interrelate on many occasions and in different (social) settings. Notes were made during and immediately after the observations and meetings.

Based on these findings an online survey was conducted. An e-mail with a request to fill out the survey and a direct hyperlink to the survey was sent to all 900 members of the organization. A total of 475 respondents filled out the questionnaire, which means a response of 52.8%. Of these 475 respondents, 313 indicated that they were members of the knowledge networks (66%), whereas 162 were not (34%). Technological failure (loss of Internet connection) was a reason for not being able to completely fill out the questionnaire, as well as the length of the survey (of the 313 network members that responded, only 233 filled out the complete questionnaire).

Respondents from each of the regions that the organization distinguishes were represented in the sample: 16% were from Asia, 8% from the Balkan regions, 24% from Eastern and Southern parts of Africa, 27% from the Western and Central parts of Africa, 20% from South and Middle America, and 5% from the Dutch head office. Respondents also had every nationality that can be found within the organization: from Burundian to Belgian, from Bhutanese to British. This response pattern matches the actual division of regions and nationalities within TDO, which increases the external validity of the findings.

3.1 Measures

The variables in the survey were predominantly measured using five-point scales (1 = strongly disagree, 5 = strongly agree), although a number of other operationalizations were used as well.

Value of networks was measured using five statements concerning the different contributions that the knowledge network has in the eyes of the respondent. These statements were derived from our interviews. Sample items are: "Being a member of this network enables me to solve problems more efficiently" and "Thanks to this network, the quality of the knowledge I use in my work has improved". This scale was newly designed for

this research, as no appropriate survey measure of network value could be found in the literature.

Embeddedness in practice was measure by a single item: "The activities of this network are directly related to my daily work". The reason that we chose not to use more items to measure this variable is that this single item basically measures the concept in a complete way – other statements that were designed were largely repetitions of this one. Since we had to be careful about the size of the survey (for logistical and technological reasons), we chose to measure this variable by a single item.

TABLE 1 Measures: descriptives, reliabilities and correlations

		M	SD	1	2	3	4	5	6
1	value of networks	3.17	0.75	0.88					
2	embeddedness in practice	3.42	1.01	0.60***	n.a.				
3	Social embeddedness	3.36	0.66	0.60***	0.50***	0.85			
4	Use of face-to-face	1.61	3.66	0.20**	0.24***	0.30***	n.a.		
5	Use of e-mail	4.64	11.60	0.17**	0.23***	0.26***	0.60***	n.a.	
6	Use of discussion groups	3.01	5.11	0.16*	0.11	0.17*	0.42***	0.30***	n.a.

Table shows Pearson correlation coefficients for all relationships. Significance indicated by:
* $p < .05$;
** $p < .01$;
*** $p < .001$
Cronbach's alpha shown on diagonals.

Social embeddedness was measured by eight items, combining items from Doosje et al 's (1995) social identification scale and Wrightsman's (1999) scale for trust with newly designed items concerning the extent to which one knows where specific expertise is located, and whether ties to such persons exist. A sample item from this scale is: "I am regularly in contact with network members who have knowledge that is relevant to me".

Media use was measured by (a) asking how many hours per month a respondent spent on the network and (b) asking what percentage of communication within the network they conducted via discussion groups, e-mail or face-to-face. Thus, ratio level measures were obtained of the number of

hours a respondent spent per month communicating via each of these media.

Table 1 contains the descriptives, correlations and reliabilities (where appropriate) for each of these variables.

3.2 Analysis

In order to test our hypotheses, the survey data were analyzed using Structural Equation Modeling applying AMOS. SEM basically enables the testing of a set of regression equations simultaneously, providing both parametric statistics for each equation and indices that indicate the ''fit'' of the model to the original data. Based on such statistics, models can be adjusted in terms of adding or deleting relationships – in line with theory, of course.

As for the interview data, Atlas was used as a software package to structure and code the fully transcribed interviews. If recording was not possible, as was the case with spontaneous and informal interviews, we made notes during and right after the interview which also formed part of the coding process.

Our findings have been reported back to TDO, both during a management meeting at the Head-office, as well as during regional meetings in various countries. Overall, TDO consultants and management indicated that our findings corresponded with their personal impression of the dynamics related to the knowledge networks.

4. Case Study Findings

The testing of our hypotheses is primarily based on the quantitative data. However, in order to get a better understanding of the practices in the networks under study, we will first give a more detailed case description based on our qualitative data.

4.1 Knowledge Networks within TDO

TDO is a Dutch organization and consequently about 40% of the employees are Dutch expats whereas the remainder of the employees are mainly "locals". Expats move to an different country every six years in order to keep their input refreshing. For the expats, working at TDO means being away from their home country for many years, often living under quite remote conditions. Locals often have difficulties with TDO's corporate lan-

guage, which is English. The inability to speak English keeps many locals working at TDO from communicating with other regions, especially in regions such as Latin America and West Africa. The culture at TDO has always been 'isolated' as there used to be little contact between the different countries; even nowadays TDO advisors said to be working on different islands. Overcoming this isolatedness, together with the shift from project work to advisory practices, motivated TDO to implement knowledge networks.

TDO advisors give advice to local governments, as well as civil society and private organizations by strengthening organizations "that serve the interests of the poor and are able to change the structures that sustain poverty." In practice, this means that TDO advisors need knowledge about dealing with local government, partnership building, client management, and advisory skills on the one hand, and about their specific practice areas on the other. For example, in the practice area "Market Access", advisors try to improve the work conditions in the cashew nut value chain by ensuring honest prices for the farmers, the distributors, the nut roasters and the salespeople. In the practice area "Forestry" advisors focus on sustainable forest management to ensure income for the future. Recently a group of advisors in Southern Africa started an initiative to get HIV on the agenda of local organizations and governments in order to prevent that HIV-infected people are excluded from society and to encourage the support of those organizations for HIV prevention and awareness programs. Notwithstanding all these different practices, TDO employees are bound together by their strong commitment to fighting poverty.

Management at TDO assumed that in order to be more effective and efficient, TDO should make better use of the existing but highly distributed knowledge. As a consequence, a knowledge management unit was installed which implemented knowledge networks. In order to locally manage these networks, the KM unit selected network leaders and allocated budget to the networks for traveling expenses and such.

During the kick-off meeting in the Netherlands, TDO's top management realized that the value of the networks' contribution not only resides in knowledge sharing, but also in bringing together the diverse expertise in TDO based on the practice areas. As a consequence, it was decided during the kick-off meeting that networks should have two aims: (1) exchanging knowledge to improve the services to clients and (2) creating a stronger profile in the practice areas. The decision to make networks at least partially responsible for strategy formulation created confusion about authority and responsibilities concerning the networks. While formerly, regional and country directors were responsible for strategic decisions, network

leaders (without much formal authority) now became more and more influential in strategic decision making. To deal with this power dilemma, a new management function was created: the regional practice area leaders, as well as a matrix structure with two lines of authority: the strategic practice area versus the knowledge area. This new matrix structure left the people close to the local practice in confusion. Moreover, most advisors were not interested in talking strategies. Their focus was on the local practice: helping local organizations and initiatives to fight poverty. Nevertheless, the new structure forced them to make their expertise more valuable not only to the local practices but also the other TDO advisors and specifically to TDO's top management. In some situations, the leaders together with a group of advisors, bypassed the formal matrix structure, resulting in local networks that grew out of a convergent interplay of expertise and interests. Other networks struggled with the confusion about authority and responsibilities while trying to adhere to TDO's formal rules and policies concerning the networks.

4.2 Results from Survey and Interviews

The testing of our hypotheses is primarily based on the quantitative data. However, we will also use transcripts from our interviews in order to offer a rich insight into the nature of different relationships, and explanations for the quantitative results.

To test the hypotheses, the model as it was presented in figure 1 was entered into an AMOS analysis. The results of this analysis indicated that the model did not have a sufficient fit to the data: Chi square was significant (148.7, $df = 7$, $p < .001$), the Adjusted Goodness of Fit Index was well below the critical value of .900 at .485, the Tucker-Lewis Index should be close to 1 but scored well below this at .202 and finally, the Root Mean Square Error of Approximation (RMSEA) should be below .050 but scored .205. All in all, the theoretical model has to be rejected in the form it is presented in figure 1.

It took three iterations of the model to arrive at a fitting model. Over the course of these iterations, the analysis pointed out that a number of relationships in the theoretical model were not significant:
- Use of face-to-face communication does *not* influence embeddedness in practice, rejecting hypothesis 4a.
- Use of e-mail does *not* influence social embeddedness, rejecting hypothesis 5b.
- Use of discussion groups does *not* influence social embeddedness, rejecting hypothesis 6.

- The relationship between social embeddedness and embeddedness in practice is *not* reciprocal, but a one-way relationship: social embeddedness positively influences embeddedness in practice, but not the other way around – partly rejecting hypothesis 3.

Furthermore, modification indices in AMOS pointed out that the use of the different media was interrelated:

- use of discussion groups positively influences both e-mail use and face-to-face use;
- use of e-mail positively influences face-to-face use.

Incorporating these changes in the testing of the theoretical model using AMOS yielded the empirical model presented in figure 2.
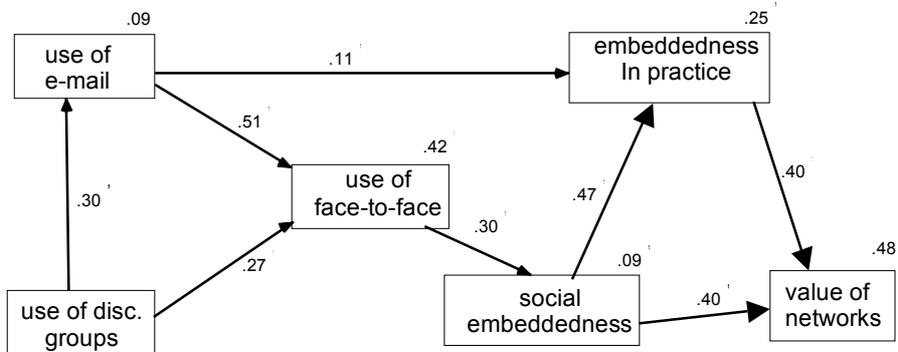
chi square = 6,295 (df = 7, p = ,506), AGFI = ,973, TLI = 1,004, RMSEA = ,000

Fig. 2. Tested model.

The fit statistics for this model are well within the acceptable range: the Chi Square is non-significant, the Adjusted Goodness of Fit index is .973, the Tucker-Lewis Index is very close to 1 at 1.004 and the Root Mean Square Error of Approximation is exactly .000. All the relationships in the model are significant at the .05 level, and the model explains 48% of the variance in the value of networks, 9% of the variance in social embeddedness, and 25% of the variance in embeddedness in practice. We will now discuss these results in more detail, providing answers to each of the research questions.

4.3 Research Question 1

We first addressed *RQ (1) What is the relationship between (a) social embeddedness and (b) embeddedness in practice of a network of practice on the one hand, and the perceived value of such a network on the other?* This question was answered by means of hypotheses 1, 2 and 3.

With regard to these hypotheses, we found that both embeddedness in practice and social embeddedness positively influence the perceived value of networks of practice, providing support for hypotheses 1 and 2.

The qualitative data also provide support for the importance of both embeddedness in practice and social embeddedness in explaining the value of a network. The more networks are embedded in the network members' practice, the higher the quality of the discussions and the better they can apply new insights gained from the network to their daily work. For instance, it is noted that value is derived from increased understanding of practice-related issues:

"Practitioners struggle with a number of very practical questions, which they debate on and discuss in knowledge networks. And over time they will find that their understanding of a particular issue had deepened".

Still, many networks (or at least their leaders) are focused on strategic issues, leading to negative consequences for the value of these networks:

"They see the networks as something that the network leader in their country goes to and brings back answers on questions of strategic direction and corporate choices, but not the daily connection of 'I have this issue, if I go to the network, I'm likely to find somebody who has dealt with it immediately".

Another problem noted by members is that the discussions are too abstract and not focused enough; the link between the discussion and the practice is too weak for them.

"I don't want to talk about market access for the poor, I want to talk about small farmers, value chains, how to value organic certifications or free certifications".

"Well, I must say I am not very satisfied [with the discussion topics] (…) it is not really about the daily practice".

The social embeddedness of a network makes it a safe place to discuss not only practice related issues, but also more delicate matters. This open and safe atmosphere enhances the perceived benefit of the networks. As the following quote shows, knowing each other, knowing who knows what and just being connected, is valuable in it self.

"What I see and hear, is that our advisors are finally talking to each other (…) and that's the benefit, moral benefit, you are no longer alone,

you don't have to continuously reinvent the wheel on your own, you have a place where you can meet each other. .

Interviewees also specifically address the importance of structural embeddedness, of knowing who knows what in a network of practice, for the value of such a network:

"That is one benefit of such a network (…), that we know, who, what, where, what's happening, who is doing what".

"If you, as a network, really want to be cutting edge, you need to know where the knowledge resides".

As for hypothesis 3, social embeddedness and embeddedness in practice were indeed found to be related – but not reciprocally, as was assumed. Social embeddedness was found to positively influence embeddedness in practice, but the reverse relationship was not found. Social embeddedness provides a fruitful context for adaptive learning through participation and interaction, enhancing the embeddedness in practice of the network.

The qualitative data provide some support for this finding in the sense that, when members trust each other, it is easier for them to open up and discuss their ideas or problems. It was frequently pointed out in the interviews that sharing problems and admitting not to know something is in general problematic in TDO:

"People feel it's difficult to write things down anyway because they fear that everyone will jump on them. Besides there is a lot of competition within TDO. Thus it is hard for people to show their weaknesses and there is a lack of trust."

Since one of the main aims of these networks is to discuss problems that people may face in daily work, a lack of trust hinders this sharing and leads to more general, hence less embedded, discussions.

4.4 Research Question 2

To address the second research question, *What is the relationship between the use of different communication media within a network of practice and the (a) social embeddedness and (b) embeddedness in practice of this network?,* we analyzed the relationship between the use of different media and both kinds of embeddedness. Two hypotheses were supported by the results: use of face-to-face was found to positively influence social embeddedness (H4b) and use of e-mail was found to positively influence embeddedness in practice (H5a). Meeting other network members face-to-face is an important precondition for the creation of stable relationships, characterized by mutual interests, understanding and trust. This is in line

with much research on the role of ICT in establishing trust (e.g.; Bos et al. 2002; Burgoon et al. 2003; Handy 1995; Jarvenpaa & Leidner, 1999; Roberts, 2000), which finds that for true trust to emerge, face-to-face interaction is indispensible. On the other hand, such face-to-face interaction is not found to influence embeddedness in practice. This can be explained by the fact that within these networks, face-to-face interaction is relatively infrequent – the day to day interactions about members' daily work take place via ICT, precisely because constraints of time and distance make it impossible to constantly meet face-to-face. This explains why e-mail *was* found to positively influence embeddedness in practice, since this medium *does* facilitate such day to day interactions. On the other hand, such interactions are considerably less important in establishing social embeddedness than face-to-face interactions.

In order to understand these findings it is worthwhile to note that most face-to-face meetings within TDO networks are group meetings, aimed at discussing a general agenda for the practice area. So not only are they infrequent, but these meetings also hardly apply to network members' daily work. However, these meetings are still valuable because they help get to know each other, to build group feeling and mutual trust.

> *"Once you have met, it can help, it speeds it up, it builds trust. The quality of sharing after a face-to-face interaction is much higher"*

This quote also indicates that once there is a substantial level of social embeddedness, the exchange of more practice related knowledge becomes easier too, as was discussed above.

> *"I have noticed that for the exchange of knowledge, it is important that you have seen each other, that you for example have had a drink together, and then when you have a problem with your work, you pick up the phone or write an e-mail and ask: hey, what about this?"*

A number of interviews indicate that the real exchange of knowledge does not happen at meetings, but afterwards, often by private communication via e-mail, supporting the results of the quantitative part of our study.

> *"So it did happen that people came into contact and started discussions about topics, but that is mostly done by e-mail".*

> *"The discussion groups are formal because TDO recognizes the discussion groups but between advisors sharing also takes pace and that doesn't always go through the discussion group. This happens through face-to-face meeting, day to day work, telephones and e-mail."*

This finding raises questions about the role of the discussion groups. Although the use of discussion groups is not found to directly influence either social embeddedness or embeddedness in practice, the results do point towards an interesting role for this medium. Apparently, discussion groups

can be considered to be a starting point for communicating within these networks. Although no influence was found on social embeddedness, even passively participating in these groups ("lurking") can provide a network member with insight into relevant contacts, relevant subjects of discussion, etc. The fact that such participation does not necessarily have to be active can explain that no relationship was found between use of discussion groups and social embeddedness: even limited participation may lead to such benefits, as the qualitative findings indicate. Discussion groups can help newcomers to get informed about the other advisors working in the same practice area at TDO as is noted by the following interviewee:

"It is a very useful tool for new people who come in as new advisors. They can log on to the discussion group, and they immediately get an overview of the people who are working here, and you can look through these names, you can read their introduction ,what they have done, what kind of documents have been posted, you can download them".

Interestingly, we seem to find a shift from public to private media: where (public) discussion groups serve to identify relevant subjects and individuals, network members seem to prefer (private) direct one-to-one media such as e-mail and face-to-face for the actual interaction with these persons. There is kind of a "growth" model here, where increasing participation in discussion groups leads to increasing use of e-mail as well as increasing face-to-face contact. E-mail use in turn also positively influences face-to-face contact. And both these "private" media exert a positive influence on the embeddedness of the network. It seems that indirectly, discussion groups do exert a positive influence on embeddedness. This relationship is supported by the following quote:

"Yes, I certainly think that there [in the discussion groups] you can easily find out who does what. If you should ask a question, then you get a pretty quick answer from a number of colleagues saying who knows what and where to go. But a lot of the actual discussion takes place outside of the discussion groups. For instance, in one network there was a discussion outside of the group about developing a partnership, and then the question arises whether we should have this discussion with the whole group, because sensitive information is likely to be involved and there are also external people in those discussion groups – so we'd rather not."

5. Discussion

The results from our study indicate that embeddedness in practice and social embeddedness are important determinants of the value of networks of practice. This means that conceptualizing such networks as tools that can be implemented to stimulate knowledge sharing is not realistic: such an instrumental approach overlooks the importance of embeddedness – both in practice, and in terms of social relations. This approach is fundamentally in contradiction to the nature of such networks of practice, which emerge out of a shared practice, shared social context and interdependence. Embeddedness is something that almost by definition emerges in a bottom-up fashion, out of shared experiences, practices and a shared social context.

This, of course, raises the question how to support knowledge sharing within networks that emerge informally out of the need to exchange practice related knowledge between members who are geographically dislocated. After all, such networks of practice cannot rely solely on face-to-face meetings. Literature on networks of practice tends to perceive electronic networks and in particular discussion groups as the most important means to support knowledge sharing (e.g. Wasko and Faraj 2005; Vaast 2004; Hustad & Teigland 2005). Our case study indicates, however, that applying a range of different communication media is more valuable when we consider the importance of embeddedness of networks. In particular, it was found that "private" communication media (both face-to-face and technologically mediated), facilitating frequent one-to-one interaction, are important in establishing both embeddedness in practice and social embeddedness. Moreover, social embeddedness was found to be a determinant of embeddedness in practice. Since face-to-face interaction was found to be especially important in establishing this social embeddedness, this indicates that – even though barriers of time and distance may be important hindrances here – providing the opportunity for face-to-face interaction within a network of practice is crucial. However, such interaction will (as a consequence of these barriers) almost by definition be relatively infrequent, which means that the frequent interaction that is necessary for establishing embeddedness in practice will mostly take place by e-mail.

This does not mean, however, that a "public" medium such as electronic discussion groups, has no value at all. Our results suggest that even the infrequent use of such discussion groups provides network members with insight into the important subjects of discussion, and into where relevant knowledge and knowledge needs reside concerning certain areas. Based on such information, our results suggest, members subsequently turn to more "private" media for rich interaction with relevant members about these

subjects, enhancing both social embeddedness and embeddedness in practice. This implies that supporting networks of practice is about wisely managing which communication media are applied, in which stage of the process of legitimate peripheral participation. Clearly, more research is needed to analyze the dynamic aspects of using media to support this social learning process through which one gradually becomes a full member of a network of practice.

As far as the methods used in our study are concerned, we can conclude that the combination of qualitative and quantitative methods has been very valuable. Combining a large scale study for quantitative analyses with qualitative methods of interviews and observation has provided us with a rich view of the value of networks of practice in this particular case, and the variables influencing this value. The qualitative data have been especially valuable in identifying the processes which lead to the importance of both forms of embeddedness, as well as the relative importance of each communication medium.

Like any research, however, this study also has its limitations. First of all, the crucial variable of embeddedness in practice was measured by only a single item in the survey. As explained in the method section, there were sound arguments for doing this, but this still could be viewed as limitation of the reliability of the quantitative results concerning this variable. In future research, the search for a richer measurement for this crucial variable should be continued.

Then, causality is always an issue in cross-sectional research. Although structural equation modeling is specifically designed to enable causal inferences in non-experimental research, there are many assumptions surrounding such causality in these analyses. A longitudinal study, in which the use of different media, social embeddedness and embeddedness in practice, and the value of networks are measured on – for instance – three different points in time would enable much stronger conclusions concerning causality.

All in all, this study helps to understand the contribution of networks of practice in managing knowledge sharing within distributed organization. It shows that the value of networks mainly resides in being embedded in practice as well as in social relations. As a consequence, the study can be considered a warning for the growing tendency to perceive knowledge networks as tools that can be implemented independently from their relation with the local practice and social context. Moreover, the study shows that the media used by members of such networks of practice influence this degree of social embeddedness and embeddedness in practice. Organizations that rely on such networks need to consider a combination of vari-

ous communication media rather than relying solely on one medium, such as electronic networks.

6. References

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