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**GOVERNING KNOWLEDGE SHARING IN ORGANISATIONS:
LEVELS OF ANALYSIS, MECHANISMS,
AND RESEARCH DIRECTIONS**

Nicolai J. Foss

Department of Strategy and Management
Norwegian School of Economics and Business Administration
Breiviksveien 40, N-5045, Bergen, Norway
E-mail: Nicolai.foss@nhh.no

and

Center for Strategic Management and Globalization
Copenhagen Business School
Porcelainshaven 24, 2000 Frederiksberg, Denmark
E-mail: njf.smg@cbs.dk

Kenneth Husted

Department of Management and International Business
The University of Auckland Business School
Private Bag 92019, Auckland, New Zealand
E-mail: k.husted@auckland.ac.nz
Phone: (+64) 9 373 7599
Fax: (+64) 9 373 7477

Snejina Michailova (corresponding author)

Department of Management and International Business
The University of Auckland Business School
Private Bag 92019, Auckland, New Zealand
E-mail: s.michailova@auckland.ac.nz
Phone: (+64) 9 373 7599
Fax: (+64) 9 373 7477

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GOVERNING KNOWLEDGE SHARING IN ORGANISATIONS: LEVELS OF ANALYSIS, MECHANISMS, AND RESEARCH DIRECTIONS

ABSTRACT

We discuss and test recent claims that research on knowledge processes has paid insufficient attention to micro (individual) level constructs and mechanisms and to the role of formal organisation in governing knowledge processes. We review knowledge sharing research published in thirteen (top academic plus top practitioner-oriented) journals in the period 1996-2006 in relation to these two propositions. The review confirms the claim that the knowledge sharing literature is pre-occupied with constructs, processes, and phenomena defined at a macro (collective, organisational) level and pay comparatively little attention to micro level constructs. However, our review provides less support for the proposition that formal governance mechanisms have been under-researched in comparison to formal organisation. Still, the multiple ways in which formal governance mechanisms may interact in influencing knowledge sharing outcomes have been under-researched, as have the interaction between more informal aspects of the firm and formal governance mechanisms. We develop a series of recommendations for future research on knowledge sharing.

KEY WORDS: Governance mechanisms, knowledge sharing, levels of analysis, research agenda

INTRODUCTION

If the doctrinal history of management research in the 1990s and the beginning of the new millennium ever comes to be written, a central — and perhaps the central — chapter will concern how “knowledge” became a dominant construct in multiple fields. Knowledge, considered both as a dependent and independent variable, has been a major research focus for various theoretical disciplines, such as philosophy, information and library science, sociology, economics, cognitive psychology, as well as in management research (notably in strategic management, organisation theory, organisational behaviour, technology management and international business). All these disciplines and fields have contributed in various ways to debates centred around “knowledge” and its “management.” Jointly they have established a very broad discourse. Since the 1960s, social scientists and others have tried to utilize “knowledge” as a unit of analysis starting from simple attempts to categorize knowledge to the complex formulations existing today. Hull (2000, p. 59) summarised this development by pointing to the emergence of the general

... notion that knowledge is an important entity, a unit of analysis, which presents particular types of problem which can no longer be left purely to philosophers, but which require the attention of various other experts. This provides for a variety of concepts, linkages, investigations, commentaries, labels, new language and re-definitions of old language, and changes in practices and techniques.

While some authors cautiously note that knowledge has been added as “... a new ‘contingency’ factor for understanding organisational arrangements” (Grandori in Grandori and Kogut, 2002, p. 225) or as a predictor of organisational arrangements (Birkenshaw, Nobel and Ridderstale, 2002), others view it as an independent construct that signals something bordering on a revolution in management thought (Spender, 1996; Tsoukas and Vladimirou, 2001). Whatever that is, few would contest that there is a shared conviction that the

management of knowledge stocks and flows has become a critical issue for competitive dynamics, international strategy, the building of resources, the boundaries of firms, and many other issues. In spite of the disciplinary pluralism that underpins the examination of knowledge and its management, it also seems that a number of themes have coalesced. A number of notions (e.g. absorptive capacity, (dynamic) capabilities, the exploration/exploitation trade-off) and taxonomies of knowledge dimensions (e.g. tacitness, stickiness, causal ambiguity) are now well established and associated with theoretical insights, disciplinary underpinning, and accumulating empirical evidence.

“Knowledge governance” (i.e., choosing structures and mechanisms that can influence the processes of sharing and creating knowledge in preferred directions and towards preferred levels) has become a distinct issue in management and organisation (Foss and Michailova, 2008). It is, however, a concept that has not yet been well explored and understood. The relationship between governance issues and knowledge processes remains under-researched, theoretically as well as empirically, not the least in comparison with the huge amount of writings concerning the characteristics of knowledge, knowledge taxonomies, how knowledge may be disseminated within and between organisations and the philosophical foundations of knowledge. As with any growing field, the knowledge (governance) field is characterised by existing gaps, problems, unresolved issues, and untested claims and propositions. Some of these have been identified in earlier contributions (e.g., Grandori, 1997, 2001; Foss, 2007; Michailova and Foss, 2008).

In this paper we examine two such recent propositions or claims. The first one relates to the *level* of constructs examined in the knowledge literature. Recent papers (Felin and Foss, 2005; Felin and Hesterly, 2007; Foss, 2007; Salvato, 2007; Teece, 2007) point out that important constructs, such as capabilities, dynamic capabilities, absorptive capacity, communities of practice, etc. are *collective-level* constructs, usually firm-level ones. It is

furthermore argued that these constructs are not clearly rooted in (micro-) foundations of individual (inter)action, which is argued to imply that their origin and nature remain unclear. A second proposition relates to the nature of organisational factors examined in relation to knowledge processes. Foss (2007) argued that when organisational issues are discussed in relation to knowledge processes, “‘organisation’ predominantly means ‘informal organisation’, that is, networks, culture, communities of practice and the like, rather than formal governance mechanisms” (Foss, 2007, p. 37). He points out that formal organisation may be invoked, but is “seldom if ever integrated into the analysis” and in general, “there is a neglect of formal organisation” (Foss, 2007, p. 37).

We acknowledge that the knowledge literature is concerned with various kinds of knowledge processes (sharing, transfer, integration, accumulation, creation, utilisation) in many different contexts (intra/inter-firm, intra/inter-unit, inter-employee). However, to focus the examination of the two propositions, we limit our review, discussion and recommendations to *knowledge sharing* within organisations. We define knowledge sharing as the provision or receipt of task information, know how, and feedback on a product or a procedure (cf. Hansen, 1999). We conjecture that much of what we say about the knowledge sharing literature generalises to literatures on other knowledge processes; however, because of the sheer size and the diversity of the relevant work, a focused discussion is warranted.

We focus on knowledge sharing for the following important reasons. First, as a practice knowledge sharing is designed to transform individual knowledge into organisational knowledge and, hence, it is a fertile context to analyse issues related to level of constructs. Second, sharing knowledge may lead to improved absorptive capacity, improved innovation capacity, and other capabilities. For example, Cohen and Levinthal (1990) argued that a firm’s absorptive capacity is related to the amount of overlap between organisational members’ knowledge sets, an overlap that can be brought by knowledge sharing initiatives.

Nickerson and Zenger (2004) argued that knowledge sharing may be an important antecedent to problem-solving activities. Knowledge sharing therefore has the potential to contribute to sustained competitive advantage (Kogut and Zander, 1992; Grant, 1996; Spender, 1996; Argote and Paul, 2000). Third, while not all organisations engage in new knowledge creation, it is difficult to imagine modern organisational life without knowledge sharing processes taking place. Finally, executives and other practicing managers continue to be interested in explanations and predictions of how knowledge sharing can be steered in desired directions.

In spite of a gestation period that is now well into its second decade (Nonaka, 1991) knowledge sharing is still an emerging field, for example, it is at the stage of initial identification, observation and definition of loosely recognised phenomena and their characteristics and contextual domains. Therefore, the key variables, relationships, and implications, and the testing of those, are by no means clear. In this light, the present paper is a sympathetic critique and an attempt to advance an important field. Accordingly, we discuss selected issues and explain how they have been dealt with. Our arguments lead into formulating research recommendations for a programme in the “governance of knowledge sharing” defined as the choice, combination and deployment of formal and informal organisational mechanisms to shape individual knowledge-sharing behaviour in organisations so that organisational knowledge-related goals (e.g., building absorptive capacity, obtaining a competitive advantage) can be achieved.

ORGANISING FRAMEWORK AND SELECTION OF JOURNALS

Micro and Macro Levels

In order to test whether the existing literature is primarily concerned with collective-level phenomena, we utilise Coleman’s (1990) distinction between macro and micro levels of analysis and the resulting four types of links between them: macro-macro, macro-micro, micro-micro, and micro-macro links (cf. also Foss, 2007; Abell, Felin and Foss, 2008). In the

context of our paper, macro refers to the organisational level while micro is the level of individual action and interaction. Explanations focused merely on macro notions/processes/phenomena and/or embedded in macro-macro links tend to oversee, and often misunderstand and misrepresent complex underlying micro-level processes. There are no plausible mechanisms that *directly* link macro (organisation-level) variables (Coleman, 1990). Translated to our framework and as illustrated in Figure 1, reliable explanation of organisation-level knowledge sharing must involve micro-level constructs (e.g. individual attitudes, intention, goals, motivation, behaviour, etc.), how these individual constructs aggregate up to a firm-level outcome, what are their firm-level determinants, how these determinants exert their influence, etc.

INSERT FIGURE 1 ABOUT HERE

Literature Review

In order to gain a systematic understanding of which level of analysis and which governance mechanisms have been the focus of attention in the knowledge sharing literature, we reviewed articles in thirteen top-tier management journals. We considered the journal lists comprised by Gomez-Mejia and Balkin (1992), Tahai and Meyer (1999), Werner (2002), and Podsakoff, Mackenzie, Bachrach, and Podsakoff (2005). These lists are comprehensive and have been consistently utilized and cited in subsequent reviews (Kirkman, Lowe and Gibson, 2006; Tsui, Nifadkar and Ou, 2007). As a result, we selected the following journals: *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *Journal of Management*, *Journal of Management Studies*, *Management Science*, *Organization Science*, *Organizational Behavior and Human Decision Processes*, and *Strategic Management Journal*. Our review work also included *Journal of Applied Psychology* and

Journal of Organizational Behavior, but a search against our three key terms did not result in any articles published in the considered period. We also included five academic journals with a strong focus on management practices: *California Management Review*, *Harvard Business Review*, *Long Range Planning* and *MIT Sloan Management Review*.

We considered articles published between 1996 and 2006 against the keywords "knowledge sharing", "knowledge exchange", and "knowledge transfer". These terms are often being used as interchangeable: sometimes authors refer to "knowledge transfer" while including "knowledge sharing" and/or "knowledge exchange" in their discussion (e.g. Levin and Cross, 2004), or treat "knowledge transfer" as the ultimate outcome of the "knowledge sharing" process (e.g. Reagans and McEvily, 2003; Tsai, 2002). Our search resulted in 100 articles. Even though we made a serious effort to be thorough in our search, we acknowledge the possibility of having missed some articles hoping that the few potential unintentional omissions would not significantly modify our conclusions.

Three researchers (one of those was an independent researcher who was not a part of the co-author team) independently reviewed the 100 articles in relation to the elements and arrows in Figure 1. In other words, the focus was on whether the articles considered organisational antecedents, conditions of knowledge sharing, individual knowledge sharing and knowledge-sharing outcomes as well as the four links between these constructs. To test the proposition whether the literature is pre-occupied with examining informal mechanisms at the cost of formal ones, the three raters also evaluated whether the articles that considered organisational antecedents looked into formal, informal or a combination of the two types of organizational antecedents. In the six instances of disagreement among the raters, a discussion was conducted until consensus was reached. Table I summarises our review.

INSERT TABLE I ABOUT HERE

Ideally, work on knowledge sharing would cover the four elements and arrows 1, 2 and 3 in Figure 1. In other words, the literature would analyse organisation-level outcomes of knowledge sharing (north-eastern corner of Figure 1), or perhaps organisation-level knowledge sharing itself, as caused by some aggregation of individual knowledge-sharing efforts (arrow 3). These would be seen as influenced by the conditions that individuals find themselves in (i.e., the incentives they face, the beliefs they hold, etc.) (arrow 2), and the conditions would, in turn, be influenced by organisation-level variables (arrow 1). In principle, the latter could be any variable that may be placed on the organisational, rather than the individual, level, such as routines, culture, network characteristics, etc. as well as formal organisation. In other words, the argument that micro-foundations are needed does not amount to a rejection of collective level variables *per se*. Also, Figure 1 takes organisation-level knowledge sharing as the *explanandum* phenomenon, and organisation as the ultimate antecedent.¹ Of course, formal organisation is only “ultimate” in terms of the figure. Such organisation is, in turn, explainable in terms of the choice behaviour of organisational members. Bearing this in mind, we now turn to examining whether collective level notions and constructs are over-researched at the cost of individual level ones and whether formal antecedents have been largely under-researched as compared to informal organisational arrangements. The mapping of the literature summarised in Table I allows us also to examine to what extent authors have engaged in multilevel analysis and how often they have considered both formal and informal mechanisms in the same studies.

EXAMINING MACRO-MICRO-MACRO LINKS AND THE ROLE OF ORGANISATION IN THE KNOWLEDGE MANAGEMENT LITERATURE

Emphasis on the Macro Level and a Relative Neglect of the Micro Level

Many contributions to the organisation-knowledge link have a methodological collectivist orientation (Argote and Paul, 2000; Felin and Foss, 2005; Felin and Hesterly, 2007; Foss and Michailova, 2008). In other words, macro-micro, micro-micro, micro-macro analyses are seldom performed and instead the explanation takes place mainly on the collective level examining macro-macro links. Our review confirms the proposition that macro level notions and phenomena and macro-macro links are preferred among researchers in the knowledge sharing field. 71 of the 100 reviewed articles address macro-macro links (arrow 4 in Figure 1). Only 10 studies explore macro-micro relationships, 16 studies examine micro-macro links and 20 studies analyse micro-micro interactions. This is hardly satisfactory. While work that involves macro-macro links may not always be methodologically illegitimate, what may secure such work its legitimacy is exactly when there are proven, well-known ways in which macro-macro links can be reduced to more fine-grained links that involve individuals and their interaction (Stinchcombe, 1991); because these ways are familiar, they can be left out of the explanation. Still, it remains that ontologically, there are no conceivable mechanisms that *directly* link one macro (organisational level) variable to another macro variable. Instead, links between macro variables are *always* mediated through individual action and interaction.²

Macro-macro links are, methodologically speaking, shorthand for a more complex substructure of individual action and interaction. For example, organisational structure never *directly* impacts organisational performance; it may well effect an influence, but only indirectly, namely through influencing individual conditions, actions and interactions. While we do not accuse the literature on knowledge-sharing for indulging in methodological collectivist excesses — there is plenty of mention (if little analysis) of individual characteristics, motives, etc. —, it seems reasonable to press the charge that the literature is not clear about the nature of the mechanisms implied by arrows 1, 2 and 3 in Figure 1.

One manifestation of this is that the large majority of contributions to the knowledge-sharing literature are not founded on clear assumptions about individual action/behaviour and the interaction of actions/behaviours. Thus, the studies listed in Table I generally do not explicate the assumptions made concerning the behavioural and cognitive set-up of agents. This is not to say that the theme has been entirely absent from the discussion. First, a few of the reviewed papers do handle the issue. For instance, Andrews and Delahaye (2000) examine the influence of the psychological filter on knowledge processes, Bouty (2000) focuses on interpersonal influences on informal resource exchange between individuals and Cabrera, Collins and Salgado (2006) examine determinants of individual engagement in knowledge sharing. Also, the main point in Osterloh and Frey (2000) is that the specific motivational assumptions that are made — extrinsic and intrinsic modes of motivation — matter a great deal to what is predicted concerning individual and organisation-level knowledge sharing outcomes. Specifically, building on the work of Edward Deci (e.g., 1972), they argue that extrinsic motivators, such as monetary rewards, have a tendency to crowd out intrinsic motivation, which may harm knowledge sharing, because it likely relies strongly on this kind of motivation.

Second, a number of papers that have not been included in the review (because they did not meet the criteria for being included) are explicit about underlying behavioural and cognitive assumptions. For example, a handful of authors draw strongly on transaction cost economics, and therefore import the behavioural assumptions of opportunism and/or bounded rationality in their arguments (e.g., Contractor and Ra, 2002; Heiman and Nickerson, 2004; Oxley and Sampson, 2004). Others, while more sceptical of transaction cost economics, are fully aware of the need to make explicit behavioural and cognitive assumptions in a knowledge sharing context; in particular, the latter assumptions are key in Grandori (1997, 2001) and Lindenberg (2003). Relatedly, motivational psychology has been explicitly used in a handful of contributions, particularly on the interface between knowledge sharing and

human resource management (e.g., Cabrera et al., 2006; Collins and Smith, 2006; Kane, Argote and Levine, 2005).

These are, however, exceptions from the general tendency of not being forthcoming about behavioural and cognitive assumptions. It is somewhat disturbing that out of the 100 studies we reviewed, by far most of them, 81, are concerned with knowledge-sharing outcomes without paying serious attention to the micro-foundations of these outcomes. This general tendency is arguably the dominant reason why micro-level mechanisms are seldom explicitly theorised: if no specific assumptions are made about organisational members, it is difficult to meaningfully theorise their interaction, including how such interaction aggregates to organisation-level knowledge-sharing outcomes. If the literature remains being pre-occupied with outcomes and the (macro-)link between organisational antecedents and those outcomes, it will remain difficult to explain and predict how organisational members react (e.g., with respect to their knowledge-sharing behaviour) to organisational processes and/or change projects.

In the absence of clear micro-foundations, research becomes predominantly descriptive (i.e., reports of events or accounts of social practices) rather than theoretical (i.e., explanation and prediction of behaviours based on systematic understandings of mechanisms), predictive and managerially relevant. To the extent that an attempt is made to inductively build theory from, for example, accounts of social practices, such theory has a tendency to be constructed in an aggregate mode. For example, attempts may be made to generalise from observed correlations between social practices in a firm and its pattern of knowledge-sharing behaviours, little attention being paid to the micro-mechanisms that initiate, mediate or moderate between these aggregate variables. We strongly believe that both theoretical and qualitative empirical work is justified and needed; a healthy feedback between empirical reality and theoretical work is necessary in virtually any discipline (see Nelson and Winter,

1982). However, knowledge-sharing research has suffered from too little attention to building micro-foundations in the form of making behavioural assumptions and building theoretical accounts of mechanisms. Note that this critique does not necessarily amount to a call for a unified “model of man,” such as is (or perhaps rather was) characteristic of economics; instead, the call is for making explicit behavioural assumptions and for explicitly identifying mechanisms in theorising. We outline what some of these assumptions and theories may be in the recommendation part of the paper.

Organisational Antecedents in the Literature on Knowledge Sharing

Organisational variables, that is, the north-western node in Figure 1, have no doubt been taken seriously in the knowledge-sharing literature. A first observation occurring from the mapping in Table I is that almost all studies have identified and examined organisational antecedents, to one extent or another, although these organisational antecedents vary widely and are conceptualised very differently, from broad conceptualizations of “organizational control” in general (Turner and Makhija, 2006) to individual organisational practices, such as reward systems (McEvily, Das and McCabe, 2000), mobility (Song, Almeida and Wu, 2003), personal rotation (Kane et al., 2005) and leadership (Srivastava, Bartol and Locke, 2006).

A second observation is that Table I does not support the notion that informal organisational antecedents have been over-emphasised relative to formal ones. It is true that much of the literature has focused on informal organisational factors. An example of this type of studies would be the examination of how network relations influence communication channels in organisations, and how such channels determine knowledge-sharing outcomes at organisational level. At the same time, several studies actually address the formal governance of knowledge, and it does not appear from the table that informal organisation has been over-emphasized at the expense of formal organisation.

Looking beyond the table, in organisational economics, there is a long standing thesis that alliances involving complex tasks and knowledge transfers should be regulated through formal proprietary agreements (e.g., Heiman and Nickerson, 2002, 2004). Also, a prominent argument is that the formal and proprietary governance regime of the firm itself has special properties in the governance of knowledge exchanges where markets fail (see, from very different perspectives, Kogut and Zander [1992] and Nickerson and Zenger [2004]). In organisation studies the role of formal integration roles and proprietary integration mechanisms in knowledge-intensive situations has also been highlighted (e.g. Davenport and Prusak, 1998; Grandori, 1997, 2001; Grant, 1996; and many others listed in Table I).

A third observation is, however, that very few studies have *simultaneously* addressed formal and informal organisational antecedents. Out of 100 articles that take on board the issue of antecedents, only 14 discuss both types. This situation is difficult to justify, because even in perspectives adopted by studies on informal antecedents, formal organisation must also matter; for example, (informal) patterns of communication are influenced by organisational structure (Cohen and Levinthal, 1990) and formal organisation influences network positions and network relations by defining tasks, task composition, roles, etc.

While organisational antecedents have made prominent appearances in recent research on knowledge sharing, there is a relative lack of concern for *how* these antecedents are related to individual knowledge-sharing behaviours (*via* arrows 1 and 2) and therefore ultimately to knowledge-sharing outcomes (*via* arrow 3). Thus, it is often unclear in the literature through exactly which mechanisms organisational variables exercise their influence on organisation-level knowledge-sharing outcomes. A number of studies listed in Table I apply team/group/network/community ideas to knowledge sharing (e.g. Bechky, 2003; Dyer and Hatch, 2004, 2006; Dyer and Nobeoka, 2000; Hansen, 2005, Inkpen and Tsang 2005). However, work that applies network ideas to knowledge sharing typically suffers from lack of

concern with critical micro-issues. Building on Granovetter (1973) and Winter (1987), Hansen (1999) argued — and empirically substantiated — that intra-organisational knowledge sharing affects project completion time. He argued that although weakly tied project teams have an advantage in terms of search ability, such teams have a problem transferring highly complex knowledge, because they are likely to incur transfer problems due to poor interaction with the source unit.

Although actors are by no means neglected in network analysis, the approach does not go very far with respect to accounting for individual interests, knowledge, beliefs, preferences, expectations, etc., — surely critical ingredients in micro-foundations for management research. For example, motivational issues are usually side-stepped in network research. Network analysis may allow for an account of how “organisation” impacts firm-level knowledge sharing outcomes through the mechanisms implied by arrows 1, 2 and 3 in Figure 1. However, since little attention is paid to individual actors, as relations are the key unit of analysis, network analysis risks neglecting potentially important results of individual action; the account will be quite circumscribed. For example, network position is usually not made endogenous to the analysis. If organisational members may benefit from specific positions in a knowledge sharing network, competition for those positions will arise. How will such competition be resolved, that is, who will end up with the favourable positions? How many resources will be consumed in the rent-seeking scramble for favourable positions? How will this impact organisational knowledge sharing? Such questions are usually not posed, much less resolved, in the network analysis literature, and indeed in the knowledge-sharing literature at large.

Managerially Relevant Knowledge Management?

Given that knowledge management emerged as a highly practice-influenced research field, it is striking that the research in this field is not more normative. For example, the

organisational behaviour grounded studies on knowledge sharing are silent about what it actually means to establish and nurture a knowledge-sharing friendly culture/climate and how managers can go about it. Likewise, the research stream that is influenced by sociological network theory has only little normative content; it is not forthcoming with respect to how management can influence network positions and relations in order to govern knowledge sharing. Typically, this would be done through changing departmentalisation, specialisation, etc., that is, formal organisation.

The lack of attention to micro-foundations is, we submit, an important reason for the relative lack of managerial advice from the various knowledge management research streams. As Coleman (1990: 1-23) argues, interventions designed to change a variable at a macro level are often naturally made at *lower* levels. For example, building a firm-level capability may require that certain employees with particular educational backgrounds, experiences, character traits, etc. are hired, socialised, and remunerated in specific ways. However, such intervention obviously requires significant knowledge about what goes on at the micro levels. Research that is not based on clear micro-foundations has difficulties supplying practitioners with such knowledge.

Relatedly, if research only considers formal *or* informal organisation, and abstracts from their interaction, and also does not specifically trace out how different kinds of organisation impact knowledge sharing behaviours, there is a tendency to lose out in the normative dimension. In contrast, a concern with both formal and informal organisational factors and antecedents has the potential to devise meaningful and efficient organisation. This is hardly surprising as many of informal factors, such as culture, are semi-permanent traits of an organisation that may be harder to change than formal arrangements, such as organisational structure, reward systems, etc.

As a result of these shortcomings, managers are not optimally equipped to make

decisions about how to embed knowledge-sharing initiatives in existing organisational structure and culture, and they lack robust models for assessing the organisational costs and benefits of engaging in knowledge sharing. This is difficult to continue to justify, especially in the light of recent calls for the need for “evidence-based management”, that is, management that is associated with making decisions that integrate the best available research evidence with decision maker expertise to guide practice toward more desirable results (Pfeffer and Sutton, 2006; Rousseau, 2006).

SETTLED AND OPEN ISSUES AND RESEARCH RECOMMENDATIONS

Settled Issues in Knowledge Management

While it is always potentially dangerous to declare any issues in a(ny) scientific field for “settled,” there are at least issues around which a strong degree of consensus exists. A closer look into the articles reviewed in Table I suggests that the knowledge sharing literature has yielded numerous insights that are now commonly accepted and that, we think, are rather uncontroversial. We outline those insights below.

Epistemological issues. While discussions of the nature of knowledge and on the “practical epistemology” of knowledge sharing in organisations have shed light on different knowledge forms, the marginal returns to further epistemological inquiry seem to be declining rather steeply. In particular, the tacit/explicit knowledge distinction is well established (e.g., Nonaka, 1991; Kogut and Zander, 1992; Hedlund, 1994; Grant, 1996; Spender, 1996; Argote and Paul, 2000; Osterloh and Frey, 2000; von Krogh et al., 2001; Almeida and Phene, 2004), and its main implications — for example, that costs of sharing and integrating knowledge differ as a function of the characteristics of knowledge, and that tacitness may contribute to the sustainability of competitive advantage — is generally accepted, and heavily researched in a number of contexts (idem.). What is needed on this particular issue is rather more operationalisation and measurement than discussion of the

basic issues (however, for a different view, see Spender, 2005). To the extent that further epistemological discussion may be needed, it should (consistent with our previous discussion) mainly concern the under-researched issues of understanding the different in organisations levels at which knowledge can be held (cf. Felin and Hesterly, 2007) and how these levels are linked in terms of individual action and interaction.

Knowledge dimensions. Although the literature continues suggesting different dimensions of knowledge related units of analysis, nevertheless certain dimensions have become dominant and attracted enough interest to be empirically tested. Examples include knowledge tacitness (Winter, 1987; Athanassiou and Nigh, 1999; Subramaniam and Venkatraman, 2001), knowledge “appropriability” (Oxley, 1997; Oxley and Sampson, 2004), knowledge “novelty” (Contractor and Ra, 2002) and knowledge stickiness (Szulanski, 1996, 2000). While suggesting and coining new dimensions is a natural part of the effort to understand deeper knowledge-related units of analysis, we argue that the field is in more need of testing empirically already established dimensions and that proposing new dimensions should be centred around hypothesising how governance mechanisms vary systematically with these dimensions. To be clear, we are not against theorising about and examining (new) dimensions of knowledge; in our context, their importance relates to the fact that different dimensions are associated with different sharing costs and the choice of governance mechanisms partially reflects such costs (Nickerson and Zenger, 2004; Oxley and Sampson, 2004).

While recommending a pluralistic attitude here, we also think it is crucial to be explicit about the unit of analysis one has adopted. Several of the articles listed in our review are not clear about the unit of analysis. As a matter of fact, it is reasonable to speculate that the failure to be explicit about the unit of analysis may be a key contributor to the absence of micro foundations in knowledge sharing research.³ Thus, if the knowledge related unit of analysis is a firm or business unit level capability, this is likely to tie in less naturally with a micro-focus

than if the unit of analysis is a knowledge transaction between two parties (Heiman and Nickerson, 2004) or a “problem,” as seen, for example, from the point of view of the management team (Nickerson and Zenger, 2004).

Open Issues

While a consensus may be emerging, or have already emerged, with respect to the above points (or at least concerning their importance), other issues remain considerably more open. Some of them are “open” in the sense that while they may be well-known, they remain under-researched. One important example concerns the performance benefits of knowledge sharing. While many benefits have been argued to stem from knowledge sharing (e.g., productivity improvement, increased innovativeness), rather little work exists that actually attempts to quantify such benefits (but see Haas and Hansen, 2005). In contrast, we find very little explicit awareness in the literature of the need to forge clear micro-foundations for the link between organizational antecedents (whether informal organizational phenomena or formal governance mechanisms) and organization level knowledge sharing outcomes. We now spell out in greater detail what are the under-researched issues and outline recommendations for future research. Starting from the north-western corner in Figure 1 and based on our mapping of the knowledge sharing literature, we identify a number of questions that we see as still unresolved.

What are the relevant organisational antecedents (and facilitators)? While the knowledge sharing literature collectively addresses an impressive number of potential organisational antecedents of knowledge sharing, are there certain antecedents that are likely to have a stronger impact on knowledge-sharing behaviour and organisational outcomes than others?⁴ Implicitly, recent literature on knowledge sharing (cf. Table I) considers informational networks to very important antecedents, at least judging from the large number of (highly cited) papers in top journals that have addressed knowledge sharing from a network

perspective (e.g., Hansen, 2002; Dyer and Hatch, 2004, 2006; Tsai, 2001). Also, direct monetary rewards have attracted considerable attention (e.g. Osterloh and Frey, 2000; Cabrera et al., 2006). However, in principle, virtually *any* organisational antecedent — reward systems, job descriptions, managerial style, corporate culture, capabilities, etc. — can be argued to matter for individual knowledge-sharing behaviour and organisational-level outcomes. It does not seem possible to place a lot of *a priori* restrictions on the set of relevant antecedents (see Grandori [2001] for an attempt).

Given this, one approach may be to engage in empirical work designed to uncover the relative contributions of different organisational antecedents to knowledge sharing outcomes, that is, essentially treat each organisational antecedent as an independent variable in properly specified regression models. Such work can become quite messy, because of the sheer number of potential variables that can be included.

One possibility is to restrict analytical attention to those organisational antecedents that can be manipulated rather directly by management, such as information systems, incentive schemes, allocations of decision rights and authority, etc. (and perhaps treat the less easily manipulable antecedents as control variables). In a knowledge sharing context, a working hypothesis then is that such governance mechanisms are deployed in the belief that influencing the conditions of actions (the south-western node in Figure 1) in a certain manner leads employees to make those knowledge sharing decisions (the south-eastern node) that, when aggregated (arrow 3), lead to favourable organisational knowledge sharing outcomes (the north-eastern node). Indeed, some research included in Table I examines these issues. However, very little systematic knowledge exists concerning many of the key issues. For example, there is extremely little knowledge about how such a fundamental organisational phenomenon as (job) specialisation impacts knowledge sharing.

Research recommendation I: *Research on knowledge sharing needs to develop a comprehensive and systematic approach to identifying the relative contributions of organisational antecedents to knowledge sharing outcomes. A first step in such a research strategy may be to begin with those antecedents that can be construed as levers that can be activated by management.*

Complementary and substituting organisational mechanisms. As noted already in the paper, some organisational mechanisms may complement each other with respect to the impact on knowledge-sharing behaviour, while other mechanisms may be substitutes. For example, a strong corporate culture that stresses general sharing behaviour (e.g., in the form of organisational citizenship behaviour) may *substitute* (within certain ranges) for explicit incentive pay (and *vice versa*) in the coordination of knowledge-sharing activities. Formal organisational arrangements and informal organisational practices may be *complementary* to each other with respect to their impact on knowledge sharing. For example, the effect of explicit incentives on knowledge sharing may be increased by the presence of a culture that accepts substantial pay differences across employees. On the other hand, studies have documented that formal organisational mechanisms (introducing extrinsic rewards in terms of payment) may act against existing informal patterns and practices (intrinsically motivated organisational members) and such a combination may destroy knowledge sharing behaviour and course irreversible, long-term negative effects on organisational behaviour (Osterloh and Frey, 2000; Robertson and Swan, 2003). Hence, we propose the following

Research recommendation II: *Research on knowledge sharing in organisations should build knowledge about the interaction between discrete organisational (governance) mechanisms (in terms of substitutability or complementarity) with respect to knowledge sharing.*

Formal and informal organisational antecedents. Both formal and informal organisational mechanisms are crucial to the understanding of the governance of knowledge sharing. One set of issues concerns their relative importance. A second set of issues relates to the points about substitutability and complementarity we have mentioned above: Are formal and informal organisational mechanisms substitutes or complements, or more precisely, which mechanisms are substitutes and which are complements? Are these relationships influenced by how mechanisms are bundled? How do formal and informal elements of organisation interact with respect to influencing knowledge sharing? It is generally recognised that informal organisational mechanisms are influenced by formal ones. A famous case is Homans' (1950) re-analysis of the bank-wiring room from the Hawthorne studies, demonstrating the existence of strong group norms with a significant element of enforcement. However, the background to those norms was the formal group piece-rate incentive system designed to increase productivity at the Western Electric Hawthorne Works in Chicago⁵. This aspect of formal organisation defined the parameters of interaction: The group piece-rate system did not directly determine behaviour, but it fostered a need for norms that could curb shirking. And these norms were more directly determinative of behaviour.

We may see a similar dynamic in the governance of knowledge sharing processes. Research has documented the importance of dysfunctional norms in knowledge sharing processes, such as “knowledge sharing hostility” in the former East Bloc countries (Michailova and Husted, 2003). It can be hypothesised that the adoption of specific mechanisms can ultimately erode such norms and that in order for these mechanisms to lead to desired outcomes, they need to be context-specific. Context, defined at different levels, is important for examining any issues relevant to organisations, including knowledge sharing governance. Organisations embedded in certain national cultural and institutional contexts understand and deal with knowledge sharing issues differently from those located in other macro environments. Michailova and Husted (2003) pointed out that knowledge sharing in

traditional Russian organisations can be achieved via direct instructions and negative sanctions of behaviour that deviates from the looked-for behaviour. In turn, such actions may help to build a beneficial knowledge sharing culture.

While informal organisation can be influenced by the deployment of formal organisation, there is no simple correspondence between the two and the lag-structure is not only complicated, but also long-termed. Managers who wish to influence knowledge sharing by influencing informal organisation must take considerable ambiguity and inertia into account. Changes in formal organisation can function as signals to organisational members. Such signals may in turn strongly influence the relations between management and employees. However, it is clear that these processes are surrounded by much ambiguity and uncertainty. Is a decision to formally reward knowledge sharing behaviour a signal that the organisation is shifting to a “gain frame” with a general emphasis on short term maximizing behaviour? Or is it rather a signal that the organisation places much value on knowledge sharing and that knowledge sharing behaviour in general is welcomed?

Research recommendation III: *Research on knowledge sharing in organisations should build knowledge about the interaction effects between formal and informal organisation, and how formal and informal organisation impact each other with respect to knowledge sharing outcomes.*

While the kind of research advocated in research recommendation I - III may begin from correlations between aggregate variables (i.e., the top arrow in Figure 1), according to the argument in this paper we can only understand why some antecedents may matter more than others by looking at the level of individual action and interaction. For example, whether a reward for knowledge sharing has negative or positive consequences for organisation-level knowledge sharing may depend on the prevailing culture. However, why this is so is hard to grasp in lieu of understanding of how organisational culture at least partly primes the

perceptions of organisational members.

How do organisational antecedents impact organisational members' knowledge sharing behaviour? In the approach we advocate, explanation fundamentally involves the individual agent. This implies making *specific, explicit* assumptions about individual agents' perceptions, beliefs, preferences, knowledge, incentives, etc. In relation to governance mechanisms, a key question is how such mechanisms influence individual organisational members and the knowledge sharing processes in which these members are involved (Figure 1, arrow 1).

Logically and temporally, the first issue to consider is that of perception: Organisational antecedents impact the *conditions of actions* of organisational members (arrow 1) partly through these members' perceptions. For example, while some members may identify strongly with their organisation, others may not buy into and internalise organisational values and beliefs. Also, individual employees may perceive managerial style differently, or employees may, as a group, perceive managerial style differently from the manager's intentions. In turn, organisational antecedents are placed in and cannot be separated from organisational members' interpretive frames (Lindenberg, 2003). How do these perception and interpretation processes impact the choices that organisational members make with respect to their knowledge-sharing choices? According to a substantial literature in psychology research, cognitive framing may strongly impact motivation (Lindenberg, 2003). If specific kinds of organisation, such as high-powered performance incentives or extensive monitoring, are perceived as controlling, this can reduce intrinsic motivation in general and intrinsic motivation to share knowledge in particular. Thus, perception and motivation may be intertwined through framing effects.

The subtlety of this is lost when one insists on separating cognition and motivation, as transaction cost scholars typically do. While we are sympathetic to the application of the

behavioural assumptions of transaction cost economics — that is, bounded rationality and opportunism (Williamson, 1996) —, as these allow for a clear identification of the organisational and exchange hazards that a micro-oriented perspective on knowledge sharing should consider (cf. Heiman and Nickerson, 2004; Oxley and Sampson, 2004), these behavioural assumptions may still be too coarse. “Bounded rationality” is associated with various phenomena and “opportunism” manifests itself in multiple ways. Similarly, a more sophisticated view of motivation (as in Osterloh and Frey, 2000) that is conventional in organisational economics must be included. A more nuanced view of motivation, one that is informed by advances in social psychology and organisational behaviour, is likely to better capture the complexity of the mechanisms that link governance mechanisms and knowledge processes (Grandori, 1997, 2001; Lindenberg, 2003; Osterloh and Frey, 2000).

For example, Osterloh and Frey (2000) examine how knowledge transfer is influenced by organisational design. This research question is embedded in a broader discussion of how firms increasingly introduce market elements to exploit the advantages of price mechanisms, by making exchanges between departments or actors more explicit and enabling them to reward according to the contribution to a firm’s profit. In order to theorise the mechanisms lying between organisational variables and organisational-level knowledge sharing, the authors identify a number of exchange hazards that beset internal knowledge transactions. They argue that the transfer of tacit knowledge cannot be accomplished by contracting, and that employees cannot be sanctioned for holding back tacit knowledge. Therefore, managing individual motivation becomes central. Firms have access to mechanisms (that markets don’t) to manage intrinsic motivation, such as participation. Participation signifies agreement on common goals and raises employees’ self-determination and personal relationships which lead to establishing psychological contracts based on emotional loyalties. This, in turn, raises the intrinsic motivation to cooperate. In contrast, too heavy-handed use of market-like incentives may destroy intrinsic motivation (i.e., the “crowding out effect”). To develop the

argument the authors rely on psychological theories of individual motivation, notably the motivation crowding effect first identified in an experimental setting by Deci (1972).

While important beginnings thus exist, it is arguable that knowledge management scholars have so far merely scratched the surfaces of the very rich bodies of motivational and cognitive psychology. For example, while most scholars continue to work with a simple distinction between intrinsic and extrinsic motivation, motivational psychologists have introduced much richer taxonomies of and corresponding insights into motivation (e.g., Deci and Gagné, 2005). Similarly, psychology-based insights on cognition also need to be brought into the discussion of knowledge sharing to the extent that the perceptions and cognitions of organisational members are seen as important for the knowledge sharing process (for an excellent beginning, see Lindenberg, 2003).

***Research recommendation IV:** Research on knowledge sharing in organisations should not only build from clear assumptions about individual organisational members' cognition and motivation in order to capture the complexity of the mechanisms that link governance mechanisms and knowledge processes; they should go beyond the simple intrinsic/extrinsic dichotomy and incorporate richer models of cognition.*

An emphasis on individual motivation and cognition not only implies being detailed about how governance mechanisms impact on these dimensions of organisational members; it also means taking into account the *a priori* heterogeneity of organisational members (Felin and Hesterly, 2007). Thus, individuals are not likely to be identically disposed to share knowledge, and governance mechanisms will have different effects on different organisational members' knowledge sharing propensities. Formally, such effects may be interpreted as exogenous variables (representing, e.g., personality traits) that moderate

2.

How do knowledge sharing behaviours aggregate to the organisational level? A final under-researched issue concerns how knowledge sharing on the level of organisational members adds up to organisational level knowledge sharing (arrow 3 in Figure 1). At first glance, this issue may seem to be reducible to simply summing all the individual knowledge sharing activities. However, this neglects that individual level knowledge sharing may be redundant, so that, for example, the same knowledge is shared with the same organisational members by different organisational members. Such redundancy is likely to be wasteful from the point of view of the organisation. Thus, the aggregation issue directly raises the issue of what is optimum organisational knowledge sharing, and therefore introduces a feedback loop from the north-eastern node in figure 1 to the north-western one: governance mechanisms should be designed, taking into account their implications for organisational knowledge sharing (e.g., Heiman and Nickerson, 2004).

CONCLUDING DISCUSSION

Almost two decades ago, Argote, Beckman and Epple (1990) pointed out that knowledge transfer within organisations (in contrast to *between* organisations) was very much a black box. To be sure, much has happened in the meantime with respect to the academic treatment of knowledge in and between organisations since then. In particular, distinctive, organized ways of thinking about knowledge in and between organisations have emerged, arguably making “knowledge” more than simply another contingency factor. The “knowledge-based theory” of the firm (e.g., Grant, 1996; Nickerson and Zenger, 2004) is an example. So is the related theoretical development that has been called “knowledge governance” (Grandori, 1997, 2001; Foss, 2007; Michailova and Foss, 2008), as are various applications of transaction cost economics and other organisational economics ideas to the understanding of the efficient governance of knowledge processes (e.g., Oxley, 1997; Oxley and Sampson,

2004).

However, as argued, there are still important black box dimensions of the understanding of knowledge sharing in organisations, and how it can be influenced by organisational means. We have reviewed existing studies in relation to the role of organisational mechanisms and micro-foundations as two specific areas in the knowledge sharing literature where our knowledge is still fragmented. That these are under-researched areas have been claimed in various earlier contributions (e.g., Felin and Hesterly, 2007; Foss, 2007). Although we broadly agree that these two areas are indeed where major challenges (if not necessarily the only ones) lie, we have been able to add considerable nuance to these claims.

First, our review reveals that it is not in general correct that the governance of knowledge sharing is a neglected area. To be sure, the literature is not in agreement concerning important issues such as the nature of key constructs, what are the relevant dimensions of the constructs, etc. However, work that explicates the link between governance mechanisms and knowledge sharing outcomes does exist, much of it empirical (e.g., Foss, 2003; Heiman and Nickerson, 2004; Hoetker and Mellewigt, 2006; Macher, 2006). For example, hypothesis development relating to how firms leverage organisational control and structural mechanisms to promote knowledge sharing (Argyres and Silverman, 2004; Chang and Harrington, 2003; Teece, 2000; Turner and Makhija, 2006), research into how governance mechanisms are deployed to knowledge-based strategic alliances (Heimeriks and Duyster, 2007; Mowery, Oxley and Silverman, 1996; Oxley, 1997; Oxley and Sampson, 2004), the understanding of the governance of human and social capital (Child and McGrath, 2001; Teece, 2003; Yli-Renko, Autio and Sapienza, 2001), the link between control of knowledge assets and the appropriation of surplus from relations (Coff, 1999; Coff and Blyler, 2003), and the provision of incentives to knowledge workers (Osterloh and Frey,

2000), have been framed in ways that are akin to the research questions we pose. The body of existing empirical work is not large, but it is growing. We take it as evidence of the fruitfulness of the overall approach we advocate.

However, it remains that even if the governance/knowledge sharing nexus is addressed in an expanding literature, many points raised by this nexus have not yet been addressed at all. Our research recommendations have centred on these. In particular, more attention needs to be devoted to understanding interaction effects between governance mechanisms in influencing knowledge sharing outcomes, and the corresponding empirical work needs to be done. This is admittedly challenging, because multi-level issues complicate such empirical work (cf. Klein, Dansereau and Hall, 1994; Dansereau, Yammarino and Kohles, 1997), and because proper standards for testing for, for example, complementarity of governance mechanisms are only emerging (Athey and Stern, 2003). Moreover, data needs to be collected at different levels of analysis, in actual research practice often quite a challenge. Such difficulties may explain why we see so little empirical knowledge sharing research that is genuinely multi-level in nature.⁶ However, enthusiasm for multi-level methods and insights has been emerging in management research for more than a decade (Klein et al., 1994; Dansereau et al., 1997), based on the recognition that many, perhaps most, management issues are inherently multi-level, and therefore necessitates multi-level approaches.

We furthermore submit that the kind of research we have called for is necessary for more pragmatic reasons: if the knowledge sharing literature is to soundly (i.e., based on research evidence) confront a number of important real-life managerial issues related to knowledge sharing, it needs to come to grips with the inherent multi-level of knowledge sharing. Executives of knowledge-intensive organisations are ready to absorb insights and evidence that can assist them to deal with knowledge sharing challenges. At least our own consulting and empirical research experience suggests that they are increasingly explicit in

their desire to “go beyond data-bases” and want to know how concrete governance mechanisms shape their employees’ actual knowledge sharing behaviour and, as they apply several mechanisms simultaneously, how those interact and what are the effects of these interactions on knowledge sharing in the organisation.

As Whetten (1998: 492) argued in an oft-cited paper on theory-building, “... one way to demonstrate the value of a proposed change ... is to identify how this change affects the accepted relationships between the variables”. Which relationships are our suggestions (potentially) changing? Correlations between macro variables may well remain; however, the point is that paying attention to the level of individual action and interaction in knowledge sharing explains *why* such correlations exist. According to Whetten this is “... probably the most fruitful, but also the most difficult avenue of theory development” (1998: 493). Moreover, the approach we have advocated can potentially refine “accepted relationships” and yield insights in new relationships. For example, work on how explicit incentives (e.g., monetary rewards) influence knowledge sharing behaviour is ambiguous: some argue that such incentives may drive out the intrinsic motivation that is necessary for unhampered knowledge sharing (e.g., Osterloh and Frey, 2000), while others argue that there are situations where such incentives may very well promote knowledge sharing (Michailova and Husted, 2003). These mixed finding may be interpreted in various ways. One is that the outcome may be dependent on whether incentives are applied in isolation or together with other governance mechanisms or managerial actions (e.g., praise). To understand this, however, more theoretical as well as empirical research into how exactly governance mechanisms influence individual motivation to share knowledge is needed, particularly concerning interaction effects between governance mechanisms.

Another aspect which remains under-researched and where considerably more attention to the issue of organisational mechanisms and how they relate to individual action and

interaction is needed is the situation-specific nature of knowledge sharing benefits: what is an appropriate pattern of knowledge sharing behaviours (and hence mechanisms for influencing the desired behaviour) under certain circumstances may be directly damaging under others. Thus, there are situations where knowledge sharing is much less desirable, for example, because it is too costly, it increases the risk of knowledge spill-overs to an unacceptable level, or because it reinforces group-think, and hampers innovation. To maximize net benefits over time from knowledge sharing, managers not only need to be aware of such different situations, they also need to know how they can call forth desired knowledge sharing behaviors by means of deploying the proper governance mechanisms.

In general, it is timely for research on knowledge sharing to pay more attention to the link between knowledge sharing and organisational performance. Research has by now advanced in terms of both quality and quantity to reach the point of starting providing detailed answers about the link between knowledge sharing and performance benefits. Managers need systematic knowledge on this link (as well as what and how moderates the link) in order to be able to make sense of organisational members' behaviours they try to shape and govern. However, the link between knowledge sharing and organisational outcomes *also* involves the level of individuals and their interaction. For example, the increased organisation-level problem-solving capacity (Nickerson and Zenger, 2004), absorptive capacity (Cohen and Levinthal, 1990), or product innovation performance (Tsai, 2001) that may result from knowledge sharing happens because of the individual-level effects (e.g., higher individual problem-solving capacity) that knowledge sharing may foster in conjunction with the right governance mechanisms (cf. also Gottschalg and Zollo, 2007).

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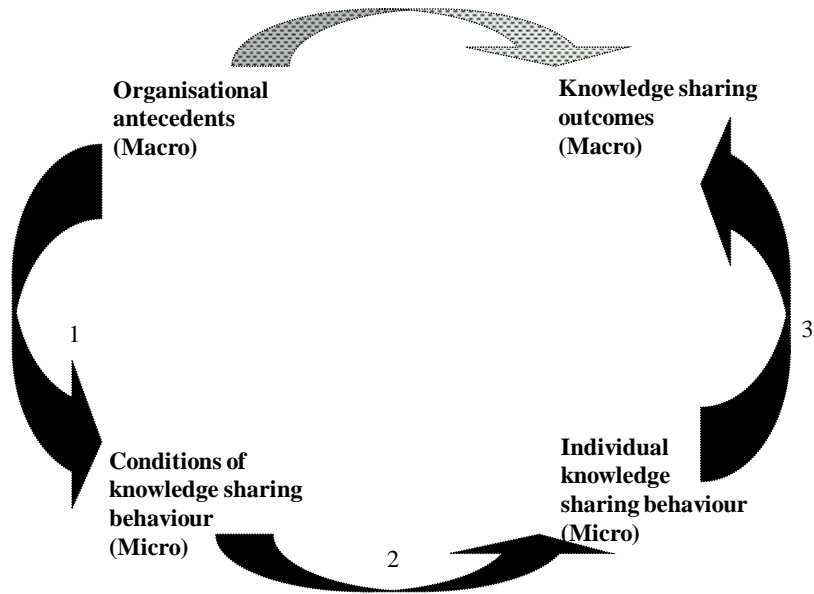
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Figure 1: Levels of analysis



Modified from Coleman (1990)¹

Table I: Articles on Knowledge Sharing in 13 Top Journals, 1996-2006

| No. | Journals and Authors | A. Organisational antecedents | | B. Conditions of action | C. Individual actions | D. Knowledge-sharing outcomes | Arrow 1 | Arrow 2 | Arrow 3 | Arrow 4 |
|---|--------------------------------|-------------------------------|----------|-------------------------|-----------------------|-------------------------------|---------|---------|---------|---------|
| | | Formal | Informal | | | | | | | |
| <i>Academy of Management Journal</i> | | | | | | | | | | |
| 1 | Bouty, 2000 | | X | X | X | | X | | | |
| 2 | Tsai, 2001 | | X | | | X | | | X | X |
| 3 | Cross and Cummings, 2004 | | X | X | X | | X | | X | |
| 4 | McFadyen and Cannella Jr, 2004 | | X | | X | | | | X | |
| 5 | Hansen et al., 2005 | | X | | | X | | X | | X |
| 6 | Smith et al., 2005 | | X | X | X | X | | | | X |
| 7 | Srivastava et al., 2006 | | X | | X | X | | | | X |
| 8 | Wadhwa and Kotha, 2006 | X | | X | | X | | | | X |
| 9 | Collins and Smith, 2006 | X | | X | X | X | X | X | X | X |
| <i>Academy of Management Review</i> | | | | | | | | | | |
| 10 | McEvily et al., 2000 | X | | | | X | | | | X |
| 11 | Bhagat et al., 2002 | | X | X | | X | | | | X |
| 12 | Tallman et al., 2004 | | X | X | | X | | | | X |
| 13 | Inkpen and Tsang., 2005 | | X | | | X | | | | X |
| 14 | Turner and Makhija, 2006 | X | | | | X | | | | X |
| 15 | Coff et al. 2006 | X | | | X | X | | | | X |
| 16 | Nebus, 2006 | | X | X | X | | | X | | |
| <i>Administrative Science Quarterly</i> | | | | | | | | | | |
| 17 | Hansen, 1999 | | X | | | X | | | | X |
| 18 | Ahuja, 2000 | | X | | | X | | | | X |
| 19 | Reagans and McEvily, 2003 | | X | X | X | | | X | | |
| <i>Journal of Management</i> | | | | | | | | | | |
| 20 | Fey and Birkinshaw, 2005 | X | X | | | X | | | | X |
| 21 | Matusik and Heeley, 2005 | X | X | X | | X | | | | X |
| 22 | Schulze and Hoegl, 2006 | | | | X | X | | | X | |

Journal of Management Studies

| | | | | | | | | | | | | |
|----|--------------------------------|---|---|---|---|---|--|---|---|---|--|---|
| 23 | Lam, 1996 | X | | | | X | | | | | | X |
| 24 | Andrews and Delahaye, 2000 | | | X | X | | | X | | | | |
| 25 | Hardy et al., 2003 | | X | | | | | | | | | |
| 26 | Bloodgood and Morrow Jr, 2003 | X | | | | | | | | | | X |
| 27 | Dyck et al., 2005 | X | | | | | | | | | | X |
| 28 | Zhao and Anand, 2005 | | X | | | | | | | | | X |
| 29 | Michailova and Hutchings, 2006 | | X | X | X | | | X | X | | | |
| 30 | Inkpen and Pien, 2006 | | X | X | | | | | | | | X |
| 31 | Watson and Hewitt, 2006 | X | | X | X | | | | X | X | | |

Management Science

| | | | | | | | | | | | | |
|----|-------------------------------|---|---|---|---|--|--|---|---|---|--|---|
| 32 | Lapr e and Wassenhove, 2001 | X | X | | | | | | | | | X |
| 33 | Li, 2002 | X | | | | | | | | | | X |
| 34 | Ingram and Simons, 2002 | | X | | | | | X | | | | X |
| 35 | Uzzi and Lancaster, 2003 | | X | X | | | | | | | | X |
| 36 | Thomas-Hunt et al., 2003 | | X | X | X | | | | X | | | |
| 37 | Zellmer-Bruhn, 2003 | X | | | X | | | | | | | X |
| 38 | Song et al., 2003 | X | | | | | | | | | | X |
| 39 | Chang and Harrington Jr, 2003 | X | | | | | | | | | | X |
| 40 | Levin and Cross, 2004 | | X | X | X | | | | X | | | |
| 41 | Gray and Meister, 2004 | | | X | X | | | | | X | | |
| 42 | Cummings, 2004 | | X | | X | | | | | X | | X |
| 43 | Singh, 2004 | | X | | | | | | | | | X |
| 44 | Kuk, 2006 | | X | | X | | | | | | | |

Organization Science

| | | | | | | | | | | | | |
|----|-------------------------|---|---|---|--|--|--|--|---|--|--|---|
| 45 | Inkpen and Dinur, 1998 | X | | X | | | | | | | | X |
| 46 | Shenkar and Li, 1999 | X | | | | | | | | | | X |
| 47 | Osterloh and Frey, 2000 | X | | | | | | | X | | | X |
| 48 | Tsai, 2002 | X | X | | | | | | | | | X |
| 49 | Birkinshaw et al., 2002 | X | | X | | | | | | | | |
| 50 | Almeida et al., 2002 | X | X | | | | | | | | | X |
| 51 | Hansen, 2002 | | X | | | | | | | | | X |

California Management Review

| | | | | | | | | | |
|----|-----------------------------|---|---|---|---|---|---|---|---|
| 82 | O'Dell and Grayson, 1998 | X | X | | | X | | | X |
| 83 | Michailova and Husted, 2003 | X | X | X | X | | X | X | X |

Harvard Business Review

| | | | | | | | | | |
|----|----------------------------|---|---|--|---|---|---|---|---|
| 84 | Hansen et al., 1999 | X | X | | | X | | | |
| 85 | Wenger and Snyder, 2000 | | X | | X | X | | | X |
| 86 | Brown and Duguid, 2000 | X | | | X | X | X | X | X |
| 87 | Davenport and Glaser, 2002 | | | | | | | | |
| 88 | Gilmour, 2003 | X | X | | X | | X | | |
| 89 | Van Alstyne, 2005 | X | | | X | | X | | |

Long Range Planning

| | | | | | | | | | |
|----|------------------------|---|---|---|---|---|---|---|---|
| 90 | Teece, 2000 | X | X | X | X | X | X | X | |
| 91 | von Krogh et al., 2001 | X | | X | | X | | | X |
| 92 | Kaser and Miles, 2002 | | X | X | | X | X | | X |
| 93 | Goold, 2005 | X | X | X | | X | | X | X |
| 94 | Söderquist, 2006 | X | | | | X | | | X |

MIT Sloan Management Review

| | | | | | | | | | |
|-----|-------------------------------|---|---|--|---|---|---|---|---|
| 95 | Gupta and Govindarajan, 2000b | X | X | | | X | | | X |
| 96 | Storck and Hill, 2000 | | X | | | X | X | | X |
| 97 | Dyer and Hatch, 2004 | | X | | | | | | |
| 98 | Hayashi, 2004 | | X | | X | X | | X | |
| 99 | Yu, 2005 | X | X | | | X | | | X |
| 100 | Fleming and Marx, 2006 | | X | | | X | | | X |

NOTES

¹ Of course, "organisation" is no more "ultimate" than that it, too, has to be explained in terms of individual action and interaction. That, however, lies outside of Figure 1.

² In other words, we subscribe to (a version of) methodological individualism. While we can build models that only involve macro (or "collective") variables, and while we can, of course, conduct empirical analysis that only involves the macro level, ultimately macro variables and their interaction must be explainable in terms of individual action and interaction

³ We owe this observation to one of the three reviewers.

⁴ Note that when we speak here, and elsewhere in this paper, about "antecedents," these also include what may be seen as "facilitators," such as broad-band communication channels that are set up to facilitate knowledge sharing (cf. Heiman and Nickerson, 2004).

⁵ The purpose of Elton Mayo's original experiment (later interpreted by Homans) was to find out how rewards would influence productivity. Surprisingly the researchers found that there was no effect. The key to understanding this is the informal group dynamics: cliques were formed so that management could be dealt with a unilateral manner and those who worked too much could be ostracized. The basic fear of the group of workers was that the reward system would lead to a lowering of the base rate in the reward system.

⁶ See Becker and Huselid (2006) for a pertinent discussion in the context of strategic human resource management, which faces very similar levels challenges.