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Intra and Inter-Organizational Knowledge Transfer Processes:
Identifying the Missing Links

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Abstract:

Inspired by the resource- and knowledge-based views, much attention has been focused on knowledge transfer as a process of strategic importance. Still, many open questions regarding knowledge transfer processes need to be addressed to complete our understanding.

For instance, what are the barriers to knowledge transfer, and what are the facilitators? A review of the literature reveals that it is divided into two streams: articles on intra-firm knowledge flows and articles on inter-firm knowledge flows. Part of the incompleteness of our understanding of knowledge transfer processes, we argue, derives from the fact that it is unclear in which way intra- and inter-firm knowledge flows are different.

The paper investigates three questions: first, how knowledge transfer is defined differently in intra- and inter-firm knowledge flows; second: how barriers to knowledge transfer processes differ; and thirdly: what we need to know to be able to formulate a management view of organizational knowledge flows, whether intra- or inter-organizational. The concluding section argues five research questions whose answers may enable research to formulate a management view of knowledge flows.

Key words: Review; internal knowledge flows; external knowledge flows; definition; barriers to knowledge flows

Jel codes: D83; L20; L22; O32

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1. Introduction

The primary insight of the knowledge-based view of the firm is that knowledge, whether originating from within the firm or from outside the firm, is a critical source of resource creation potentially leading to sustained competitive advantages (Grant 1996).

The interest in knowledge *flows* stems from primarily two observations. The early literature on information transfer has suggested that the cost of transmitting a given body of information is frequently very low (Arrow 1962). However, von Hippel (1994: 429) observed that the above statement is only true as long as knowledge is not sticky, that is only when information is costly to acquire, transfer and use does the issue of knowledge transfer become interesting. An alternative observation suggests that because the character of knowledge is fundamentally different from physical goods, the transfer of knowledge becomes more complicated than physically moving something from A to B (Arrow 1969: 30).

Knowledge can either be generated within firms, or accessed externally that is knowledge flows may viewed as intra-firm or inter-firm. As it turns out, these two ways of building knowledge have been used as foundation for (at least) two sets of literatures. While different terms are being used and different entry points exist, the underlying problem is basically the same one: how can knowledge flows be stimulated and managed, within the firm and across its boundaries? Before such questions can be dealt with, it is evident that a definition of knowledge transfer is needed, which leads to research question 1:

RQ1: What are the differences in how knowledge transfer is defined in the literature on intra- and inter-firm knowledge transfer and what can we learn from these differences?

However, prior to the analysis of this question, a further question needs to be addressed: What is knowledge - i.e. what is the object to be transferred?

The definition of knowledge has typically been approached as a description of knowledge in the form of taxonomies. Most common is the tacit-codified distinction (Cohendet & Steinmueller 2000; Connell, Klein, & Powell 2003; Polanyi 1962) but also the distinctions between individual-collective, private-public, component-architectural and complementary-supplementary knowledge

are typically applied in the literature. We do not attempt at answering the question: how can knowledge be defined? But we recognize that it has the properties of being embedded in an individual, who is part of an organizational context (Tsoukas & Vladimirou 2001). The consequence of combining personalized knowledge and organizational embeddedness is that knowledge can be at either end of the tacit-codified continuum and may therefore be straightforward or almost impossible to transfer (Connell, Klein, & Powell 2003).

The literature on knowledge transfer mentions a number of barriers to successful knowledge transfer like causal ambiguity (Reed & DeFillippi 1990), tacitness of knowledge (Cohendet et al. 2000; Polanyi 1962), and lack of motivation to share knowledge (Osterloh & Frey 2000). Since the management of knowledge transfer processes is important to achieve the sustained competitive advantages, reduction of the barriers that may prevent knowledge sharing is a key managerial task. The paper therefore proceeds to analyze the question:

RQ2: How do the barriers to knowledge transfer processes differ for respectively intra-firm and inter-firm knowledge flows?

Based on the findings on the above two questions, we conclude by highlighting the missing links in the literature that may enable the formulation of a management view of organizational knowledge flows:

RQ3: What do we need to know, in order to be able to formulate a management view of organizational knowledge flows?

The aim of the paper is therefore to combine insights from the two streams of literature on respectively intra-firm and inter-firm knowledge flows with the opportunities for formulating a management view of organizational knowledge flows by identifying the missing links in the literature.

The paper is conceptual in nature, building on a thorough review of the literature of knowledge flows. Other authors have reviewed the literature on knowledge flows, e.g. Eisenhardt and Santos (2002) on a comparison of the knowledge-based view and the resource-based theory, and Hillebrand and Biemans (2003) on the differences between internal and external cooperation with some attention to communication and organizational learning. The prime focus of the paper is

problem-oriented trying to synthesize the literature to provide new insights and to deduce the gaps that need to be filled in future research. The contribution of the paper therefore lies in organizing different streams of literature around the key theme of knowledge transfer processes, in providing conceptual clarification of the knowledge transfer process, and in identifying the missing links before a management view of organizational knowledge flows can be formulated.

The paper is organized as follows. To establish the scope and the relevance of the paper, section 2, presents the extent of research on knowledge transfer processes and develops the search protocol used in carrying out the review. Section 3 delimits inter-firm and intra-firm knowledge sharing processes by use of transaction cost economics and the property rights perspective. This delimitation is applied in organizing the papers into the categories of intra-firm and inter-firm knowledge transfer. A number of concepts have been associated with intra-firm knowledge flows (such as retrieval, utilization, acquisition, exchange, sharing and integration), whereas the literature on inter-firm knowledge flows applies concepts like transfer, absorption, adaptation, application, and acquisition, but do these lead to the same definition and what are the requirements for formulating a unique definition? Section 4 therefore reviews the articles on both internal and external knowledge flows, compares these in terms of their definitions of knowledge transfer and from these comparisons deduces the important lessons that can be learnt. This will enable us to answer *question 1*. From the literature review, the mechanisms and barriers to knowledge transfer are identified (section 5) and these are compared for the two streams of literature and the lessons to be learned are deduced. Accordingly, the differences in the barriers become apparent, which results in a discussion of *question 2*. Finally, these barriers and facilitators to knowledge flows lead to suggestions for management of knowledge flows. Based on the identification of the problems and not least the differences between intra-firm and inter-firm knowledge flows, the paper identifies the missing links in the literature in section 6, suggests the directions in which future research may go and formulates the five important questions for future research in order to formulate a management view of organizational knowledge flows (*question 3*).

2. The scope and methodology of the paper

Knowledge and knowledge flows are concepts of importance and relevance in a number of apparently distant research disciplines. An important task in a review paper covering several

disciplines is therefore to set the boundaries for the literature to be included. In the following review, the aim of the paper is to identify the missing links in order to formulate a management view of knowledge transfer processes. When knowledge is considered a vital resource for firms in achieving a sustained competitive advantage, a key point is to focus on the governance of the processes of knowledge transfer. Questions of relevance to a transferor of knowledge include, which knowledge bits should I share, which knowledge bits am I able to share, and what are the problems in doing so? At the same time, the recipient needs to consider if he is able to receive the knowledge, use the knowledge to solve a problem and maybe even use the knowledge in new projects. Evidently, managers therefore need to consider what the barriers are such that knowledge sharing may be stimulated or facilitated. Management of knowledge transfer processes therefore implies an explicit handling of key strategic resources, whereas unintentional spillovers of knowledge between e.g. two competitors are less straight forward to manage. The paper therefore restricts itself to review papers that cover strategic implications for the governance and management of knowledge flows.

The next challenge is to identify the relevant papers to include in the review. The applied methodology to select the papers for the review takes its point of departure in the framework developed by Tranfield *et. al.* (2003) focusing in particular on stage II – *conducting the review*. Conducting the review includes the steps of identifying the search terms and keywords, and the development of an appropriate search protocol. The choice of particular search terms and keywords must be grounded on solid arguments since these will make the first delimitation of the literature. In the following, we use the terms knowledge *transfer*, *sharing* and *flow*¹ to provide a broad review that captures as many publications as possible. The overall descriptive analysis of the concepts ‘knowledge transfer’, ‘knowledge sharing’ and ‘knowledge flows’ is shown in figure 1, which illustrates the growth in papers from 1996 to 2005 using EBSCO host as database.

¹ The search terms have only been used to search in the titles of the articles.

Figure 1: Number of publications on knowledge transfer

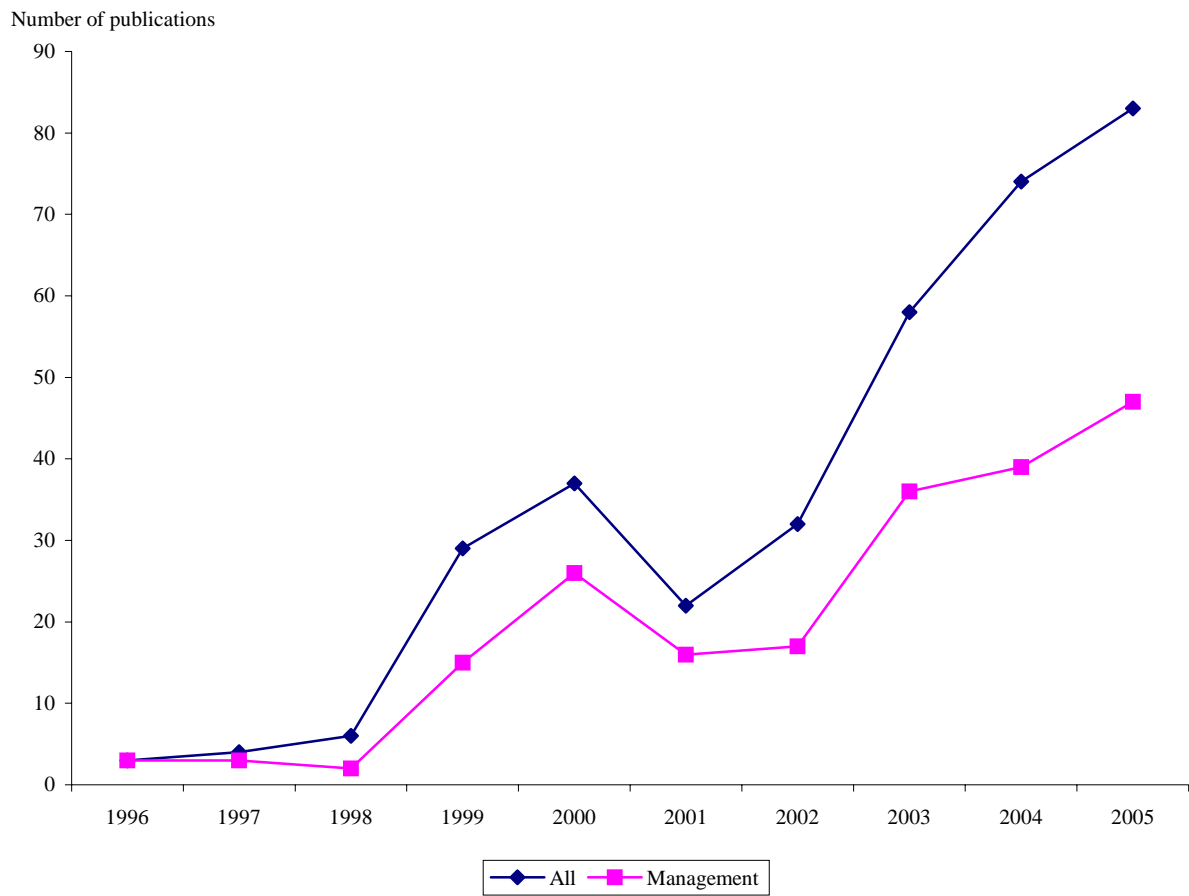


Figure 1 clearly illustrates an increasing trend in publications on knowledge sharing over the years. The lower graph illustrates the number of publications including managerial aspects of knowledge sharing, whereas the upper graph shows the total number of identified publications. From this total set of publications, we deleted the papers that were concerned with knowledge transfer in medicine and information technology, which is in accordance with the stated focus on management issues. By reading of the titles and abstracts of the papers, the term *transfer* is used more often in relation with IT-mediated knowledge transfer, whereas knowledge *flows* is more often used in addressing more or less random knowledge flows in e.g. cluster studies or other studies at a geographical level, and knowledge *sharing* appears to be more common among papers that view knowledge sharing as a governed process among firms or individuals. In the following, we will therefore use the term knowledge sharing more often, but still consider the three terms as synonyms.

The *second* step, after having defined the search terms is to develop a search protocol for the collection of papers for the review. Because we combined three broad search terms, we decided to delimit the selection by focusing on high impact journals primarily. In the *third* step, we sort the papers in two groups: first, by definitions of knowledge sharing and second, by barriers and facilitators to knowledge sharing to follow the logic of the research questions. The reference lists of these two sub-sets are then searched for all relevant papers and these are then included in the review. Finally in the *fourth* step, we review a set of key journals for other articles starting in 1996, since figure 1 above clearly indicated that only very few papers are published before this time.

High impact journals within the management literature include Academy of Management Review, Academy of Management Journal, Strategic Management Journal, Organization Science, and Administrative Science Quarterly. These journals have an impact score between 2.0 and 3.7 as published in the Journal Citation Reports by ISI Web of Knowledge. From these journals we have the following number of publications using the three search terms (see table 1 for a chronological list). We argue that the following list of articles and authors comprise the most influential contributions simply because they are published in these journals.

Table 1: Articles in high impact journals (1996-2005)

Author and year	Scope	Description	Analysis
Hansen, Mors and Løvås (2005)	Intra-firm	Analysis of social networks and how these are inter-linked with knowledge sharing outcomes	121 new product development teams

Inkpen and Tsang (2005)	Intra and inter-firm	Networks are characterized by social capital constructs and related to the transfer of knowledge between network members both at intra-firm networks, strategic alliances and industrial district	Theoretical
Agarwal, Echambadi, Franco, and Sarkar (2004)	Intra-firm	Technological and market-related capabilities are assessed for firms in a longitudinal study to analyze the survival and performance of spin-outs	All industry members in the disk drive industry; analysis based on secondary information
Carlile (2004)	Intra-firm	Three boundaries, syntactic, semantic and pragmatic are linked with three progressively complex processes, transfer, translation and transformation and analyzed in the context of settings where innovation is desired.	Case study in a firm
Szulanski, Cappetta and Jensen (2004)	Intra-firm	The paper explores the conditions as to when and how a recipient's perception of the trustworthiness of a source affects the effectiveness of the transfer of organizational practices.	Eight companies were studied based on 271 questionnaires involving 122 transfers of 38 practices.
Reagans and McEvily (2003)	Intra-firm	Focuses on how network structure defined by cohesion and range, influences the knowledge transfer process. The paper incorporates the willingness and motivation of individuals to engage in knowledge sharing	Combined survey, interview and database analysis on temporary project teams in a single contract R&D firm
Spencer (2003)	Inter-firm	The paper explores the relationship between firms' strategies to share knowledge with their innovation system and innovative performance	Uses patent data to explore knowledge sharing and the innovative system (1969-1989)
Hansen (2002)	Intra-firm	Explains why some business units re able to benefit from knowledge residing in other parts of the company while others are not using the relatedness in knowledge content in the business units	Study of 120 new product development projects in 41 business units of a large multiunit electronics company
Postrel (2002)	Inter-firm	The paper discusses the dilemma that the economy depends for its efficiency upon a drastic separation of knowledge across individuals and organizations, yet studies of product development find that greater knowledge commonality is associated with better firm performance.	Simulation model
Tsai (2002)	Intra-firm	Investigates the effectiveness of coordination mechanisms on knowledge sharing in intra-organizational networks that consist of both collaborative and competitive ties among organizational units.	Data from a questionnaire survey in one large multiunit company in the petrochemical industry.
Boland, Singh, Salipante, Aram, Fay, and Kanawattanachai (2001)	Intra-firm	Develops a framework for classifying forms of knowledge representation and proposes how this form is related to processing and utilization of knowledge	Laboratory experiments with 82 students in MBA programs
Schulz (2001)	Intra-firm	Analyses how the production of knowledge in a subunit of a given firm affects outflows of knowledge to other units of the same corporation. The paper distinguishes between horizontal and vertical flows of knowledge	570 subsidiaries in Denmark and USA. Data was gathered using surveys administered to the leaders of the subsidiaries.
Tsai	Intra-firm	Knowledge transfer is enabled through	Questionnaire was

(2001)		absorptive capacity of the receiving business unit, and access to knowledge is determined by the network position that unit occupies.	distributed to the business units of two MNC's with respectively 24 and 36 business units.
Dyer and Nobeoka (2000)	Intra-firm	The ability to effectively create and manage knowledge sharing within Toyota raised productivity among Toyota and its suppliers.	Exploratory study of Toyotas network.
Levin (2000)	Intra-firm	Uses the ideas of learning curves to illustrate that learning may not only result in efficiency improvements but also in quality improvements	Sample includes all passenger car models assembled exclusively in the US and Canada.
McEvily, Das and McCabe (2000)	Inter-firm	The paper discusses the dilemma that while ambiguity slows the diffusion of superior practices and technologies across firms, it impedes the creation of new knowledge within the firm.	Theoretical
Osterloh and Frey (2000)	Intra-firm	The paper links the importance of intrinsic and extrinsic motivation to different organizational forms in analyzing how knowledge is generated and transferred.	Theoretical
Hoopes and Postrel (1999)	Intra-firm	Based on a resource-based view organizational integration may be viewed as patterns of shared knowledge among firm members. The paper explores the costly error ("glitches") when knowledge is not shared and develops a set of syndromes leading to this error.	Observation in scientific software company over a period of two years.
Simonin (1999)	Inter-firm	Explores the role of causal ambiguity on technological knowledge transfer, where ambiguity is seen as a mediator for of antecedents on knowledge transfer.	Cross-sectional study of 147 MNC's
Appleyard (1996)	Inter-firm	Identifies and examines the mechanisms and determinants by which technical knowledge is disseminated in a knowledge-intensive industry.	Questionnaire results from 134 employees in the semiconductor industry.
Mowery. Oxley and Silverman (1996)	Inter-firm	Analyzes the effects of interfirm knowledge transfers within strategic alliances on partner firms' technological capabilities	Patent citation analysis of bilateral alliances involving at least one US firm and were established during 1985 and 1986.

To supplement the high impact journals, a number of other key journals that have a history of publishing papers on knowledge sharing were reviewed including Journal of International Business Studies, Management Science, Organization Studies, and Knowledge and Process Management. The reason for including the latter journal is that it is particularly aimed at publishing research on knowledge sharing processes, whereas the other mentioned journals are of a broader scope.

Table 2: Number of publications in selected journals (1996-2006)

	Intra-firm	Inter-firm
High impact journals	14	7

Key journals	19	15
Total	33 (60 %)	22 (40 %)

Table 2 highlights the overall distribution of papers from the high impact journals and the key journals showing that the majority of papers (60 %) are studies on intra-firm knowledge sharing. However, we do not wish to over-emphasize this result but merely indicate that more papers are published with a scope covering intra-firm knowledge sharing.

3. Delimiting intra- and inter-firm knowledge flows

Based on simple logical thinking, we can say that knowledge transfer must take place between (at least) two parties. A relationship between two parties is known as a dyad, which consists of a pair of actors and the possible ties between them (Wasserman & Faust 1994: 18). Dyadic analyses focus on the properties of pair-wise relationships; in this paper, the flow of knowledge between the two parties in the pair. Given the aim of the paper, which is to compare and synthesize the differences between intra-firm and inter-firm knowledge transfer, we need to establish a criterion for the delimitation of the literature in either of the categories.

Based on transaction cost economics, we can view organizational forms on a continuum ranging from the market to the hierarchy involving a number of intermediate forms like joint ventures, bilateral agreements etc. (Williamson 1985). If the knowledge transfer takes place in the market, we are talking about inter-firm knowledge transfer and if we consider knowledge sharing in a hierarchy we are talking about intra-firm knowledge transfer. But this criterion is not sufficient to cover a number of borderline cases like joint ventures and multinational corporations. We may therefore add a further criterion using the property rights literature (see e.g. Alchian & Demsetz 1972 or Demsetz 1967), because knowledge may be viewed as a resource, and resources may be viewed as bundles of property rights to attributes (Foss & Foss 2005: 543).

Property rights to resource attributes consist of the rights to use, consume, obtain income from and alienate these attributes (Foss et al. 2005: 542). If we then define the knowledge to be transferred as “molecules” that are composed of bundles of rights to attributes (Foss et al. 2005: 543), we can

argue that knowledge transfer is concerned with *allowing*² other actors to use, consume, obtain income from and alienate these attributes, but also that it is the role of the manager to determine what the molecule should look like, i.e. what components of knowledge should be made available to another party. If the knowledge then is shared with an actor that *already possesses* these rights, then we can talk of *intra-firm* knowledge transfer, and in cases where the property rights are shared with someone that *did not previously* have these rights then we talk of *inter-firm* knowledge transfer. In practice the problem of assigning borderline cases as either intra- or inter-firm is now straightforward. The borderline cases consist of joint ventures (Kogut 1988), multinational corporations (Mudambi & Navarra 2004) and acquisitions (Bresman, Birkinshaw, & Nobel 1999). Joint ventures are characterized by joint ownership of key resources, and the property rights to the knowledge are determined by the actor's equity in the company. A joint venture is therefore to be considered an intra-firm transfer (from Mother Company to JV), since the property rights are retained. A MNC transfer of practice (i.e. from subsidiary to mother or vice versa) is also to be considered an intra-firm transfer since the property rights are not shared with an independent actor. Finally an acquisition is to be considered an inter-firm activity as the property rights of the original company is transferred to the acquirer.

Inter-firm knowledge flows may lead to downstream (with customers), upstream (with suppliers, universities and other organizations) or horizontal (with competitors) knowledge flows. A number of different types of relationships may act as channel for knowledge flows. The present review takes only the first step in distinguishing between internal and external knowledge flows (within a firm or across firm boundaries). But even this modest step is of importance, because the two separate streams of literature emphasize different aspects and different managerial opportunities that are not necessarily distinct. Studies that compare intra-firm and inter-firm knowledge transfer processes can assist us in advancing our understanding of how these processes differ or are similar, and ultimately in establishing a more comprehensive view of managerial scope in governing knowledge sharing processes. The Special Issue in Academy of Management Journal (Smith, Carroll, & Ashford 1995) received only papers on either of the dimensions even though the title of the issue was *Intra- and Interorganizational Cooperation: Toward a Research Agenda*. However we have identified two papers that do make a distinct point about comparing the insights. First, Eisenhardt and Santos'

² We can obviously only talk of 'allowing' in cases where knowledge transfers is intended to take place. In cases like reverse engineering, imitation and diffusion, knowledge transfer must be viewed as other actors taking possession of the rights to use, consume, obtain income from and alienate the attributes. These cases are however not treated in this paper.

(2002) review of both internal and external knowledge transfer made no attempt at discussing the differences or similarities in terms of either findings or practices for knowledge transfer. Instead they focused on the strategic importance of knowledge for firm survival by asking whether the research on knowledge and knowledge flows represents the emergence of a new theory of strategy (Eisenhardt and Santos 2002) thereby synthesizing the results from both streams of literature. Second, Hillebrand and Biemans (2003) compared the literature on cooperation within organizations with cooperation between organizations and identified five relevant perspectives: first, the involvement of both internal and external partners, communication patterns, organizational learning, organizational norms and internal cooperation as a coordination mechanism for external cooperation.

4. Defining knowledge flows

The reading of the literature on knowledge transfer processes shows that there are many different perceptions of and attempts at defining knowledge transfer processes. The multiplicity of definitions calls for a systematic overview to answer two questions: first, what are the similarities in the definitions of how knowledge flows? Second, what are the differences between intra- and inter-organizational knowledge flows when drawing on these definitions? The answers to these questions allow us to derive a number of lessons concerning the fundamentals of knowledge transfer processes and therefore to address research question 1.

4.1 The organizing frame for analyzing the definitions of knowledge transfer

To organize the vast amount of articles in a meaningful way we use one of the standard references on *definition* in philosophy (Robinson 1950) to categorize the articles. The work by Robinson (1950) is both a representation of the types and categories in which definitions may be grouped and an account for the consequences of using particular types of definitions for the subsequent research. In the following sub-section, we present the main categories in which definitions can be grouped, we then proceed to organize the identified literature into these groups, and finally discuss the differences and what we can learn from these differences. The work by Robinson is therefore solely used as an organizing frame for the presentation of different definitions of knowledge sharing.

Robinson's work is based on a classical distinction between nominal and real definitions, where nominal definitions encompass definitions of words, signs, or symbols, and real definitions are concerned with things in general (Robinson 1950: 16). *Nominal* definitions are further subdivided into word-word definitions and word-thing definitions. The word-word definition states that one word means the same as another word, e.g. 'knowledge transfer is the same as knowledge sharing' (see as an example Appleyard 1996). The word-thing definition correlates a word to a thing. To successfully correlate a word and a thing, both must be known to the recipient of the definition. Definitions of this sort may be suggested using seven different methods: applying synonyms, using analysis, bringing synthesis, by implication, by denotation and the regular method (Robinson 1950: 94-131). In summary, the above categories of definitions are therefore concerned with defining words by assimilating one word (the one to be defined) with another word (which should be known to the reader of the definition) to apply meaning.

The *second* approach defines the thing itself (real definitions). A real definition is seen as a thing-thing definition that attempts to reveal the true meaning of the concept. However "*to define a word by attempting to present the true meaning or the essence is an almost impossible quest since words by nature are ambiguous*" (Robinson 1950: 152). The search for a true real definition of knowledge transfer therefore appears to be an impossible quest. Robinson continues by arguing that the cause of a thing combined with the circumstances under which it will necessarily occur may prove a useful compromise (Robinson 1950: 161). For instance the question, 'what is learning?' is not really concerned with the content of learning, but what is sought is really the conditions for learning and the mechanisms by which people may be brought to learn more and to learn faster. Therefore if we accept Robinson's suggestion that a definition must encompass the antecedents, the mechanisms and the outcome of a particular thing, we can derive the necessary conditions for formulating a definition of knowledge transfer, here formulated as questions:

- What leads to a thing, which for knowledge transfer can be formulated as:
 - What makes knowledge transfer take place?
- What may prevent or stimulate this thing in occurring, which for knowledge transfer can be formulated as:
 - What stimulates or prevents knowledge transfer from taking place?
- What is the outcome, given the previous two conditions, which for knowledge transfer can be formulated as:

- What is the outcome of knowledge transfer given the antecedents and the mechanisms?

To develop our understanding of the differences and similarities in knowledge transfer processes within and across organizational boundaries, we draw on the categories developed above, and within each category we distinguish between internal and external knowledge transfer.

4.2 Word-word definition: Description by other terms

The problem of capturing the nature of knowledge transfer processes has led a number of authors to suggest definitions of the word-word type, where another term is used to exemplify, what is meant by the concept knowledge transfer.

Internal knowledge transfer

The most simple word-word definition was suggested by Lord and Ranft (2000: 574), who defined knowledge transfer as 'the dissemination of knowledge from one division to another division within the same firm'. Kalling views knowledge transfer as 'a process by which an organization makes available knowledge about routines to its members' (2003: 115). In contrast to Kalling, who is rather imprecise about the exact nature of the process by using the phrase 'making available', Styhre (2002: 229) explicitly states that 'knowledge is produced as it is shared'. Knowledge thereby is not consumed but shared, given away and received. Finally, knowledge transfer may be seen as knowledge sharing with the characteristics of a public good dilemma (Cabrera & Cabrera 2002: 692-694). The dilemma pinpoints the temptation by individuals to free-ride: why should they share knowledge?, which we shall return to later.

External knowledge transfer

Appleyard (1996: 138) used a similar simple definition as Lord and Ranft (2000) in defining knowledge sharing as 'the transfer of useful know-how or information across company lines'. Along the same lines McEvily, Das and McCabe (2000: 299) define knowledge sharing as 'exchanging information about management practices and associated performance outcomes with other firms' and continue by arguing that knowledge transfer can be seen as 'exchange of context specific knowledge'. Hence, in the simplest form, knowledge transfer between organizations may be viewed as obtaining existing knowledge from an outside source by crossing the company boundaries. Kessler, Bierly and Gopalakrishnan (2000) equals the obtaining of external knowledge to external learning. Beecham and Cordey-Hayes (1998: 194) also focus on learning by defining knowledge transfer as 'learning about new ways of doing things'. Notice that the former approach explicit the external source in the definition, and therefore makes external knowledge transfer distinct from internal knowledge transfer. Both Beecham and Cordey-Hayes (1998) and Makino and Delios (1996) propose more generic definitions, with the latter stating that knowledge transfer, acquisition and earning seem to be quite similar. Knowledge acquisition consists of processes of

experiential and vicarious learning, where the former is related to 'learning from strategic alliance experience' and the latter is related to 'learning the other partners skills' and therefore combines the internal and external aspects (Tsang 2002: 836). A further contribution along these lines is Darr and Kurtzberg (2000: 29), who define knowledge transfer as 'having occurred when a contributor shares knowledge that is used by an adopter'. Thus, Darr and Kurtzberg transcend the distinction between internal and external knowledge transfer processes with their definition. Finally, Inkpen and Dinur (1998) transcend the word-word definition in defining knowledge creation as a multi-stage process, analogous to the innovation diffusion process. In their study of JVs, the authors assume that the innovation diffusion process models are known and moreover that they are generally seen as stage models. These models will be presented further in section 4.3.

From the above definitions, two points become apparent: first, the process of knowledge transfer whether within or between firms implies an element of intentionality or ignition in stressing both the concepts of 'sharing' and 'makes available'. However, these aspects are stated more explicit in the literature on internal knowledge transfer. As an exception, Darr and Kurtzberg (2000: 29) view knowledge transfer as an opportunity to receive knowledge from within the firm or from other firms, based on their understanding of knowledge transfer as a process of sharing. This observation leads to an interesting two-edged question assuming that employees' incentives are not always aligned with their firms, i.e. agency problems can exist

1. What motivates the transferor to send the knowledge with the least efficiency losses?
2. What motivates the recipient to be open towards receiving the knowledge in question?

Larsson et. al. (1998) formulates a principle of mutuality in knowledge sharing and argue that the sender should be transparent and the recipient should be receptive in order to ensure a balanced and successful knowledge transfer. In the literature, the problems of motivating the recipient have been associated with the not-invented here syndrome (Katz & Allen 1982), whereas less attention has been focused on the sender of knowledge. One suggestion is to search for answers in the broader management literature on motivation theory and to apply these general findings to the specific circumstances of knowledge transfer. Second, the content of the knowledge transfer process is rarely specified precisely, whereas there seems to be agreement that the outcome of the process should be learning. Further research therefore needs to consider explicitly the object of knowledge transfer.

4.3 Real definition by essence: Stage models

The understanding of knowledge transfer as consisting of a number of stages beginning with the sender and ending with the recipient has found support in a number of studies. The primary aim of stage models is to present the elements of the process by suggesting a differing number of stages through which the knowledge flows until it reaches the recipient.

Internal knowledge transfer

The mathematical theory of communication by Shannon and Weaver (1949) has been used extensively as a point of departure for defining and analyzing knowledge transfer processes in stages. Among others Szulanski (1996; 2000), Carlile (2004) and Szulanski, Cappetta and Jensen (2004) have all used the model as an organizing frame. Using this model leads to an understanding of communication involving different levels of communication complexity, where transfer of knowledge is associated with the lowest level of complexity. The work by Szulanski (1996, 2000) focus on the role knowledge characteristics, especially stickiness of knowledge, play at different stages in the phase model that includes four phases; initiation, implementation, ramp-up and integration. Based on the same organizing frame, Hansen, Mors and Løvås (2005) formulated three stages: deciding to search for knowledge, searching for knowledge and transferring knowledge. Hansen (1999) viewed knowledge sharing in a more simplified manner as consisting of a process of search and a process of actual transfer. The former incorporates both the looking for and the identification of knowledge, whereas the latter include the move and the incorporation of the knowledge into the firm. Therefore, the model by Hansen and the model by Hansen, Mors and Løvås are clearly related. Obviously, the difficult part in identifying the appropriate stages is to identify where to start the process and where to end the process. Tsai (2002) defines knowledge sharing as ‘the extent to which knowledge among different parts of an organization can be harnessed, shared, and integrated’. Tsai (2002) therefore limits the process to three stages focusing on the ending at the point where enough understanding is achieved to be able to integrate the knowledge in the receiving organization. However, none of the above stage models take into account the element of use by the adopter to ensure that knowledge is traceable (Darr and Kurtzberg 2000). This is however made explicit by Almeida, Song and Grant (2002: 148) in their definition of knowledge transfer within MNC's, who view knowledge transfer as a process of creation, transfer, application and subsequent development through combination of the transferred knowledge with the recipients existing knowledge.

External knowledge transfer

Cummings (2004: 352) rests on the definition by Hansen (1999) and elaborates by stating that sharing is the 'provision or receipt of task information, know-how and feedback regarding a product or procedure'. This definition can therefore be applied to both inter-firm and intra-firm. An important observation of Cummings definition is the focus on the recipient, which is followed by Lorenzoni and Lipparini (1999) by pointing to the importance of both the ability to absorb competences from others and the ability to combine existing competencies or generate new knowledge if required. In a similar vein, Lane and Lubatkin (1998) view the knowledge transfer process as consisting of three elements of valuation, assimilation and application, which jointly may be understood as absorptive capacity as originally presented by Cohen and Levinthal (1990). Gilbert and Cordey-Hayes (1996) present a more balanced view by recognizing both the recipient and the sender, which forms a more unified conceptualization viewing knowledge transfer as consisting of acquisition, communication, application, acceptance and assimilation of knowledge. Finally, Albino, Garavelli and Schiuma (1999) base their perception of knowledge flows on the definition by Cutler (1989), who view knowledge transfer as a process by which the knowledge of one actor is acquired by another. This definition leads Albino et. al. (1999) to suggest that knowledge transfer processes consist of two elements, an information system and an interpretative system comprising acquisition, communication, application, acceptance and assimilation of knowledge. Thus, even though the definition of Cutler (1989) does not explicitly take the use of knowledge on the recipient side into account, the assimilation element of the interpretative system leads to the same conclusion, namely that knowledge transfer should stress the use of the transferred knowledge.

In summary, from the above definitions and conceptualizations two points can be drawn, namely that an explicit focus on the use of knowledge may enable the identification of the ending of knowledge transfer processes (see e.g. the last phase in Szulanski (1996, 2000) and Gilbert and Cordey-Hayes (1996). Hence, it is not sufficient to focus on the move of some knowledge molecules; it should also lead to a near-immediate use of the knowledge by the recipient organization. Second, by including an explicit dyadic perspective, the definition can point towards possible barriers at all levels of the transfer process, which will enable a more thorough examination of what managers can do at different stages of the process. But the question of what it takes to ensure that the knowledge transfer does in fact take place is still not covered. Therefore, in the

following section, we focus on a real definition explicitly taking into account the antecedents, mechanisms and outcome of the process.

4.4 Real definition by analysis: Antecedents, mechanisms and outcome

The word-word definitions presented above are categorized as 'use of other terms', which attempt at defining the 'word' by contrasting it to a 'thing'. To define knowledge transfer by means of stage models provides a description of some process elements and therefore points towards a real definition. The stage models describe the process by pointing to a number of stages that arguably are the necessary ones for knowledge to be moved from one unit to another, but they do not take into account the antecedents, mechanisms and the outcome to complete out understanding. According to Robinson all three conditions are needed to ensure that the definition is at least an approximation to a real definition (1950). The reason for not having all definitions complying with this principle automatically is also provided by Robinson (1950: 162-165) 'apparently the literature appears to prefer short and clear definitions over comprehensiveness'.

The first condition, antecedents, includes the underlying factors or pre-requisites that at the beginning of the knowledge transfer process cannot be changed by managerial action, such as ownership, knowledge characteristics etc. Second, in the mechanisms both the barriers and the facilitators of knowledge flows are included, which can be changed by managerial action. Finally, the knowledge transfer process may be defined using the outcome of the process e.g. the extent to which the knowledge that was actually send is also being received or the efficiency of the process.

Antecedents

External knowledge transfer

Antecedents include the surrounding context for the knowledge transfer process. Bell, Giordano and Putz (2002: 13) stress the importance of the situational settings on the practice of learning and knowledge sharing in an inter-organizational framework, where the setting can be a strategic alliance or a buyer-supplier relationship. Within a strategic alliance, the context complicates the process of transferring knowledge partly due to the competitive aspects of the alliance (Bengtsson & Kock 2000; Dussauge, Garrette, & Mitchell 2000), whereas the competitive element vanishes from the buyer-supplier relationship leading to the proposition that a situational setting activates a particular constellation of meanings, which shapes the knowledge sharing practice.

Internal knowledge transfer

Similarly, Tsai (2001) focuses on knowledge transfer within the boundaries of a shared social context, which is operationalized as a network of units within a firm thereby stressing the importance of context in an intra-organizational setting. The characteristics of the knowledge to be transferred also play an important role as an antecedent of knowledge flows. The characteristics may e.g. be tacit-codified knowledge, the degree of common knowledge or whether the knowledge is simple or complex. These are developed further in the following sub-section.

Internal and external knowledge transfer

Most often the studies refer to tacit versus explicit knowledge, where explicit knowledge can be transmitted without loss of integrity and at low cost, whereas tacit knowledge implies increased complexity, raising cost and possible agency problems (Connell et al. 2003; Dyer, Cho, & Chu 1998; Mangematin & Nesta 1999; Simonin 1999).

Similarly, Prencipe and Tell (2001: 1378) argue that knowledge transfer is more efficient if knowledge is codified, where knowledge codification is one of three learning processes: experience accumulation, knowledge articulation and knowledge codification. On the other hand, tacit knowledge complicates the process of selecting, moving and applying the knowledge (Grant 1996; Hansen 1999; Kogut & Zander 1992; Mangematin et al. 1999; Simonin 1999).

In all of these studies whether related to internal or external knowledge transfer, the conclusion appears to be the same; the higher the degree of tacitness the higher becomes the level of ambiguity and the complexity in the process leading to potentially higher losses of efficiency in using the knowledge by the recipient.

Other antecedents include common knowledge (Reagans et al. 2003: 243), simple or complex knowledge (Hansen 1999), the stock of past host country experience (Makino and Delios 1996), the active involvement of the foreign parent (Foss & Pedersen 2002), the degree of conflict and ownership (Lyles & Salk 1996), social status and perceived expertise (Thomas-Hunt, Ogden & Neale 2003), and previous experience (Lorenzoni & Lipparini 1999).

Between antecedents and mechanisms, we find absorptive capacity (AC). Absorptive capacity is highly relevant for the successful application of knowledge on the recipient side (Cohen &

Levinthal 1989; Cohen et al. 1990), whereas the flip-side has only been touched upon briefly in the literature. The role of absorptive capacity is treated similarly in intra-firm and inter-firm knowledge flows departing in the work by Cohen and Levinthal (1989, 1990). The notion of absorptive capacity has been applied in various studies e.g. Bosch, Volberda and Boer (1999), Gupta and Govindarajan (2000), Koza and Lewin (1998), Tsai (2001), and Minbaeva et. al. (2003). Various arguments would support the view of absorptive capacity as an antecedent emphasizing AC as a pre-requisite for successful knowledge transfer. On the other hand, AC can be argued to be a mechanism emphasizing the argument by Cohen and Levinthal (1989) that the level of absorptive capacity increases as the firm invests in R&D. How may these conflicting views then be balanced? As this paper regards knowledge transfer as a process the balance may tip towards arguing for AC as a mechanism. On the other hand, if the distinction between potential and realized absorptive capacity (Zahra & George 2002) is applied the above balance can be settled. According to Zahra and George (2002: 190) potential AC makes the firm receptive towards acquiring and assimilating external knowledge. On the other side, realized AC is a function of the transformation and exploitation capabilities. Therefore the realized AC may be viewed as an antecedent for future knowledge transfer processes, whereas potential AC may be viewed as a mechanism for enabling knowledge transfer.

Mechanisms

Mechanisms are constructs by which managers can influence or even guide the knowledge transfer process. Mechanisms can focus on reducing conflict, uncertainty or even syndromes like Not-Invented-Here (Katz & Allen 1982). Mechanisms may also support e.g. individual motivation to share knowledge by raising the level of information about the purpose of the activities. Mechanisms are therefore highly relevant for managing the knowledge transfer process, but obviously different mechanisms work in different situations. In the following section 5, the importance of the barriers and facilitators to knowledge flows are discussed in more detail and we therefore focus on the definitions alone here.

Internal knowledge transfer

An obvious starting point is the observation that barriers are considered less important in intra-firm knowledge transfer processes. Szulanski (1996: 27) supports this observation indirectly by stating that confidentiality and legal obstacles should be prioritized in inter-firm knowledge transfer

processes. Szulanski (1996: 28) does, however focus on barriers in an internal context by defining knowledge transfer as a process of replicating internal practice thereby stressing the importance of allowing the replication to take place.

External knowledge transfer

Inter-firm knowledge transfer processes can be mediated through organizational learning (Richter & Vettel 1995), through the richness of information processing mechanisms (Subramaniam & Venkatraman 2001) and through rules and directives, sequencing and routines (Grant 1996). Grant (1996) argues further in another paper that organizational routines may also play an important role as a facilitator of knowledge flows. Dyer and Nobeoka (2000: 48) continue to argue that inter-organizational routines should be purposefully designed to facilitate knowledge transfers across organizational boundaries.

In summarising the antecedents and mechanisms, obvious overlaps exist between them, where e.g. the antecedents may influence the extent to which a mechanism becomes a barrier or facilitator and the extent to which it will be necessary to impose the mechanism on the knowledge transfer. However, as should be obvious from the above short account is that definitions of knowledge transfer do not very often include the mechanisms.

Outcome of knowledge transfer

The outcome of the knowledge transfer process is the third and final condition to be reviewed.

Internal knowledge transfer

Argote et. al argues most powerfully for an outcome based on a definition of knowledge transfer as a process through which one unit is affected by the experience of another (Argote & Ingram 2000; Argote, Ingram, Levine, & Moreland 2000; Darr, Argote, & Epple 1995). This definition has recently been applied in Inkpen and Tsang (2005). Darr, Argote and Epple (1995) measured the effect of knowledge transfer on the recipient by estimating the productivity improvements resulting from the experience of other fast-food stores. Schulz (2001: 662) also enforces a quantitative approach by defining knowledge transfer as 'the aggregate volume of know-how and information transmitted per unit of time'. Levin (2004: 1477) applied an understanding emphasizing improvement in the receivers outcome as the key outcome variable in a study of the mediating role

of trust in knowledge transfer. Mudambi and Navarra (2004) emphasize the relative bargaining power of the knowledge owner compared to the partner by defining knowledge transfer as ‘the current sources of value creation and future sources of potential value creation’. Also focusing on internal knowledge transfer, but with a more balanced view on the partners, Kalling (2003: 116) defines knowledge transfer as ‘the processes by which members within an organization learn from each other, without interacting with the environment’. In this line of argument, learning becomes an outcome in itself and not a mechanism to achieve successful knowledge transfer.

External knowledge transfer

Similarly, from an inter-firm point of view, the effectiveness of transferring and deploying tacit knowledge is a function of a 'fit' between the tacitness in the overseas information acquired and the richness of the information-processing mechanisms employed (Subramaniam and Venkatraman 2001: 363). Finally, Simonin (1999a) argues for the outcome to be related to dependence upon external partners; the less you depend on your partner the more successful the knowledge transfer process has been.

The literature therefore needs to clarify what is to be achieved through the knowledge transfer process, and what are the mechanisms to do so? Obviously, the strategic management literature would argue for a view which takes into account the achievement of sustained competitive advantages (Eisenhardt and Santos 2002). However, the majority of papers seem to argue for some behavioral outcome that is related to the knowledge itself, and not the strategic ends this knowledge may achieve.

In summary, as argued by Robinson (1950) the real definition may provide the most comprehensive understanding of knowledge transfer processes, but as highlighted through the above review, neither of the reviewed papers include more than two of the three components. A future conceptualization of knowledge transfer processes should therefore focus on providing a definition that takes into account all three components and specifying the outcome explicitly.

To answer question 1, important lessons may be learned from comparing the conceptualization of internal and external knowledge transfer processes even though these are treated separately in the articles. The most important lesson is that a definition of knowledge transfer needs to include the

following three elements: first, knowledge transfer should include the *intent* of the transfer. Second, the *use* of the knowledge by the recipient should be included at the end of the process in the final stage, and third, all three components of *antecedents, mechanisms and outcome* of the process should be provided to ensure a comprehensive understanding of knowledge transfer processes. In particular, the outcome should be explicitly stated. Second, lesson is concerned with the view of knowledge transfer as a dyadic activity, which implies that a definition should at least implicitly include both the transferor and the recipient of the transfer. This would again allow for a consideration for the mutuality of the process as argued to be highly relevant by Larsson et. al. (1998). So the answers to the questions posed at the beginning of section 4 are yes the processes are different as they are conceptualized presently and most significantly in the specification of the mechanisms. Whether these may be reconciled by arguing that external knowledge transfer processes strengthen the effect of the barriers or facilitators compared to internal knowledge transfer remains to be proven. In the following section we review the barriers and facilitators further.

5. Barriers and facilitators to knowledge flows

In the previous section, we applied the distinctions by Robinson (1950) to compare and discuss definitions and to have guidance on what are the important elements to investigate. Amongst his types of definitions, we have argued that a real definition is the most fruitful one for our purposes. In the example of the question 'what is learning?', for instance, pursuing such a definition would comprise the antecedents, the mechanisms and the outcome of learning. In this article, our focus is on knowledge flows. In line with the type of definition just mentioned, this section therefore tackles the question 'What are the barriers to knowledge flows?' by identifying the barriers and facilitators to knowledge sharing activities. While the numerous published contributions on these questions have identified lists of facilitators, open questions remain. First among those open questions is: How do intra-firm and inter-firm knowledge flows differ with regard to knowledge barriers and knowledge flows?

There are more questions that would help further our understanding of knowledge flows: What are the causal mechanisms underlying the barriers and facilitators? What is the relationship amongst the

barriers and facilitators? What is appropriate timing for the application of various mechanisms? Does something like a 'hierarchy' of barriers and facilitators exist, and if so, what does it look like?

As mentioned previously, knowledge transfer may be viewed as taking place between two parties known as a dyad. The dyad ties units within a firm or across firms. According to section 4, any conceptualization of knowledge transfer would optimally seen include the object, the pair, the characteristics of the pair and the context in which the pair exists and operates. The most important aspect of the context or environment is the network in which the dyad is embedded. While the characteristics of each of the parties - their organizational characteristics and the characteristics of the individuals involved - have an impact on knowledge transfer, so does the context in which the dyad is embedded. Argote, McEvily and Reagans (2003: 573) suggested the application of a framework based on the following three dimensions, the properties of units, properties of relationships between units and properties of knowledge. We build on their framework and add another three dimensions:

- 1) Characteristics of the network in which the dyad is embedded
- 2) Characteristics of the dyad (equals 'Properties of relationships between units')
- 3) Characteristics of the individual organization (equals 'Properties of units')
- 4) Characteristics of the individual actor
- 5) Characteristics of the knowledge transferred (or, more broadly speaking, the 'content') (equals 'Properties of knowledge')
- 6) Applied transfer 'devices'.

These six categories form a hierarchy of different levels of factors that impinge upon knowledge transfer (see figure 2). Two conclusions can be drawn: First, in function of the research question at hand, one might have to choose one or several of those dimensions. As mentioned at the beginning of this section, Robinson's real definition requires identifying the causal mechanism giving rise to the phenomenon defined. The six dimensions indicate the levels on which such a mechanism might be found. Second, in terms of developing measures, the above list indicates that a multi-dimensional construct would be appropriate.

A complete illustration of the relevant entities is provided in figure 2.

Figure 2: Factors used to identify mechanisms for knowledge transfer

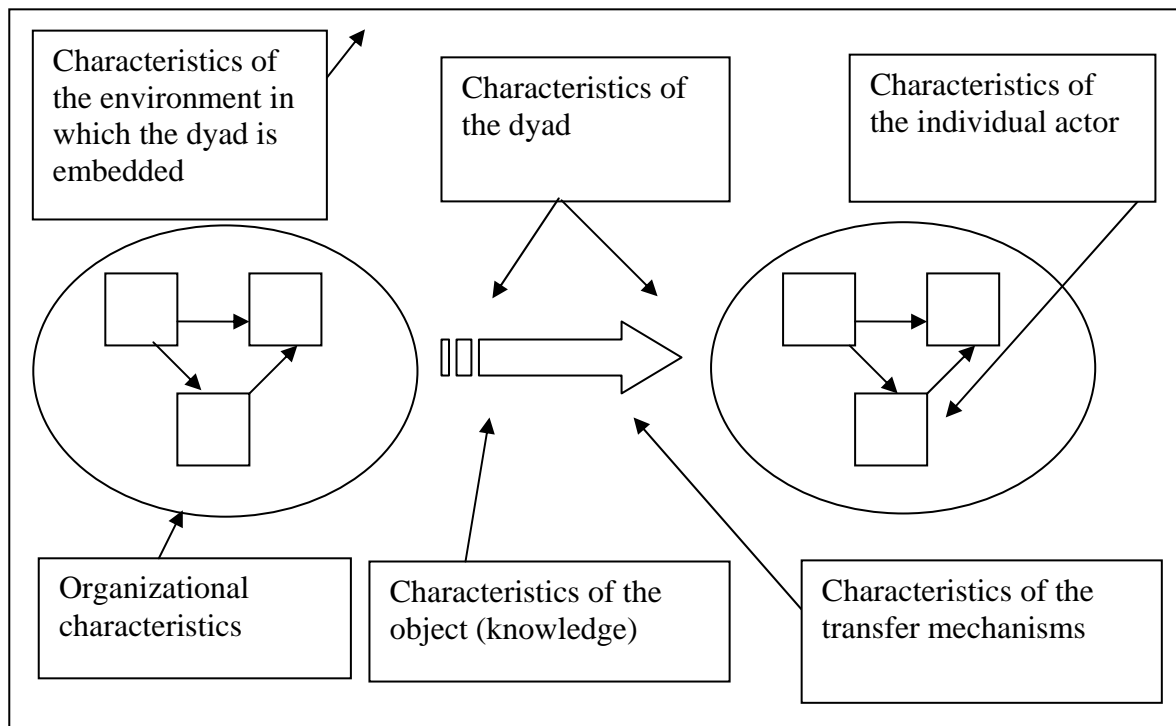


Figure 2 shows that in investigating knowledge transfer we need to consider the characteristics of the environment to illustrate e.g. how surrounding environment influences the dyad through which knowledge is shared and hence ultimately influences the potential knowledge transfer performance. Similarly the characteristics of the dyad itself are important, e.g. if the dyad is a joint venture and thereby regulated by contracts then the conditions for knowledge sharing are different than with a more informal collaborative venture. The characteristics of the organization and the individuals involved may also influence knowledge transfer success, e.g. does the upper management team support the knowledge sharing processes and are the members motivated to share knowledge? The transfer mechanism itself is also important and needs to be matched with the characteristics of the knowledge, e.g. simple and codified knowledge requires other mechanisms than tacit and complex knowledge to ensure the most successful transfer process.

The two categories that have drawn most attention are knowledge characteristics, and the transfer device. By now, insights on tacit knowledge and richness and reach of transfer mechanisms are common currency (Cohendet & Meyer-Krahmer 2001). In what follows, we present the

characteristics of each category identified in the literature and relate the categories to knowledge transfer processes. As a first result of applying the scheme of categories, note that only a few articles deal with the full breadth of categories, but very often, treatment is limited to one or a few categories.

5.1 Characteristics of the network in which the dyad is embedded

Liebeskind et al. (1996: 438) have established that social networks ‘warrant serious consideration as mechanisms for organizing the transfer and integration of knowledge between both individuals and organizations’. Networks have been credited with contributing to extending the scope of organizational learning, to the integration of knowledge, to increasing organizational flexibility, and to promoting organizational learning and fostering organizational flexibility (Liebeskind et al., 1996).

In this section, we therefore consider the barriers and facilitators for knowledge flows on the level of the network. Characteristics of the network basically fall in two sub-categories: characteristics describing the general context of the dyad, and legal characteristics.

External knowledge transfer

Next to stressing the context, the literature on external knowledge transfer mentions the **legal form** in which the knowledge transfer takes place (strategic alliances and joint ventures), and specifies a number of other characteristics of the network like cultural factors (Bhagat, Kedia, Harveston, & Triandis 2002), parent-subsidiary interaction (Inkpen and Dinur 1998), unilateral vs. bilateral alliances, and high learning stakes (Larsson et al. 1998; Lyles et al. 1996; Mowery et al. 1996).

Internal knowledge transfer

The creation and motivation for joint ventures can be described within the transaction costs framework see e.g. Kogut (1988) and Blumberg (2001). The legal boundaries specified by the contract between the parties also outline the conditions for knowledge sharing and should therefore, to a large extent, ensure that knowledge transfer does not result in property rights problems. However, the peculiarity of knowledge is that once you have specified the knowledge to be shared, it is already fully available to the receiver and along with the costs of writing and enforcing contracts this characteristic will not fully ensure the property rights to the firm. But the most

extensive barrier is found in the exchange of knowledge in loose collaborative relationships that are only guided by ad hoc rules and 'knowing what to share' among the employees. Here the parties may withhold important knowledge to avoid losing the knowledge to the partner. Kogut (1988: 321) points to this apparent paradox by stating that 'the initial complementarity between the parents' assets both motivates joint cooperation and poses the transactional hazard of negative externalities, either through erosion or imitation'.

External knowledge transfer

The **inter-organizational context** can refer to an industry, a market, a nation or a geographical area like Europe or Asia (Albino et al. 1999; Cabo 1999; Downes & Thomas 2000; Griffith, Zeybek, & O'Brien 2001; Makino et al. 1996). Kogut (1988: 323) argues that a distinction should be drawn between capital specific to individuals for which there may be an external labor market, and capital specific to organizations. The context therefore provides understanding of the knowledge and specific resources (Lyles and Salk 1996). In their study of Toyotas knowledge sharing network, Dyer and Nobeoka (2000) find that a strong network identify with rules for participation and entry into the network are important conditions for stimulation of knowledge sharing. In a study of a contract R&D firm Reagans and McEvily (2003) studied how network structure influences the knowledge transfer process. Their results indicate that network density as well as network diversity eases knowledge transfer (Reagans and McEvily 2003: 260) and hence demonstrate that these characteristics of the network are important facilitators for knowledge sharing. In addition, Inkpen and Tsang (2005) identify the proximity to other members, weak ties and boundary spanners to maintain relationships with various cliques and stable personal relationships as important factors.

Internal knowledge transfer

Within firms, there are contexts, too, such as teams (Hansen 1999), units (Tsai 2002) and multinational corporations (Gupta et al. 2000). Matson, Patiath and Shavers (2003) use the concept of internal knowledge markets to describe the boundaries of knowledge transfer processes. This market consists of knowledge seekers and experts, and the role of management is to avoid market failures by ensuring a high degree of liquidity of knowledge and transparency (Matson, Patiath and Shavers 2003: 276). Several studies based on the network idea suggest that the position in the network and the identity created by a highly interconnected network structure characterized by strong ties (Granovetter 1973) is important to facilitate knowledge sharing. The network position

assumption states that different positions enable different opportunities for accessing important knowledge (Tsai 2001: 997) because stickiness of knowledge and the uneven distribution of knowledge will concentrate knowledge in pools within the organization (Szulanski 1996; Winter & Szulanski 2001). Hansen, Mors and Lovas (2005) extend this argument by emphasizing size, strength and competition in networks, and Hansen (2002) by pointing to network paths and network connections (Hansen 2002). These factors can be seen as a specification of the more general point made by Tsoukas and Vladimirou (2001) that whether individual or organizational, knowledge always depends on the context. Finally, Inkpen and Tsang (2005) identify personnel transfer between network members, decentralization of authority by headquarters and personnel turnover organization wide as important factors that can act as barriers to knowledge flows.

Finally it seems reasonable to suggest that the effects of different legal forms have an impact on internal knowledge transfer. Downes and Thomas (2000) stress the function of expatriates to include the facilitation of knowledge transfer across national borders. The expatriate's role is to transfer tangible as well as tacit resources to overseas affiliate. The mediating role of single individuals has more generally been labeled knowledge brokers (Baba, Gluesing, Ratner, & Wagner 2004; Spencer 2003) and gatekeepers (Harada 2003; Lee & Juda 2004) and these may be used to ensure the process of knowledge transfer.

Table 5.1: Network characteristics

	<i>Internal</i>	<i>External</i>
Network characteristics	Distribution of knowledge seekers and experts, Identity, Social positions, Structural position in network, Network density; Personnel transfer between network members; Decentralization of authority by headquarters; Low personnel turnover organization wide (Hansen 1999; Tsai 2002; Gupta and Govindarajan 2000; Matson, Patiath and Shavers 2003; Tsai 2001; Szulanski 1996; Winter and Szulanski 2001; Hansen, Mors and Løvås 2005; Hansen 2002; Tsoukas and Vladimirou 2001; Inkpen and Tsang 2005)	Legal form (strategic alliances, joint ventures), Culture, Parent-subsidiary interaction Unilateral vs. bilateral Learning stakes; Proximity to other members; Weak ties and boundary spanners to maintain relationships with various cliques; stable personal relationships (Bhagat, Kedia et. al. 2002; Inkpen and Dinur 1998; Lyles and Salk 1996; Mowery et al 1996; Larsson et. al. 1998; Albino, Garavelli and Schiuma 1999; Cabo 1999; Downes and Thomas 2000; Griffith, Zeybek and O'Brien 2001; Makino and Delios 1996; Dyer and Nobeoka 2000; Reagans and McEvily 2003; Inkpen and Tsang 2005)

5.2 Characteristics of the dyad

The characteristics of the dyad fall into a number of different subcategories. As we show below, the literatures on internal and external knowledge flows differ substantially with regard to the subcategories they devote attention to. We will therefore address the question, whether the different subcategories of characteristics are due to inherent differences between internal and external knowledge flows, or due to a potential neglect of some characteristics in either of the streams of research.

Internal knowledge transfer

Characteristics of the dyad relating to internal knowledge transfer fall in three subcategories: similarity between individuals (see also the concept of homophily, e.g. Ruef, Aldrich and Carter 2003), between the knowledge they hold (Argote et al. 2000; Lapré & Wassenhove 2001), types of relationships (horizontal/vertical, one-way/two-way (Moorman & Miner 1997), and characteristics of relationships (knowledge of what other persons know, access to other persons, willingness to

engage in problem solving, safety in the relationship that promotes learning, kind of relationship (arduous), differential access to the template (Winter and Szulanski 2001), tie strength, relational embeddedness, knowledge redundancy, relatedness in knowledge content, trustworthiness, shared vision and collective goals; accommodation for local or national cultures, clear and transparent reward criteria to reduce mistrust among network members, and syntactic, semantic, and pragmatic boundaries (Carlile 2004; Cross, Parker, Prusak, & Borgatti 2001; Hansen 1999; Inkpen et al. 2005; Rindfleisch & Moorman 2001; Szulanski 2000; Szulanski et al. 2004).

External knowledge transfer

Both in the literature on internal and external knowledge transfer, the similarity between the two parties is an important characteristic. Given the (at least implicit) social psychology fundament for the problem of knowledge transfer (Homans 1947), this is not surprising. The idea of similarity seems to have been explored more in the literature on external knowledge transfer than that on internal knowledge transfer. The literature on external knowledge transfer discusses similarity in, for instance, knowledge bases, organizational structures and compensation policies, dominant logics (Lane and Lubatkin 1998), extent to which the knowledge is common (Zander & Kogut 1995) and learning strategies (Larsson et al. 1998). If similarity is just as important in internal knowledge transfer as in external knowledge transfer, we find it necessary to suggest that the characteristics identified on external knowledge transfer could be extended to include the internal knowledge transfer processes.

The literature on external knowledge transfer has a more fine-grained description of characteristics of relationships, distinguishing legal characteristics of relationships (for ownership see Mowery et al. 1996), temporal characteristics of relationships (for prior related interaction between partners, alliance duration and long-term interaction (Larsson et al 1998; Simonin, 1999b; Makino and Delios 1996), and interaction effects (for interaction between the partner's learning strategies see Larsson et. al. 1998) as well as interaction logic derived from cooperation, norms and rules to govern informal knowledge trading, and commercial transactions embedded in social ties (Inkpen and Tsang 2005).

As the comparative overview of internal and external knowledge flows has shown, the literature on external knowledge transfers seems to be more thorough than the literature on internal knowledge

transfers: more characteristics of relationships have been identified, and a wider breadth of such characteristics (including prior relations) are included. Furthermore, interaction effects in external knowledge flows are taken explicitly into account.

Table 5.2: Dyad characteristics

	<i>Internal</i>	<i>External</i>
Similarity	Similarity between individuals, the knowledge they hold, relatedness in knowledge content, types of relationships, characteristics of relationships, differential access to routines, ties strength, relational embeddedness and knowledge redundancy, syntactic, semantic, and pragmatic boundaries; shared vision and collective goals; accommodation for local or national cultures; clear and transparent reward criteria to reduce mistrust among network members (Argote and Ingram 2000; Lapré, and Wassenhove 2001; Moorman and Miner 1997; Winter and Szulanski 2001; Rindfleisch and Moorman 2001; Cross, Parker et. al. 2001; Szulanski, 1996; Hansen, 1999; Szulanski, Cappetta and Jensen, 2004; Carlile 2004; Inkpen and Tsang 2005).	Similarity in knowledge bases, organizational structures, compensation policies, dominant logics, extent to which knowledge is common, differential access to template, learning strategies; interaction logic derived from cooperation; norms and rules to govern informal knowledge trading; commercial transactions embedded in social ties (Larsson et al 1998; Simonin, 1999b; Makino and Delios 1996; Lane and Lubatkin 1998; Zander and Kogut 1995)
Characteristics of relationships		Legal characteristics, temporal characteristics, and interaction effects (Larsson et al 1998; Simonin, 1999b; Makino and Delios 1996)

5.3 Characteristics of the individual organization

Three dimensions of organizations have been discussed in the literature on internal and external knowledge flows: organizational practices, organizational capabilities and organizational structure. These dimensions are presented in the following three tables:

Table 5.3: Organizational practices

	<i>Internal</i>	<i>External</i>
Organizational practices	Personnel movements, training, managerial reward and incentive systems, organizational structures or practices that have an impact on communication, organizational structures or practices, which in turn have an impact on the replication of routines (Argote, Ingram et. al. 2000; Lord and Ranft 2000)	Personnel transfers and organizational routines (Inkpen and Dinur 1998; Dyer and Nobeoka 2000)
Characteristics of interaction within firms	Interdependence, intra-MNC trade, the characteristics of firms as social communities, collective identity, heedful interrelating and collective emergent knowledge, surfacing and integrating tacit knowledge for collective learning, informal lateral relations, opportunities for communication with suppliers and customers; capability to avoid glitches (Foss and Pedersen 2002; Kogut and Zander 1992; Tsai 2002; Argote, Ingram et. al. 2000; Hoopes and Postrel 1999) (Mohrman, Tenkasi, & Mohrman 2000)	
Organizational capabilities		
	<i>Internal</i>	<i>External</i>
	Absorptive capacity (Gupta et al. 2000; Minbaeva et al. 2003; Tsai 2001)	Absorptive capacity (Bosch et al. 1999; Koza et al. 1998; Lane et al. 1998)

The literature on internal knowledge transfer focuses more on practices and characteristics of the interaction within organization structures, rather than the organization structures themselves. In particular, the article by Tsai (2002) is notable, because he identifies a novel criterion that makes an important difference for internal knowledge transfer: whether organizational sub-units compete with each other for market share or whether they compete with each other for internal resources. The internal knowledge flow literature also has identified a large number of characteristics of interaction within firms. Further, it can be noted that HR practices identified are overlapping in both literatures,

but a larger number seems to have been identified in the case of internal knowledge transfer than for external knowledge transfer. The influence of ownership seems to have been discussed only in the literature on external knowledge flows. In the literature on internal knowledge transfers, finally, there seems to be a scant explicit consideration of informal organizational characteristics.

Table 5.4: Organizational structure

	<i>Internal</i>	<i>External</i>
Formal characteristics	Hierarchical structure, autonomy, control; unit size; corporate size; number of peer units; unit autonomy; distance to peers (Foss and Pedersen 2002; Tsai 2002; Schulz 2001)	Structural barriers, task-specific sequential structure vs. diffuse-overlapping structure, ownership type (Lam 1997; Lyles et al. 1996)
Informal characteristics	Whether organizational sub-units compete with each other for market share or whether they compete with each other for internal resources; Local responsiveness pressures; global integration pressures; informal vertical relationships (Tsai 2002; Schulz 2001)	Conflicts and misunderstandings, internal communication channels, firms as social communities) (Kogut and Zander 1992; Beecham and Cordey-Hayes 1998; Lyles and Salk 1996)

5.4 Characteristics of the individual actor

Both regarding internal and external knowledge flows, the main characteristics of the individual actor taken into consideration are attitudes and capabilities. These are presented in table 4.5.

One difference between the literatures on internal and on external knowledge transfer is that in the literature on internal knowledge transfer the distinction between the 'sender' and the 'receiver' comes out much clearer. Moreover, the emphasis on motivation, in particular, intrinsic motivation is much stronger there than in the literature on external knowledge flows. The reason for this might be simply that both parties belong to the same firm, thus offering the possibility to know as much about the sender as about the receiver. That is quite different in the case of external knowledge transfer.

Table 5.5: Attitudes and capabilities

	<i>Internal</i>	<i>External</i>
Attitudes	Willingness; knowledge presentation (Hansen 1999; Boland et al. 2001)	Openness, trust, motivation, active involvement, learning intent, sensitivity to the specific task of knowledge acquisition and transparency (Dyer and Nobeoka 2000; Larsson et. al. 1998; Lyles and Salk 1996; Subramaniam and Venkatraman 2001; Albino et. al. 1999; Richter and Vettel 1995)
	Referring to 'sender' motivation to share knowledge; intrinsic motivation (Gupta and Govindarajan 2000; Szulanski 1996; Osterloh & Frey 2000)	
	Referring to 'receiver' motivation to share knowledge: Motivational disposition to acquire knowledge (Gupta and Govindarajan 2000; Szulanski 1996)	
Capabilities	Capacity of observation, transfer ability, and how much attention is required in the transfer process (Argote, Ingram et. al. 2000; Hansen, 1999; also Lapré and Wassenhove 2001)	Receptiveness (Larsson et al 1998)
	Referring to the 'receiver': Absorptive capacity, motivational disposition to acquire knowledge, retentive capacity (Gupta and Govindarajan 2000; Szulanski 1996).	Prior experience (Albino et. al. 1999; Beecham and Cordey-Hayes 1998)

5.5 Characteristics of the knowledge transferred

The tacitness of the knowledge transferred is probably the characteristic that has received most attention. A closer look, however, shows there is more to knowledge characteristics than just tacitness. These concepts are illustrated in the following table:

Table 5.6: Characteristics of the knowledge transferred

	<i>Internal</i>	<i>External</i>
Knowledge characteristics	Tacitness, causal ambiguity, un-provenness, and degree of knowledge dispersion) (Szulanski 1996; Moorman and Miner 1997; Foss and Pedersen 2002; Lord and Ranft 2000)	Strategic importance of acquired knowledge and ambiguity; characteristics of fit (fit between knowledge characteristics and richness of mechanisms) (Subramaniam and Venkatraman 2001; Simonin 1999a; Ranft and Lord 2000). Tacit knowledge (Cavusgil, Calantone, & Zhao 2003; Martin & Salomon 2003)
Knowledge characteristics		Point of time of knowledge access (Kessler, Bierly, & Gopalakrishnan 2000)
Knowledge level	Organizational memory levels, intensity of knowledge production and knowledge absorption of subsidiaries; (Moorman and Miner 1997, Foss and Pedersen 2002)	Hired employees used for technologically distant knowledge (Song, Almeida, & Wu 2003)
Sources of knowledge	Network-based, cluster-based (Foss and Pedersen 2002)	How well a firm can integrate and apply its knowledge depends on whether the knowledge "comes from" internal or external knowledge (Kessler, Bierly and Gopalakrishnan 2000)

While there is some overlap in the knowledge characteristics identified (for instance tacitness), there are also knowledge characteristics that are not identified in the literature on internal knowledge flows, such as the strategic importance of acquired knowledge and ambiguity (Subramaniam and Venkatraman 2001; Simonin 1999a). The divergences between the factors identified in the internal and external knowledge flow literatures become even more pointed

considering the other characteristics of the knowledge transferred. Only in the literature on external knowledge transfer, characteristics of fit (fit between knowledge characteristics and richness of mechanisms) have been considered.

Table 5.7: How knowledge is dealt with in the organization

	<i>Internal</i>	<i>External</i>
How knowledge is dealt with in the organization	The organizational instruments and conditions that surround the transfer of knowledge within an MNC, existence and richness of transmission channels (Foss and Pedersen 2002, Gupta and Govindarajan 2000)	
Characteristics of the task that the organization attempts to learn	Frequency, heterogeneity, and causal ambiguity (Prencipe and Tell 2001)	
Characteristics of the ‘memory’	Broad scope of the routines that embody knowledge, value of knowledge stock (Winter and Szulanski 2001; Gupta and Govindarajan 2000)	

Considering how knowledge is dealt with in the organization, finally, confirms that idea that certain characteristics have only been considered in the literature on internal knowledge flows.

5.6 Transfer mechanisms

Finally, table 5.8 illustrates the differences in knowledge transfer mechanisms.

It is notable that the discussion of transfer mechanisms is more detailed in the external than in the internal knowledge transfer case. For instance, the benefits of knowledge sharing are considered in some depth, such as inputs to strategic plans, access to professional networks, formation of industry standards, preparation of the knowledge-sharer and constructing a circulation system (Appleyard 1996). At first glance, this is a somewhat surprising finding given that, in principle, a broader array of transfer mechanisms is available within firms than between firms. Possibly, this difference in attention allocated to the issue of knowledge transfer indicates that the topic of imitation (from competitors) is seen as more important than replication (in-house). Furthermore, in the external

knowledge transfer literature, the media themselves have been defined more closely. These considerations are discussed in more detail in the conclusions.

Table 5.8: Transfer mechanisms

	<i>Internal</i>	<i>External</i>
Knowledge transfer mechanisms	Patents, technology and reverse engineering (Argote, Ingram et. al. 2000)	Patents (Mowery, Oxley and Silverman 1996; Appleyard 1996)
		Technology sharing, strategic integration, articulated goals and milestones, richness, fit between knowledge characteristics and richness of mechanism, overseeing, and management involvement; reverse engineering; benchmarking studies; visits, consortia (Appleyard 1996; Inkpen and Dinur 1998; Lyles and Salk 1996; Subramaniam and Venkatraman 2001; Tsang 2002)
		<i>Channels:</i> Code, channel, capacity, richness, and document-based vs. human-network based (Albino et. al. 1999; Lam 1997).

Based on the organizing frame in figure 2, the barriers and facilitators hindering and stimulating knowledge transfer processes were identified. The concepts in figure 2 allow us to identify and highlight the differences between internal and external knowledge transfer. The tables clearly illustrate where there is a high degree of overlap and where some mechanisms are only treated in one of the literature streams. In the following section, we conclude my taking out the most important differences and discuss the implications of these for future research. But before that the five most important questions for future research identified from the above review are presented and discussed.

6. The missing links to a management view of knowledge flows and conclusions

The article has presented a review of the literature on knowledge transfer, given an overview of the different definitions of knowledge transfer in the intra-firm and the inter-firm case, and has highlighted differences in the barriers and facilitators in intra- and inter-firm knowledge flows. In

this concluding section, we deduct the questions for further research and draw some final conclusions regarding a management view of knowledge flows.

Our vantage point for identifying implications is a management perspective, in the sense that firms have an interest in knowledge flows because they want to govern or influence them in such a way that it benefits their objectives. From such a vantage point, the fit between the ‘object’ of what is to be managed or influenced, and the mechanisms by which it is managed, is important. In order to manage knowledge flows such that they have beneficial effects in line with corporate objectives, three questions thus become relevant: How to best describe the ‘object’ of such management efforts? What tools to use? By what mechanism do the tools impact the knowledge flows?

6.1 Research questions for the future

The thrust of our article was to add precision regarding the first question, the ‘object’, by making the simple observation that inter- and intra-firm knowledge flows might be different, and thus require slightly different management tools. This is why we chose a type of definition that comprises causal mechanisms and that comprises the complete process and its antecedents, mechanisms and outcome³. In what follows, we now consider the findings at each level of analysis for knowledge transfer (the network, the dyad, the organization, and the individual). When we comprise these findings we are able to deduct what we need to know to formulate a management view of knowledge flows. These findings are then formulated as research questions for future research.

On the level of the *network*, an important difference that came out in the comparative overview was the importance of the legal form of the entities that are involved in the knowledge transfer. Two important arguments underline why the legal form may have an impact on external knowledge transfer processes. The legal form of the unit involved in knowledge transfer, for instance, has an impact on the appropriability of the knowledge transferred (Teece 1986). Only independent legal units can contract on markets, amongst others make contracts on knowledge access. As we know from principal-agent theory (Alchian et al. 1972), the legal status of (both) partners to the

³ As mentioned above, for reasons provided in section two this article focuses on barriers and facilitators of knowledge flows, and on comparing them in intra- and interfirm settings. In terms of antecedents, mechanisms and outcomes, the article focuses only on the first two. Outcome measures of knowledge transfer are a fascinating research topic, but in order to maintain focus and for reasons of space constraints, we need to leave it for further research.

knowledge transfer also has an influence on the motivation of agents to exchange knowledge and/or cheat. And as we know from transaction cost economics (Williamson 1985), it also has an influence on the cost of safeguarding the transfer. The question to be analyzed in future research is therefore:

Research question 1:

What difference does the legal form play for different types of external knowledge transfer processes?

Regarding the level of the *dyad*, the two sets of literature have a different emphasis: the literature on internal knowledge transfer has an emphasis on distinguishing types or categories of relationships, while the literature on external knowledge suggests a more fine-grained description of the characteristics of relationships. Amongst others, they include temporal characteristics (prior experience) and interaction effects. Both points, however, seem very important, as we know from e.g. the literature on path dependence (Arthur 1988), but also systems theory. Both aspects do not yet seem to have been explored to the degree that they promise interesting insights (a notable exception is Larsson et al. 1998). Again, we do not find any convincing arguments why they should not also apply to internal knowledge transfer. Still, we suggest that future research analyzes:

Research question 2:

What role do interaction effects play for transfer of knowledge within a firm and how are interaction effects similar to the ones observed in inter-firm knowledge transfers?

Coming to the level of the *organization*, Tsai's (2002) paper has given a good example of work that pushes the research agenda on knowledge flows forward, by introducing the distinction between organizational sub-units that compete for market share and for internal resources. These findings seem to be important explanatory dimensions of internal knowledge flows. We suggest that his insight in the form of hypotheses should be generalized to include also external knowledge flows. It is a task for further research to subject this hypothesis to empirical testing by analyzing research question 3:

Research question 3:

What role do centralization and social interaction play in inter-firm knowledge transfer and how can they be linked to inter-firm knowledge transfer in e.g. strategic alliances?

At the level of the *individual actor*, the literature on internal knowledge transfer has brought out differences between sender and receiver much clearer than literature on external knowledge transfer. Again, there is no a priori argument, why such a distinction should only matter for internal knowledge transfer. In the same vein, the literature on external knowledge transfer emphasizes the historical characteristics much more, in line with the picture gained on the level of the dyad. Finally, it seems that there is still mileage in exploring the two broad categories of characteristics of the individual actor, attitudes and competences. Both push towards a more dynamic perspective by asking how attitudes and competences change, but also by exploring the potential application of sub-dimensions in competencies and attitudes where they have previously not been explored. A first hypothesis could be that the mechanisms by which competencies and attitudes change are very different (cognitive mechanisms in the first, resource accumulation processes as described by Dierickx and Cool (1989), in the second case). One could then identify the mechanisms of such change, and the difference in speed with which the change is taking place for different situations.

Research question 4:

What knowledge sharing mechanisms impose change in competencies and attitudes in the form of individual behavior and to which degree do they change?

Although knowledge characteristics have been in the focus of much attention, and tacitness is an important dimension of knowledge, there are still other knowledge characteristics that warrant further attention and promise some contribution to our understanding of knowledge transfer processes. Both of the characteristics that we want to highlight come from the literature on internal knowledge transfer. First, the level of knowledge (or organizational memory) seems to matter. That is an argument for taking the context (including the history) into account much more. Second, in the same vein, the point of time at which the knowledge in question has been accessed matters. These lead us to formulate the more broad fifth and final research question for the future:

Research question 5:

What are the possible characteristics of knowledge and how do these characteristics influence our understanding of intra- and inter-firm knowledge transfer?

6.2 Some final conclusions and remarks

It is time to take a step back and draw some broader conclusions. As mentioned, we take a management perspective, which focus on how to govern knowledge flows. Our review has shown

there are commonalities, but also differences in internal and external knowledge flows. From a management perspective, this immediately raises the question ‘are different governance mechanisms required for internal and external knowledge flows?’ After all, if the knowledge flows to be governed differ, the governance mechanisms might have to be different, too. A topic for further research is to scrutinize the differences between internal and external knowledge flows with regard to their governance and identify the differences that actually require different governance mechanisms. Such research will then allow the following question to be answered whether internal knowledge flows can be governed just like external knowledge flows or else, how their governance mechanisms need to be adapted.

For the governance of knowledge flows, it is probably necessary to discuss the level of causal mechanisms underlying the transfer. Our distinction of different types of definition of knowledge flows has contributed to the insight that many actually do not explicitly consider the mechanism. In order to design an effective governance mechanism, it is probably helpful to design it in such a way that it works directly on the causal mechanism of transfer. One possibility is to consider the transfer of knowledge as the replication of routines and investigate the replication mechanism further (Winter et al. 2001). Another possibility would be to consider experts as the crucial repository of knowledge. The research program would then be to investigate how experts are best governed.

Second, it should by now have become clear through the review exercise, how important it is to place the analysis of knowledge transfer in a more comprehensive perspective. Figure 2 and the accompanying section have shown the benefits of setting the many articles in the perspective of a comprehensive framework. Amongst others, it becomes much clearer that many of the articles focus on one, or a few, elements that matter for knowledge transfers. There seems to lie still quite some mileage in casting light on the knowledge transfer process from a comprehensive picture. For instance, in many cases the review has shown that different factors have been taken into account in the internal and external knowledge transfer case. Rarely have all factors been taken into account in both cases. Often, however there seems to be no apparent reason why the list of factors considered could not be extended by those additional ones considered in the other case. Considering a more comprehensive list of factors should allow to answer more research questions in a more specific way by being able to draw on the most pertinent category. Less pertinent factors risk being overlooked.

In taking a management perspective and an interest in the governance of knowledge flows, the review also raises questions regarding the importance of legal aspects. How important are legal aspects (such as intellectual property rights or the legal boundaries of the firm) for governance mechanisms? How important are they for governing internal knowledge flows? How important are they for governing external knowledge flows? How important are they as opposed to other influences in governance mechanisms, such as intrinsic motivation or de-facto operational boundaries of the firm (for instance, consider guest engineers of a supplier in the design center of an auto manufacturer).

Other broader insights from the review are that specificities should be taken much more seriously than they have been so far. For instance, partner-specific aspects in relationships have been shown to matter for knowledge transfer (Lane and Lubatkin 1998). History, and the point of time at which knowledge is accessed matters (see above). Work like that of Lane and Lubatkin (1998) shows how one could follow up on this point. Moreover, many important influences on knowledge transfer seem to remain hidden if one stops short of applying a dyadic perspective. Although it is true that tacitness of knowledge is an important influence on the success of knowledge transfer, it is also true that the characteristics required from the 'sender' and the 'receiver' are somewhat different. More importantly, their interaction also matters, as Larsson et al. (1998) have shown. Finally, in line with a more comprehensive perspective on knowledge flows, we should remind ourselves that barriers and facilitators of knowledge flows are not two separate 'entities', but can be interpreted as the flip sides of the same coin. Whether they hinder or foster knowledge flows will be decided by the strength with which the various characteristics are expressed. Which of the other characteristics matter for deciding whether a particular characteristic acts as a barrier or facilitator, in turn, is something that needs to be identified in further research formulating a comprehensive management perspective on knowledge transfer processes.

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