Governing Knowledge Sharing in Organizations: Levels of Analysis, Governance Mechanisms, and Research Directions

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ABSTRACT   We discuss and examine recent claims that research on knowledge processes has paid insufficient attention to micro (individual) level constructs and mechanisms and to the role of formal organization in governing knowledge processes. We review knowledge sharing research published in 13 (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 preoccupied with constructs, processes, and phenomena defined at a macro (collective, organizational) level and pay comparatively little attention to micro level constructs. The review provides less support for the proposition that formal governance mechanisms have been under-researched in comparison to formal organization. Still, the multiple ways in which formal governance mechanisms may interact in influencing knowledge sharing outcomes have been under-researched, as has the interaction between more informal aspects of the firm and formal governance mechanisms. We argue that future research on knowledge sharing needs to fill these gaps.

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 a number of management fields. Knowledge, considered as both 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, and, more recently, in management fields such as strategic management, organization theory, organizational behaviour, technology management, and international business. All these disciplines and fields have contributed in various ways to debates on 'knowledge' and its 'management'

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and 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) summarized this development by pointing out that:

> . . . knowledge is an important entity, a unit of analysis, which presents particular types of problems 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 organizational arrangements' (Grandori in Grandori and Kogut, 2002, p. 225; cf. also Birkinshaw et al., 2002), others view it as a broader, more independent construct with multiple, far-reaching implications, and 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, flows, and processes 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 distinct, unifying themes have coalesced. A number of constructs and 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 and increasing empirical evidence.

'Knowledge governance' (i.e. choosing organizational structures and mechanisms that can influence the processes of using, sharing, integrating, and creating knowledge in preferred directions and towards preferred levels) has recently become a distinct issue in management and organization (Grandori, 1997; Michailova and Foss, 2009). It is, however, a concept that has not yet been well explored and understood, and is arguably not yet on the relative level of conceptual development and acceptance that characterize constructs such as absorptive capacity or insights such as the exploitation/exploration trade-off. The relationship between governance issues and knowledge processes remains under-researched, theoretically as well as empirically, at least in comparison with the huge amount of writings concerning the characteristics of knowledge, knowledge taxonomies, how knowledge may be disseminated within and between organizations, and the philosophical foundations of knowledge. More generally, the literature on knowledge and organizations is characterized by existing gaps, problems, unresolved issues, and untested claims and propositions. Some of these have been identified in earlier contributions (e.g. Foss, 2007, 2009; Grandori, 1997, 2001; Michailova and Foss, 2009).

In this paper we subject two potentially weak points in the knowledge and organization literature to closer scrutiny. Remedying these weaknesses may be critical for the quality of the explanations, predictions, and managerially relevant advice the literature can offer. The first point relates to the *level* of constructs examined in the knowledge

literature. Recent papers (Felin and Foss, 2005; Felin and Hesterly, 2007; Foss, 2007, 2009; Salvato, 2007; Teece, 2007) point out that important constructs, such as capabilities, dynamic capabilities, absorptive capacity, communities of practice, etc are *macro-level* constructs, usually firm-level ones. It is furthermore argued that these constructs are not clearly rooted in (micro-) foundations, which, among other things, means that their origin and nature remain unclear. Micro-foundations involve a quest for theorizing explanatory mechanisms that are located at levels of analysis lower than those of the phenomena that one seeks to explain (i.e. it entails explanatory reduction; Elster, 1989). While teams, groups, projects, etc may be invoked as micro-foundations for the above macro-constructs, and are entirely legitimate components of explanation, ultimately micro-foundations mean theorizing in terms of the actions and interactions of individuals. This involves making explicit cognitive and behavioural *assumptions* in the manner of deductive theory. Anthropological description does not therefore constitute micro-foundations, but may be an excellent starting point for the building of theoretically grounded micro-foundations.

The case for micro-foundations may be motivated in philosophical terms (i.e. ontologically – 'ultimately, only individuals act'), or more pragmatically. For example, understanding the fundamental cogs and wheels of what happens in organizations requires beginning from their fundamental constituents, namely individuals (Felin and Foss, 2005); an understanding of the level of individuals (i.e. organizational members) and their interaction may yield novel insights in organization-level phenomena (Stinchcombe, 1991). It may also be argued that explaining in terms of micro means identifying the true mechanisms producing observed correlations, and an understanding of such generative mechanisms is the basis for informed intervention (Coleman, 1990). If indeed the knowledge literature neglects micro-foundations, this is potentially a serious problem.

A second problem that has been highlighted in the literature relates to the nature of organizational factors examined in relation to knowledge processes. Foss (2007) argued that when organizational issues are discussed in relation to knowledge processes, ' "organization" predominantly means "informal organization", that is, networks, culture, communities of practice and the like, rather than formal governance mechanisms' (Foss, 2007, p. 37). He further argued that formal organization may be invoked, but is 'seldom if ever integrated into the analysis' and in general, 'there is a neglect of formal organization' (Foss, 2007, p. 37). In a nutshell, Foss (2007) argued that knowledge issues are seldom explicitly dealt with from the perspective of organizational design. In contrast, 'knowledge governance' is explicitly identified as organizational design exercises aimed at influencing knowledge processes in value-creating directions. The broader issue is, however, whether formal governance is in general neglected in the knowledge literature. This is examined in the following.

The knowledge literature is concerned with different kinds of knowledge processes (using, sharing, integrating, and creating knowledge) in many different contexts (intra/inter-firm, intra/inter-unit, inter-employee). A comprehensive discussion would take all of this complexity into account. However, given the need to focus the examination of the above two alleged weak points of the knowledge literature, we limit our review, discussion and recommendations to *knowledge sharing* within organizations. 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 acknowledge that this choice of the scope of the investigation is not unproblematic. First, knowledge sharing is intertwined with other knowledge processes. For example, Cohen and Levinthal (1990) and Tsai (2001) explicitly treat knowledge sharing as a crucial antecedent to knowledge creation. The two processes are inherently linked in the treatments by, for example, Nonaka (1991) and Zahra and George (2002). Second, and relatedly, there is a potential danger of bias from generalizing findings from the knowledge sharing literature to other parts of the knowledge literature. For example, neglecting knowledge creation means that the many micro-studies on creativity are automatically excluded (e.g. Oldham and Cummings, 1996), as well as potentially relevant insights from the organizational innovation literature which is often taken up with individual level issues in the context of teams and projects (e.g. Sarin and Mahajan, 2001). Moreover, parts of the organizational learning literature explicitly adopt a multi-level approach which naturally implies attention to micro-issues (e.g. Crossan et al., 1999). It may be the case therefore that the scope of our review means that existing micro-perspectives automatically become under-represented. However, this problem needs to be traded off against the sheer size and the extreme diversity of the knowledge literature, and our preference is for a focused discussion, issuing the *caveat lector* that there is a risk of bias.

We focus on knowledge sharing for several important reasons. First, because knowledge sharing is designed to transform individual knowledge into organizational knowledge, it directly involves the levels issue (individual, organizational) that we are taken up with in this paper. Second, knowledge sharing is interesting in its own right: while not all organizations engage in new knowledge creation, it is difficult to imagine modern organizational life without knowledge sharing processes taking place. Sharing knowledge may lead to improved absorptive capacity, improved innovation capacity, and other capabilities, and therefore, to sustained competitive advantage (Argote and Ingram, 2000; Grant, 1996; Kogut and Zander, 1992; Spender, 1996). For example, Cohen and Levinthal (1990) argued that a firm's absorptive capacity is related to the amount of overlap between organizational members' knowledge sets, an overlap that can be brought by knowledge sharing initiatives. Bechky (2003) and Nickerson and Zenger (2004) argued that knowledge sharing is functional to organizational problem-solving activities and Srivastava et al. (2006) concluded that knowledge sharing, along with team efficacy, conveys the indirect effect of empowering leadership performance on team performance. Examining the knowledge sharing network of Toyota and its suppliers, Dyer and Nobeoka (2000) found that knowledge sharing improves productivity. They also pointed out that knowledge sharing placed rules to entry into the knowledge sharing network and contributed to building network identity that motivates network members to engage in increased knowledge sharing, solve free-riding problems, and decrease the cost of searching and discovering different types of knowledge. McEvily et al. (2000, p. 297) emphasized that when competencies are complex and the factors driving a firm's performance are ambiguous, 'knowledge sharing can be used to enhance the credibility of a firm's commitments by making performance drivers more evident to certain stakeholders'. In a recent study, Haas and Hansen (2007) developed a differentiated productivity model of knowledge sharing in organizations and concluded that sharing different knowledge explains differential task performance.

In spite of a gestation period that is now well into its second decade (beginning with Nonaka, 1991), knowledge sharing is still an emerging area of inquiry. This implies that it is at a stage of initial identification, observation, and definition of loosely recognized 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 the development of an important area of inquiry. Accordingly, we discuss two selected issues, levels of analysis and the influence of formal organization on knowledge sharing, and explain how the existing literature has dealt with them. 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 organizational mechanisms to influence individual knowledge sharing behaviour in organizations so that organizational knowledge-based goals (e.g. building absorptive capacity, obtaining a competitive advantage) can be achieved.

ORGANIZING FRAMEWORK AND SELECTION OF JOURNALS

Micro and Macro Levels

In order to examine whether the existing literature is primarily concerned with collective- (or macro-) level phenomena, we build on 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 Abell et al., 2008; Foss, 2007). Of course, this is the simplest possible representation of multi-level phenomena, and it is quite possible that understanding organizational knowledge sharing may involve more levels and links between these. Henceforth we therefore restrict attention to only two levels, micro and macro, because all our points can be made by considering only these two levels, and hence including more levels would lead to unnecessary complications.

In the present context, macro refers to the organizational level while micro is the level of individual action and interaction. Explanations focused solely on macro variables and/or embedded in macro–macro links overlook the micro-level processes that mediate between macro variables and create observed correlation between those variables. Macro links are always mediated by micro links (cf. also Gupta et al., 2007), and macro explanation is therefore inherently shorthand for a more complicated, multi-level explanation (Coleman, 1990). Translated to our framework and as illustrated in Figure 1, reliable explanation of organization-level knowledge sharing must involve micro-level constructs (e.g. individual attitudes, intention, goals, motivation, behaviour, etc), how these constructs aggregate up to a firm-level outcome, what are their firm-level antecedents, how these determinants exert their influence, etc (cf. also Abell et al., 2008; Kozlowski and Klein, 2000).

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
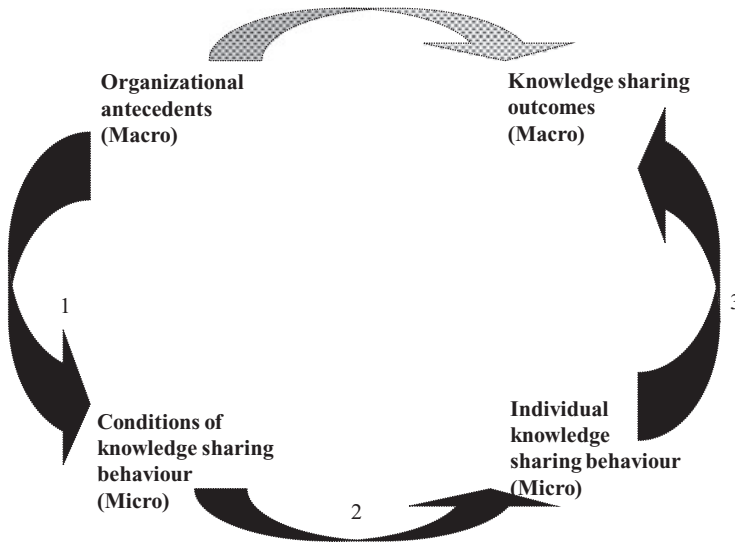
Figure 1. Levels of analysis
Source: Modified from Coleman (1990).

literature, we reviewed articles in 13 top-tier management journals. We considered the journal lists compiled by Gomez-Mejia and Balkin (1992), Tahai and Meyer (1999), Werner (2002), and Podsakoff et al. (2005). These lists are comprehensive and have been consistently utilized and cited in subsequent reviews (Kirkman et al., 2006; Tsui et al., 2007). Based on these lists, 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 key terms did not result in any articles published in the considered period. We also included four academic journals with a strong focus on management practice: *California Management Review*, *Harvard Business Review*, *Long Range Planning*, and *Sloan Management Review*.

We considered articles published between 1996 and 2006 inclusive against the keywords 'knowledge sharing', 'knowledge exchange', and 'knowledge transfer'. These terms are often used interchangeably: 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. In spite of sustained efforts to be thorough in our search, we acknowledge the possibility of having missed some articles, but trust 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

organizational antecedents, conditions of knowledge sharing, individual knowledge sharing, and knowledge sharing outcomes as well as the four links between these constructs. To examine the claim that the literature is preoccupied with examining informal mechanisms at the cost of formal ones, the three raters also evaluated whether the articles that considered organizational 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 summarizes our review.

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 organization-level outcomes of knowledge sharing (north-eastern corner of Figure 1), as caused by some aggregation of individual knowledge sharing efforts (arrow 3). These would be seen as influenced by the conditions that organizational members find themselves in (i.e. the incentives they face, the beliefs they hold, etc) (arrow 2), and those conditions would, in turn, be influenced by organization-level variables (arrow 1). In principle, the latter could be any variable that may be placed on the organizational, rather than the individual, level, such as routines, organizational culture, network characteristics, etc as well as formal organization. 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 organization-level knowledge sharing as the *explanandum* phenomenon, and organizational variables as ultimate antecedents.[1] Of course, these variables are only 'ultimate' in terms of the figure, as organizational variables are, in turn, explainable in terms of the choice behaviour of (past and present) organizational members. Bearing this in mind, we now turn to examining whether organizational level notions and constructs are over-researched at the cost of individual level ones and whether formal organizational antecedents have been largely under-researched as compared to informal organizational antecedents. The mapping of the literature summarized in Table I allows us also to examine to what extent authors have engaged in multi-level analysis and how often they have considered both formal and informal mechanisms in the same studies.

MICRO-FOUNDATIONS AND ORGANIZATIONAL VARIABLES IN THE KNOWLEDGE SHARING LITERATURE

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

Many contributions to the organization-knowledge link are uni-level, focusing on the link between organizational antecedents and knowledge outcomes on the organizational level (Argote and Ingram, 2000; Felin and Foss, 2005; Felin and Hesterly, 2007; Foss and Michailova, 2009; Gupta et al., 2007; Volberda et al., 2009). In other words, while macro–micro, micro–micro, and micro–macro links may be mentioned, explanation mainly takes place on the collective level examining macro–macro links. Our review confirms the proposition that researchers in the knowledge sharing area prefer macro level notions and phenomena and macro–macro links. Seventy-one 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.

Table I. Articles on knowledge sharing in 13 top journals, 1996–2006

No.	Journals and authors	A. Organizational antecedents		B. Conditions of action	C. Individual actions	D. Knowledge-sharing outcomes	Arrow 1	Arrow 2	Arrow 3	Arrow 4
		Formal	Informal							
Academy of Management Journal										
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, 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
Academy of Management Review										
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		
Administrative Science Quarterly										
17	Hansen, 1999		X			X				X
18	Ahuja, 2000		X			X				X
19	Reagans and McEvily, 2003		X	X	X			X		
Journal of Management										
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			X				
26	Bloodgood and Morrow, 2003	X				X				X
27	Dyck et al., 2005	X				X				X
28	Zhao and Anand, 2005		X			X				X
29	Michailova and Hutchings, 2006		X	X	X		X	X		
30	Inkpen and Pien, 2006		X	X		X				X
31	Watson and Hewitt, 2006	X		X	X	X		X	X	
Management Science										
32	Lapré and Wassenhove, 2001	X	X			X				X
33	Li, 2002	X				X				X
34	Ingram and Simons, 2002		X			X	X			X
35	Uzzi and Lancaster, 2003		X	X		X				X
36	Thomas-Hunt et al., 2003		X	X	X			X		
37	Zellmer-Bruhn, 2003	X			X	X				X
38	Song et al., 2003	X				X				X
39	Chang and Harrington, 2003	X				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	X
43	Singh, 2004		X			X				X
44	Kuk, 2006		X		X					
Organization Science										
45	Inkpen and Dinur, 1998	X		X		X				X
46	Shenkar and Li, 1999	X				X				X
47	Osterloh and Frey, 2000	X				X		X		X
48	Tsai, 2002	X	X			X				X
49	Birkinshaw et al., 2002	X		X						
50	Almeida et al., 2002	X	X			X				X
51	Hansen, 2002		X			X				X
52	Bechky, 2003			X		X				
53	Owen-Smith and Powell, 2004	X		X		X				X
54	Szulanski et al., 2004			X		X				

Table I. *Continued*

No.	Journals and authors	A. Organizational antecedents		B. Conditions of action	C. Individual actions	D. Knowledge-sharing outcomes	Arrow 1	Arrow 2	Arrow 3	Arrow 4
		Formal	Informal							
Organizational Behaviour and Human Decision Processes										
55	Gruenfeldf et al., 2000	X				X				X
56	Paulusf and Yang, 2000				X	X			X	
57	Szulanski, 2000		X	X		X				X
58	Darra and Kurtzberg, 2000		X			X	X			X
59	Alge et al., 2003	X		X	X	X	X	X		X
60	Kane et al., 2005		X	X		X				X
Strategic Management Journal										
61	Spender and Grant, 1996									
62	Appleyard, 1996			X						
63	Szulanski, 1996		X			X		X	X	X
64	Mowery et al., 1996	X				X				X
65	Simonin, 1999		X			X				X
66	Athanassiou and Nigh, 1999		X			X				X
67	Gupta and Govindarajan, 2000a	X				X		X		X
68	Dyer and Nobeoka, 2000		X			X				X
69	Subramaniam and Venkatraman, 2001	X				X				X
70	Yli-Renko et al., 2001		X			X				X
71	Uzzi and Gillespie, 2002		X			X				X
72	Tsang, 2002	X				X				X
73	Spencer, 2003	X				X				X
74	Kotabe et al., 2003		X			X				X
75	Almeida and Phene, 2004		X			X				X
76	Argyres and Silverman, 2004	X				X				X
77	Feinberg and Gupta, 2004	X	X			X				X
78	Oxley and Sampson, 2004	X				X				X
79	Haas and Hansen, 2005					X			X	
80	Dyer and Hatch, 2006		X			X				X
81	Szulanski and Jensen, 2006					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	X	
91	von Krogh et al., 2001	X		X		X				X
92	Kaser and Miles, 2002		X	X		X	X	X		X
93	Goold, 2005	X	X	X		X			X	X
94	Söderquist, 2006	X				X				X
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

This is potentially problematic: links between macro variables are always (ultimately) mediated through individual action and interaction,[2] although various meso-level phenomena, such as groups and teams, may enter the explanation. Usually an account should be made of these micro-links. However, for two reasons, work that solely involves

macro–macro links may not be methodologically illegitimate. First, it may serve explor-atory purposes, identifying correlations in need of micro-explanation (Abell et al., 2008). Second, it is so straightforward how the macro–macro links can be reduced to more fine-grained links that an account of this is superfluous (Stinchcombe, 1991). In the context of the relatively recent and still emerging area of knowledge sharing the first reason should be acknowledged as a possible cause of the predominance of macro–macro studies. However, it should be borne in mind that macro–macro work should be treated as fundamentally exploratory, calling for further inquiry at lower levels of analy-sis. The second reason does not seem at all plausible, since how the causal structure mapped in Figure 1 plays out is still highly unclear.

It is likely that the macro emphasis that we note is driven by the well known difficulties of sampling data on more than one level (Becker and Huselid, 2006; Rousseau, 1985), a preference for sampling on the organizational level, and the consequent neglect of micro-based explanation as such explanation cannot be supported by available data. Moreover, there is a possibility that the well-known empirical problems of investigating macro–micro and micro–macro links in the presence of substantial individual heteroge-neity may have discouraged multi-level research on knowledge sharing.

Ultimately, however, research on the knowledge and organization nexus must rise to such challenges (Rothaermel and Hess, 2007), which implies sampling and examining data at the individual level. Such sampling allows for aggregation to organizational levels but also allows for an examination of individual level variables as the main effect of organizational outcomes (independent of aggregation) (Gupta et al., 2007; Rousseau, 1985). However, sampling at the level of individuals should be informed by theoretically grounded micro-foundations.

In Search for Micro-Foundations

As we have pointed out, macro–macro links are, methodologically speaking, shorthand for a more complex substructure of individual action and interaction. For example, organizational structure never *directly* impacts organizational performance; it may well effect, 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 real analysis) of individual characteristics, motives, etc – it seems fair 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. The studies listed in Table I gen-erally 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 Osterloh and Frey (2000) and Cabrera et al. (2006)

examine psychological determinants of individual engagement in knowledge sharing, relying on the work of Deci (e.g. Deci, 1972). Second, a number of closely related papers that have not been included in the review because they did not meet the inclusion criteria 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 (cf. Grandori, 1997, 2001; Lindenberg, 2003).

These are exceptions from the general tendency of not being forthcoming about behavioural and cognitive assumptions. Given what we believe is a sound goal of conducting multi-level analysis of links between organizational variables, individual variables and organizational knowledge sharing, it is potentially problematic that out of the 100 studies we reviewed, by far most of them, 81, are concerned with organizational level knowledge sharing outcomes without paying serious attention to the micro-foundations of these outcomes. However, if no specific assumptions are made about organizational members, it is difficult to meaningfully theorize their interaction, including how such interaction aggregates to organization-level knowledge sharing outcomes. Given this, knowledge sharing research can be characterized as devoting 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 was) characteristic of economics; instead, the call is for making explicit behavioural assumptions and for explicitly identifying mechanisms in theorizing. We outline what some of these assumptions and theories may be in the recommendation part of the paper.

Organizational Antecedents in the Literature on Knowledge Sharing

Our review suggests that organizational variables (i.e. the north-western node in Figure 1) have not been neglected in the knowledge sharing literature. A first observation based on the mapping in Table I is that almost all studies have identified and examined organizational antecedents, to one extent or another. These organizational antecedents vary widely and are conceptualized very differently, from broad conceptualizations of 'organizational control' in general (Turner and Makhija, 2006) to individual organizational practices, such as reward systems (McEvily et al., 2000), mobility (Song et al., 2003), personal rotation (Kane et al., 2005), and leadership (Srivastava et al., 2006).

A second observation is that Table I does not support the notion that informal organizational antecedents have been over-emphasized relative to formal ones. It is true that much of the literature has focused on informal organizational factors. An example of this type of studies would be the examination of how network relations influence communication channels in organizations, and how such channels determine knowledge sharing outcomes at organizational level (e.g. Tsai, 2001, 2002). At the same time, our review shows that 45 studies actually address the formal governance of knowledge, and

it does not appear from the table that informal organization, addressed in 58 studies, has been over-emphasized *at the expense* of formal organization.

Looking beyond the table, in organizational 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 (for different perspectives, see Kogut and Zander, 1992; Nickerson and Zenger, 2004). In organization 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 that very few studies have *simultaneously* addressed formal and informal organizational antecedents. Of 100 articles that take on board the issue of antecedents, only 14 discuss both types. This is somewhat surprising, given that there is a strong *a priori* expectation that formal and informal organization are linked in numerous ways (i.e. they may act as substitutes or complements, or mediators or moderators depending on the situation). In studies that stress informal antecedents, formal organization must also matter; for example (informal) patterns of communication are influenced by organizational structure (Cohen and Levinthal, 1990), and formal organization influences network positions and network relations by defining tasks, task composition, roles, etc. Strictly speaking, these organizational factors should be controlled for, or their moderating influence investigated.

While organizational antecedents have made prominent appearances in recent research on knowledge sharing, there is also a lack of concern for the fine details of *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 organizational variables exercise their influence on organization-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 et al., 2005; Inkpen and Tsang, 2005). In particular, network approaches have recently been highly influential in work on knowledge sharing (Hansen, 1999; Hansen et al., 2005; Tsai, 2001, 2002). Such work often does not consider potentially critical micro-issues. Although actors are by no means neglected in network analysis, it remains that relations are the focal units of analysis, and 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, which has been defended by arguing that network positions determine motivation (Burt, 1992). As a result network position is usually not made endogenous to the analysis: if organizational 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

organizational 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 Sharing Research?

Given that knowledge sharing (and knowledge management in general) emerged as a highly practice-influenced research area of inquiry, it is striking that research in this area is not very normative. For example, studies on knowledge sharing grounded in the organizational behaviour literature (e.g. Robertson and Swan, 2003; Srivastava et al., 2006) are often not explicit about what it actually means, in managerial terms, to establish and nurture a culture/climate that fosters knowledge sharing. Likewise, the research stream that is influenced by sociological network theory has little normative content; it is not forthcoming with respect to how management can influence network positions and relations in order to govern knowledge sharing.

The lack of attention to micro-foundations has the potential of making it difficult to come forward with managerial advice. As Coleman (1990, pp. 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, socialized, and remunerated in specific ways. 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. The same problem may arise if research only considers formal *or* informal organization, abstracts from the multiple ways in which they may be related, and does not specifically trace out how different kinds of organization impact knowledge sharing behaviours. Organizational design exercises that aim at influencing knowledge sharing but pay no attention to informal organization are likely to be misguided. In contrast, a concern with both formal and informal organizational factors and antecedents has more potential to devise efficient organization for knowledge sharing. This is hardly surprising as many informal factors, such as culture, are semi-permanent traits of an organization that may be harder to change than formal arrangements, such as organizational structure, reward systems, etc.

As a result of these shortcomings, it may be the case that managers are not optimally equipped by the current literature to make decisions about how to embed knowledge sharing initiatives in existing organizational structures and cultures, and they lack robust research-based models for assessing the organizational costs and benefits of engaging in knowledge sharing. This is difficult to justify, especially in the light of 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 towards more desirable results (Pfeffer and Sutton, 2006; Rousseau, 2006). In the following section we map a number of issues in the knowledge and organizations literature that, in the light of the previous discussion, are 'open' ones, and where research efforts need to be concentrated to improve understanding and therefore also managerial recommendations.

OPEN ISSUES

Knowledge Dimensions

Discussions of the nature of knowledge and on the 'practical epistemology' of knowledge sharing in organizations have shed considerable light on different knowledge forms. To be sure, substantial, deep-seated and philosophically-grounded differences may still exist in the knowledge and organizations literature (as well as, obviously, in the field of epistemology itself). However, some basic distinctions are fairly settled. Chief among these is the tacit/explicit knowledge distinction (e.g. Almeida and Phene, 2004; Argote and Ingram, 2000; Grant, 1996; Hedlund, 1994; Kogut and Zander, 1992; Nonaka, 1991; Osterloh and Frey, 2000; Spender, 1996; von Krogh et al., 2001). There is also much agreement on the overall organizational implications of this distinction; 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.

More generally, certain knowledge taxonomies and dimensions have become dominant and attracted enough interest to be empirically tested. Examples include knowledge tacitness (Athanassiou and Nigh, 1999; Subramaniam and Venkatraman, 2001; Winter, 1987), knowledge 'appropriability' (Oxley, 1997; Oxley and Sampson, 2004), knowledge 'novelty' (Contractor and Ra, 2002), and knowledge stickiness (Szulanski, 1996, 2000). While considerable agreement thus exists on some core knowledge issues, it cannot be ruled out that further epistemological inquiry may identify other relevant knowledge dimensions (Spender, 2005).

At the same time, more research effort may be devoted to examining the role of the already identified dimensions in the context of the causal structure described in Figure 1. In particular, it seems highly relevant to examine the micro-aspects of, for example, 'stickiness' in the transmission of knowledge between organizational units. While stickiness may be related to motivational and cognitive factors (Szulanski, 1996), such factors are shaped by complex processes of interaction among individuals in a social setting. In other words, both motivation and cognition are to a certain socially embedded. For example, rather than stickiness being an inherent property of knowledge, knowledge may *come to be* sticky because, for example of ingroup–outgroup dynamics that builds reluctance to share knowledge with other units. Similarly, the extent to which (rent from) knowledge is 'appropriable' is partly dependent on the extent to which individuals decide to contribute making it so (e.g. not let themselves be persuaded or bribed to let knowledge leak). In other words, while notions of stickiness and appropriability are often theorized on a macro level (i.e. they are properties of the firm-level knowledge assets), they are endogenous to individual action and interaction. In general, the interaction of knowledge dimensions and individual action and interaction along the lines of these examples is a fairly underexplored area in the knowledge sharing literature.

What Are *Relevant* Organizational Antecedents of Knowledge Processes?

The knowledge sharing literature collectively addresses an impressive number of potential organizational antecedents of knowledge sharing, as shown earlier. In principle,

virtually *any* organizational antecedent – reward systems, job descriptions, managerial style, corporate culture, capabilities, etc – can be argued to matter for individual knowledge sharing behaviour and organizational-level outcomes. It seems difficult on *a priori* grounds to rank order antecedents in terms of their impact on knowledge sharing. However, the knowledge sharing literature implicitly makes such a rank order. Thus, the literature (cf. Table I) considers informational networks to be very important antecedents, at least judging from the large number of (highly cited) papers in top-tier journals that have addressed knowledge sharing from a network perspective (e.g. Dyer and Hatch, 2004; Hansen, 2002; Tsai, 2001). Also, direct monetary rewards have attracted considerable attention (e.g. Cabrera et al., 2006; Osterloh and Frey, 2000). However, there are numerous other organizational arrangements and mechanisms that may be argued to have a likely impact on knowledge sharing behaviours and the organization-level outcomes thereof, such as information systems, HRM practices, and traditional organizational design variables, such as the allocation of authority, departmentalization, specialization, and so on. Very little systematic research exists on these issues.

Given this, there seems to be a general need for systematic empirical work aimed at uncovering the relative contributions of different organizational antecedents to knowledge sharing behaviours and their organizational ramifications; that is, essentially treat each organizational antecedent as an independent variable in properly specified regression models, examine which antecedents are and which are not significant, and compare the direct effects. Such work can become quite messy, because of the sheer number of potential variables that can be included, degrees of freedom problems, etc. To keep empirical analysis manageable it may therefore make sense to restrict analytical attention to those organizational antecedents that can, in the language of optimal control theory, be treated as 'control variables' rather than 'state variables'. Such managerial control variables may include HRM practices, information systems, incentive schemes, and allocations of decision rights and authority. The working hypothesis then is that under norms of managerial rationality, 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 organizational knowledge sharing outcomes (the north-eastern node).

Interaction among Organizational Mechanisms

While it is highly useful to examine the direct effects on knowledge sharing behaviours and ultimately organizational outcomes of organizational mechanisms, it should also be recognized that there may be various kinds of interaction effects between mechanisms on knowledge sharing. Some organizational mechanisms may complement each other with respect to the impact on knowledge sharing behaviours, while other mechanisms may be substitutes. For example, a strong corporate culture that stresses general sharing behaviour (e.g. in the form of organizational citizenship behaviour) may *substitute* (within certain ranges) for explicit incentive pay (and vice versa) for knowledge sharing. Formal organizational arrangements and informal organizational 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 organizational mechanisms (introducing extrinsic rewards in terms of payment) may act against existing informal patterns and practices (intrinsically motivated organizational members) and such a combination may destroy knowledge sharing behaviour and cause irreversible, long-term negative effects on organizational behaviour (Osterloh and Frey, 2000; Robertson and Swan, 2003).

The space of combinations of organizational mechanisms is a vast one. Combinations may impact knowledge sharing in very different ways. Only very little of this has been explored in the literature. What is necessary therefore is a 'chemistry of organization' (Grandori and Furnari, 2008) that identifies the relevant organizational mechanisms/ variables, and hypothesizes how various combinations of these may impact knowledge sharing.

Formal and Informal Organizational Antecedents

Both formal and informal organizational mechanisms are crucial to the understanding of the governance of knowledge sharing. It is generally recognized that informal aspects of organization can be influenced by formal organizational mechanisms. A famous case is Homans' (1950) reanalysis of the bank-wiring room from the Hawthorne studies, demonstrating the existence of strong group norms with a significant element of enforcement. The background to those norms was the formal group piece-rate incentive system designed to increase productivity at the Western Electric Hawthorne Works in Chicago.[3] This aspect of formal organization 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.

One 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 Eastern Bloc countries (Michailova and Husted, 2003). It can be hypothesized 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 organizations, including knowledge sharing governance. Organizations 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 Hutchings, 2006). Michailova and Husted (2003) pointed out that knowledge sharing in traditional Russian organizations 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.

However, managers who wish to influence knowledge sharing by influencing informal organization must take considerable ambiguity and inertia into account. Changes in formal organization can function as signals to organizational members. Such signals

may, in turn, strongly influence the relations between management and employees. 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 organization is shifting to a 'gain frame' with a general emphasis on short-term maximizing behaviour (Lindenberg, 2003)? Or is it rather a signal that the organization places much value on knowledge sharing and that knowledge sharing behaviour in general is welcomed?

While the kind of research advocated above may begin from correlations between aggregate variables (i.e. the top arrow in Figure 1), according to the key argument of this paper, ultimately the level of organizational members and their interaction must be factored in. For example, whether a reward for knowledge sharing has negative or positive consequences for organization-level knowledge sharing may depend on the prevailing culture. However, why this is so is hard to grasp in lieu of understanding of how organizational culture, at least partly, primes the perceptions of organizational members.

Organizational Antecedents' Impact on Knowledge Sharing Behaviours

In the approach we advocate, explanation inherently and fundamentally involves individual agents and their interaction. 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 organizational 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: organizational antecedents impact the *conditions of actions* of organizational members (arrow 1) partly through these members' perceptions. For example, while some members may identify strongly with their organization, others may not buy into and internalize organizational 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, organizational antecedents are placed in and cannot be separated from organizational members' interpretive frames. How do these perception and interpretation processes impact the choices that organizational 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 organization, 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 are intertwined because of framing effects. This is only partly captured by the work of scholars who study knowledge sharing based on self-determination theory in social psychology (Deci and Gagné, 2005) (e.g. Cabrera et al., 2006; Foss et al., 2009; Osterloh and Frey, 2000). Moreover, existing empirical work on individual knowledge sharing behaviour does not deal very comprehensively with organizational mechanisms. For example, Foss et al. (2009) proxy job design variables with job characteristics variables.

An emphasis on individual motivation and cognition not only implies being detailed about how governance mechanisms impact on these dimensions of organizational members, it also means taking into account the *a priori* heterogeneity of organizational 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 organizational members' knowledge sharing propensities (Michailova and Husted, 2003; Michailova and Hutchings, 2006). Formally, such effects may be interpreted as exogenous variables (representing, e.g. personality traits) that moderate arrow 2.

How Do Knowledge Sharing Behaviours Aggregate to the Organizational Level?

A final issue concerns how knowledge sharing on the level of organizational members adds up to organizational level knowledge sharing (arrow 3 in Figure 1). This issue has been treated in some detail in parts of the knowledge sharing literature and has been seen as a key issue since the early, founding statements (notably Nonaka, 1991). Relatedly, it is a key theme in the organizational learning literature (Crossan et al., 1999). Nevertheless, open issues remain.

'Knowledge aggregation' is problematic because arrow 3 in Figure 1 is often not a matter of simply summing all the individual knowledge sharing activities (e.g. knowledge may be redundant), and because 'knowledge aggregation' is not independent of the organizational design. The first issue suggests that there is a limit to how much knowledge sharing should efficiently be undertaken in an organization. Efficient organizational knowledge is seldom, if ever, identical to maximum organizational knowledge sharing. In fact, it has been argued that the key advantages of such mechanisms as pricing (Hayek, 1945) and managerial authority (Demsetz, 1988) is that they reduce the need for knowledge overlap, and therefore for knowledge sharing efforts. The broader lesson is that the aggregation of individual knowledge sharing to organizational knowledge sharing may be critically dependent on not just informal knowledge sharing networks (Tsai, 2001), but also formal governance mechanisms. Such mechanisms not only influence the motivation to share knowledge, as argued earlier, but also influence the ability and the opportunity to do so. Organizational design variables such as specialization and departmentalization may be expected to rather directly influence knowledge sharing ability and opportunity. Empirically, this may be investigated by looking at the extent to which such organizational variables moderate the relation between individual knowledge sharing behaviours and organizational knowledge sharing outcomes.

CONCLUDING DISCUSSION

The Contribution of This Paper

Almost two decades ago, Argote et al. (1990) pointed out that knowledge transfer within organizations (in contrast to *between* organizations) was very much a black box. To be sure, much has happened in the meantime with respect to the academic treatment of

knowledge sharing in and between organizations. In particular, distinctive, organized ways of thinking about knowledge sharing in and between organizations have emerged, arguably making 'knowledge' more than simply another contingency factor, and perhaps more like a distinct analytical lense. The 'knowledge based theory' of the firm (e.g. Grant, 1996; Nickerson and Zenger, 2004) is an example of such a lense. So is the related theoretical development that has been called 'knowledge governance' (Foss, 2007, 2009; Grandori, 1997, 2001; Michailova and Foss, 2009), as are various applications of transaction cost economics and other organizational economics ideas to the understanding of the efficient governance of knowledge processes (e.g. Heiman and Nickerson, 2004; Nickerson and Zenger, 2004; Oxley, 1997; Oxley and Sampson, 2004).

As we have argued, there are still many black box dimensions of the understanding of knowledge sharing in organizations. We have reviewed existing studies in relation to the role of organizational mechanisms and micro-foundations as two specific lacking areas in the knowledge sharing literature. That these represent under-researched areas has been claimed in various 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 links between governance mechanisms and knowledge sharing, what are the relevant governance mechanisms, etc. However, work that explicates the link between governance mechanisms and knowledge sharing outcomes does exist, much of it empirical (e.g. Foss, 2007; Heiman and Nickerson, 2004; Hoetker and Mellewigt, 2006; Macher, 2006; Oxley, 1997). For example, hypothesis development relating to how firms leverage organizational 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 et al., 1996; Oxley, 1997; Oxley and Sampson, 2004), the understanding of the governance of human and social capital (Child and McGrath, 2001; Teece, 2007; Yli-Renko et al., 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 explored. 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.

Research Challenges

As Whetten (1989, p. 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 develop-

ment' (Whetten, 1998, p. 493). Moreover, the approach we have advocated can poten-
tially refine accepted relationships and yield new insights. For example, work on how
explicit incentives 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 findings 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, more theoretical and 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 atten-
tion to the issue of organizational 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 behaviour (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 spillovers
to an unacceptable level, or because it reinforces group-think and hampers innovation.
To maximize net benefits 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 behaviours by means of deploying the appropriate governance
mechanisms. The theoretical challenges here are huge.

   Empirically, challenges certainly also arise from our proposals for research on knowl-
edge sharing. For example, testing for complementarity between organizational mecha-
nisms is a challenging task (Athey and Stern, 2003). Moreover, regarding our call for
multi-level research, collecting data at different levels of analysis is a serious practical
difficulty. Knowledge of the relevant statistical methods, such as hierarchical linear
modelling (Snijders and Bosker, 1999), is not that widespread. Such difficulties may
explain why we see so little empirical knowledge sharing research that is genuinely
multi-level in nature (Becker and Huselid, 2006; Gupta et al., 2007; Rothaermel and
Hess, 2007). However, enthusiasm for multi-level methods and insights has been emerg-
ing in management research for more than a decade (Dansereau et al., 1997; Klein et al.,
1994; Kozlowski and Klein, 2000; Rousseau, 1985), based on the recognition that many,
perhaps most, management issues are inherently multi-level, and therefore ultimately
necessitate multi-level approaches. Exploratory research on these issues may rely on
sophisticated qualitative methodology, such as the methodology of narrative explanation
(Abell, 2004), which is explicitly designed for exploring processes that play out at multiple
levels of analysis.

Managerially Relevant Research on Knowledge Sharing

We furthermore submit that the kind of research we call 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 nature of knowledge sharing processes. Executives in knowledge intensive organizations are ready to absorb insights and evidence that can assist them to deal with knowledge sharing challenges. Our own consulting and empirical research experience suggests that executives are increasingly explicit in their desire to 'go beyond databases' 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 organization.

From a managerial perspective, it is timely for research on knowledge sharing to pay more attention to the link between knowledge sharing and organizational performance. Research has by now advanced in terms of both quality and quantity to reach the point of starting to provide detailed answers about the link between knowledge sharing and performance benefits. Managers need systematic knowledge on this link (as well as what mediates/moderates the link and how) in order to be able to make sense of the organizational members' behaviours they try to shape and govern. Note that the link between knowledge sharing and organizational outcomes also involves the level of individuals and their interaction. For example, the increased organization-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).

ACKNOWLEDGMENTS

NOTES

[1] Of course, 'organization' 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.
[3] 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.

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