

■ Research Article

Why Share Knowledge? The Influence of ICT on the Motivation for Knowledge Sharing

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Information and communication technology (ICT) can enhance knowledge sharing by lowering temporal and spatial barriers between knowledge workers, and improving access to information about knowledge. Looking at ICT for knowledge sharing in this light, however, has limited value, because it ignores when and how the quality of knowledge sharing will be enhanced. A more encompassing perspective will come about if ICT is studied with relation to the motivation for knowledge sharing. The article explores this perspective by developing a theoretical model identifying and linking the variables involved. By presenting the outcomes of an empirical investigation, it also illustrates the differential effects of ICT on the motivation for knowledge sharing in different settings. Copyright © 1999 John Wiley & Sons, Ltd and Cornwallis Emmanuel Ltd.

INTRODUCTION

Knowledge sharing has been identified as a major focus area for knowledge management. The relevance of this theme particularly derives from the fact that it provides a link between the level of the individual knowledge workers, where knowledge resides, and the level of the organization, where knowledge attains its (economic, competitive) value. While being recognized as an important pillar in knowledge management efforts, reports also show that, in practice, knowledge sharing proves to be a significant barrier for effective knowledge management. Various factors have been identified as impediments for knowledge sharing, including inadequate organizational structures, sharing-unfriendly organizational cultures, and denominational segregation (Davenport and Prusak, 1998; Tissen *et al.*, 1998). Of critical concern is the issue whether or not knowledge workers are motivated to share their knowledge with others.

Related problems may occur when information systems, such as intranets, distributed libraries, document manage-

ment systems, or groupware applications, are introduced to support knowledge sharing. The common motivation to introduce these technologies is that they may empower the individual knowledge worker by providing the tools to support and boost his or her knowledge-sharing skills (Tampo, 1996). Reports, however, show that all too often the introduction of these systems does not result in significant improvements in knowledge sharing, as many instances occur in which these systems are not used to their full potential (e.g. see DeLong, 1996). Again, if individuals are not motivated to share knowledge, it is not likely that they are motivated to use tools facilitating knowledge sharing. As Tissen *et al.* (1998, p. 31) put it, 'An intranet will not cause people to work for the good of the company rather than for the good of themselves'.

How do information systems, and more particularly information and communication technology (ICT), relate to the motivation for knowledge sharing? Let us presume that some technology has been introduced in an organization to further knowledge sharing, and that no significant increase has yet been established. Perhaps a first reaction then might be to ask for factors influencing the motivation for using the ICT. This question may then, for instance, lead to introducing incentives for using the technologies, such as money or 'air miles' (e.g. see DeLong, 1996). More careful consideration learns, however, that this first reaction is inadequate. It confuses means and goals. The more fundamental question is to assess how ICT affects the motivation for knowledge sharing (Kempees, 1998, unpublished manuscript). This

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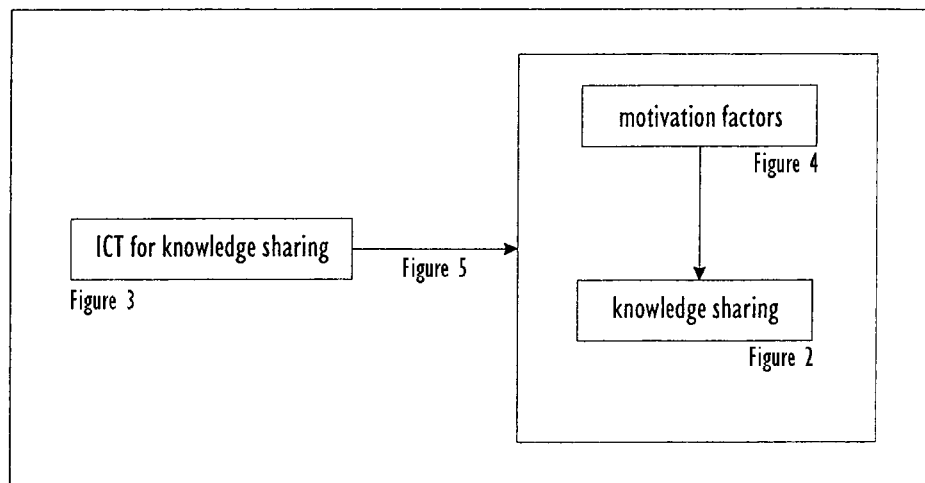


Figure 1 A diagram of problem statements and key concepts

focus also takes the interest in knowledge-sharing technologies beyond their empowerment function. Implicit in the notion of empowerment is that the role of ICT for knowledge sharing lies in the fact that the technology may take away barriers. Studying ICT within the broader perspective of their relation to motivation factors broadens the horizon of interest. It leads to the recognition of questions concerning how using ICT may stimulate or perhaps even frustrate the will to share knowledge.

The objective of the article, therefore, is to explore which factors affect the motivation of knowledge workers to share their knowledge and how ICT relates to these factors (see Figure 1). Its aim is to present a theoretical model in which the relevant classes of variables are identified and related. Its aim is also to present empirical material to illustrate the practical side of some elements of the model.

KNOWLEDGE SHARING

Before the role of ICT with relation to knowledge sharing can be considered, some notion needs to be developed of what knowledge sharing is. Knowledge sharing is something else than but related to communication. It is also different from but related to information distribution (e.g. see Huber, 1991; Nelson and Coopriider, 1996). In a strict sense, knowledge cannot be shared. Knowledge is not like a commodity that can be passed around freely, it is tied to a knowing subject. To learn something from someone else, i.e. to share his or her knowledge, an act of reconstruction is needed. It takes knowledge to acquire knowledge and, therefore, to share knowledge. Knowledge sharing presumes a relation between at least two parties, one that possesses knowledge and the other that acquires knowledge. The first party should communicate its knowledge, consciously and willingly or not, in some form or other (either by acts, by speech, or in writing, etc.). The other

party should be able to perceive these expressions of knowledge, and make sense of them (by imitating the acts, by listening, by reading the book, etc.).

Figure 2 presents this process that is commonly described as 'knowledge sharing' in a simplified form. Two subprocesses make up the process of knowledge sharing. First, knowledge sharing presumes an act of 'externalization' by those that have knowledge (in the figure identified as 'knowledge owners'). This externalization can take many forms, including performing actions based on this knowledge, explaining it in a lecture or codifying it in an intelligent knowledge system. Part of the externalization may be the explication of cognitive elements of knowledge information base (for instance, a document or a structured knowledge base). Knowledge externalization does not have to be a conscious act, nor does it have to be aimed at being shared by others. For instance, we can learn by watching someone perform a task, even if this person is unaware of the specific knowledge needed for the task, or unaware of being watched. However, in most situations where knowledge sharing is to occur, it may prove fruitful to stimulate the knowledge owners to externalize their knowledge in a form (or in more forms than one) suitable for reconstruction by others. Second, knowledge sharing presumes an act of 'internalization' by those seeking to acquire knowledge (identified in the figure as 'knowledge reconstructors' instead of, for instance, knowledge receivers to stress the activity of the role). Internalization, too, may occur in many different forms, including learning by doing, reading books, or trying to understand the codified knowledge in a knowledge base. Barriers exist that may distort the internalization of (previously or simultaneously) externalized knowledge. These barriers may be relatively straightforward, such as barriers of space and time. They may also be more fundamental, such as barriers of social distance, culture and language, and differences in mental or conceptual frames (Vriens, 1998). The externalization and

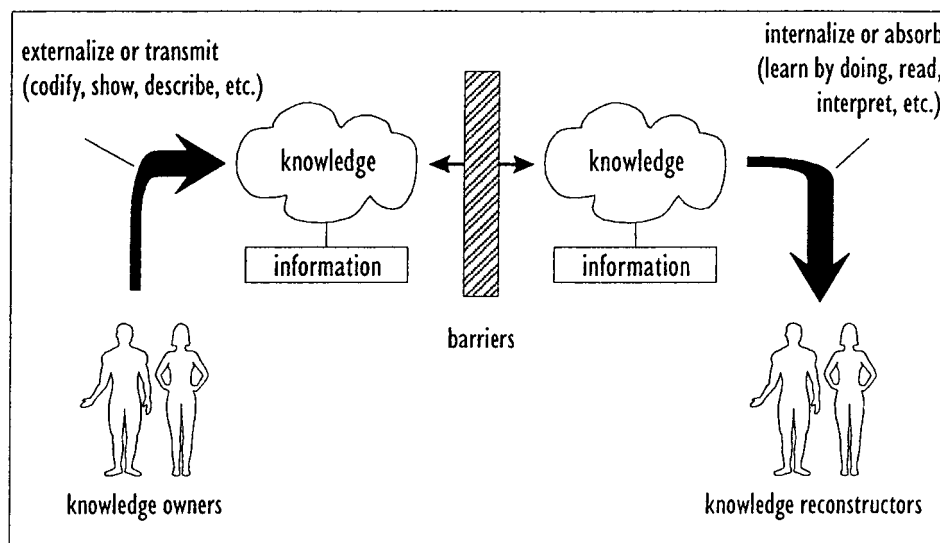


Figure 2 A simplified model of knowledge sharing

internalization sides of knowledge sharing may also be recognized in [Davenport and Prusak's \(1998\)](#) formula: Transfer (or sharing) = Transmission + Absorption.

ICT FOR KNOWLEDGE SHARING

Perhaps the most prominent ICT tool for facilitating knowledge sharing is an intranet. Some authors even equate promoting knowledge sharing with the challenges and pitfalls associated with the introduction and deployment of an intranet (e.g. [Marshall, 1997](#)). The potential role of ICT in supporting knowledge sharing, however, goes beyond the facilities of an intranet, although many of these functions may be bundled through the common interface of the intranet. The elements of knowledge sharing as shown in [Figure 2](#) may be used to identify the potential roles of ICT with relation to knowledge sharing. Four main areas may be identified (these are summarized in [Figure 3](#)). The first three concern the groupware functionality classes as distinguished by [McGrath and Hollingshead \(1994\)](#): overcoming constraints, increasing range and speed of information access and improving task performance. The fourth area refers to meta-knowledge, using technology to identify the elements in [Figure 2](#). It should be stressed that these four areas do not necessarily coincide with classes of ICT. One type of ICT application may prove useful for more than one of these four areas.

First, ICT may be effective in lowering at least some barriers involved in knowledge sharing. [Ruggles' \(1997\)](#) approach to identify ICT for knowledge transfer (which is treated here as a synonym of knowledge sharing) is based on the identification of types of barriers. He discerns three types of barriers: temporal distance, physical distance and social distance. Overcoming constraints because of temporal distance may refer to preserving knowledge over time. This

area is usually addressed under the heading of organizational memory. ICT may prove useful here in several forms, e.g. a knowledge base, thesaurus, or dictionary (see also [Stein and Zwass, 1995](#); [Lewis, 1997](#)). When temporal distance refers to barriers in the present (e.g. problems in coordinating schedules) ICT may prove helpful in the form of Internet-based discussion groups or electronic meeting software (EMS). For instance, an electronic meeting concerning specific topics may be scheduled to run for a preset period. Participants may contribute to the discussion at a time when their schedule allows or their inspiration suggests. By leveling temporal and spatial barriers, ICT may also facilitate new organizational forms for knowledge sharing, such as virtual knowledge teams (e.g. [Kristof et al., 1995](#)). Overcoming social barriers, the third subclass discerned by [Ruggles \(1997\)](#), may be expected to prove the most difficult problem ('social' is treated here more broadly than by Ruggles, also including barriers related to different 'conceptual frames' on the part of knowledge owners and knowledge reconstructors). ICT may be of assistance here too, for instance, in the form of tools facilitating social translation (e.g. learning maps, see [Ruggles, 1997](#); see also [Vriens, 1998](#), Chapter 6, and [Huber, 1991](#), pp. 143–148).

Second, ICT may facilitate the access to information bases storing data that are relevant beyond the individual level. As an example, consider electronic document management, document information systems and document imaging systems (EDM, DIS, see [Turban and Aronson, 1998](#), Chapter 7). A DIS typically allows the user to acquire electronically a set of documents, generate an indexing system to facilitate their retrieval (either automatically or manually), allows the definition of additional intelligence to link documents (e.g. by means of a hypertext structure), and offers facilities for search and retrieval of individual documents (note that 'document management' is also used in another sense to indicate tools for managing the process of

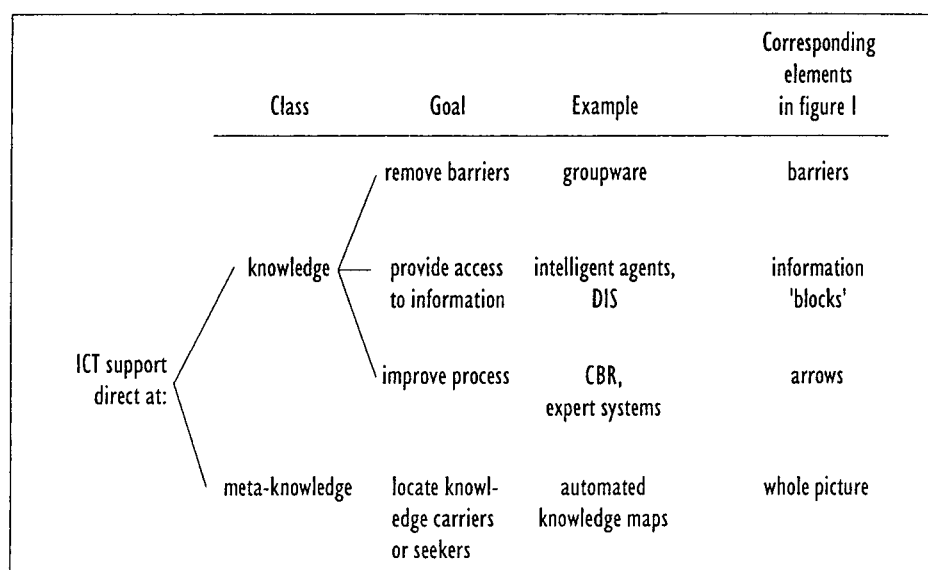


Figure 3 ICT support for knowledge sharing

using and adjusting documents, under the heading of workflow management). Much knowledge in organizations resides in a semi-structured or unstructured form in documents. A DIS may prove helpful to tap into the knowledge contained in documents, by allowing group members to identify each others' documents without having to read or memorize all of them.

Third, ICT may be introduced with the purpose of improving the processes involved in knowledge sharing. A distinction can be made between ICT aimed at supporting knowledge sharing processes versus partially taking over or directing these processes (these are levels 2 and 3 of groupware functionality as identified by DeSanctis and Gallupe, 1987; their level 1 combines the first and second areas identified previously). Case-based reasoning systems (CBR) provide examples of the first subclass (see Turban and Aronson, 1998). CBR may assist knowledge sharing by extracting knowledge from past cases, which may have been dealt with by other individuals, for use in current situations. Expert systems are examples of ICT support in the second subclass.

Fourth, ICT may help locate the various elements relevant to the process of knowledge sharing. In this sense, ICT does not address the knowledge to be shared itself, but meta-knowledge, i.e. knowledge about the knowledge to be shared. Meta-knowledge in one form, refers to the location and accessibility of relevant information bases. An example of this form is a clearinghouse, accessible via the Internet or via an intranet, providing a catalog to multiple data sets. Meta-knowledge in a second form refers to both knowledge owners ('Who has knowledge relevant to my situation?') and knowledge reconstructors ('Who is interested in elements of my knowledge?'). An example of the second form is an expertise database organized around functional knowledge domains and linked to a CV database with details of

people's personal careers and experiences (e.g. Davenport and Prusak, 1998, pp. 72–80).

One class of ICT has not yet been mentioned that deserves to be addressed as it advertises itself as 'knowledge sharing technology' (e.g. Gomez-Perez, 1996; see also 'Knowledge Sharing Papers' on the Internet: <http://www-ksl.stanford.edu/knowledge-sharing/papers/>). This class of ICT is built around the goal of defining ontologies, or conceptual models of domain knowledge, independent of individual subjects. These technologies, which are the offspring of research into Artificial Intelligence and knowledge engineering, may result in more intelligent information bases, or knowledge bases. It should be stressed that a knowledge ontology only addresses explicable knowledge, and, therefore, only a subclass of knowledge sharing. ICT for sharing knowledge is more than, and different from the knowledge sharing technology centred around shared ontologies.

MOTIVATING KNOWLEDGE WORKERS

How does ICT affect the motivation for knowledge sharing? This question brings us to the realm of motivation theories, and their implications for the area of knowledge sharing. Perhaps the best-known motivation theory is Maslow's needs hierarchy (Maslow, 1954). Maslow suggests that human conduct is motivated by five classes of needs: basic (e.g. food, water, sex), safety (e.g. secure environment), belongingness (e.g. love, affection), esteem (e.g. self-respect, recognition from others), and self-actualization (e.g. reach one's full potential). Maslow's theory has been widely criticized, for instance, because of the assumed strict hierarchy in needs, because it does not address the question of how behaviour is affected within the hierarchy, and

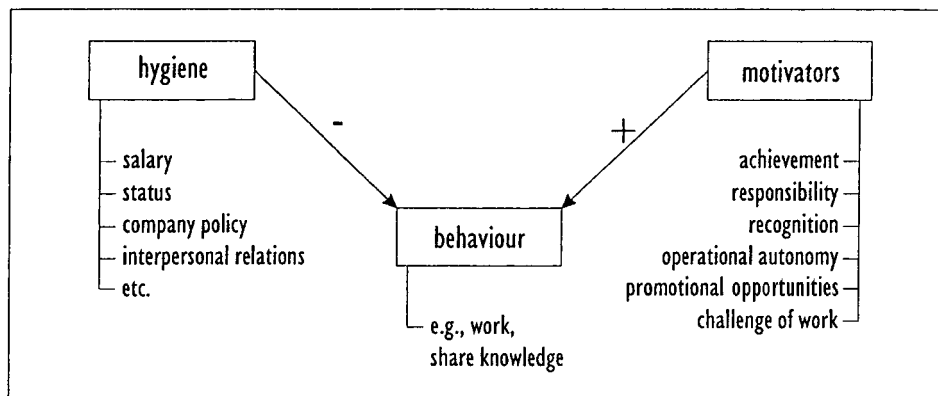


Figure 4 Herzberg's two-factor theory, slightly adapted. For explanation see text

because of its weak empirical foundation (e.g. Maccoby, 1988). Yet it still proves its value to the present day. For instance, both Stott and Walker (1995) and Tampoe (1996) refer to Maslow's theory to indicate that motivation for knowledge work comes from his three highest hierarchical levels. Their implication is that knowledge workers, for instance, do not share knowledge because of money or to improve their relations with their co-workers. Their motivation rather comes from their desire for self-actualization.

Maslow's theory belongs to the class of content or needs theories, as distinct from process theories (Stott and Walker, 1995). A content theory addresses the factors that determine motivation. A process theory, on the other hand, treats motivation as a process, and aims to identify how individuals will or should act to identify what their motivators are and to achieve the goals associated with these motivators. Although a full understanding of motivation also requires a process perspective, it is beyond the scope of this article to address this perspective. Here, the focus will be on the factors that may provide the motivation for knowledge sharing, and, therefore, on content theories.

Several content-oriented motivation theories can be found in the literature (next to Maslow, also, for instance, McGregor, 1960; Vroom, 1964; Herzberg, 1968, 1987; and McClelland, 1971, have produced popular, widespread theories). These theories, when combined, present a smorgasbord of individual motivation factors. A random selection: the wish to earn wages, to expend mental or physical energy, to contribute to the production of goods or services, the desire for social interaction and social status (Vroom, 1964), the wish to survive, enjoy, belong, play, the desire for recognition and respect (Maccoby, 1988), the need for achievement, affiliation and power (McClelland, 1971). An important instrument for introducing some order into this smorgasbord is offered by Herzberg's (1968) two-factor theory (see Figure 4). This theory will be used here, particularly because of its wide acceptance and because of its empirical verification (Herzberg, 1987). Herzberg's theory is based on the distinction between motivation factors and maintenance or hygiene factors. Factors in the

latter class only contribute, as Stott and Walker (1995) point out, to motivation in a roundabout, primarily negative way. They do not motivate behavior when they are present, but they will lead to dissatisfaction and, therefore, to a decreased motivation when absent. The minus sign in Figure 4 indicates the nature of the relation. Based on several empirical studies, Herzberg asserts that, for instance, salary, working conditions, status and interpersonal relations are hygiene factors. Herzberg assesses the following five factors that may act as motivators: challenge of work, promotional opportunities, sense of achievement, recognition of job done, and sense of responsibility. In addition, a sixth factor will be distinguished here, i.e. the desire for operational autonomy that is defined as the balance between regulatory needs and regulatory capacities (see De Sitter, 1994). Other studies show the relevance of this factor as a distinct motivator (e.g. Maccoby, 1988; McClelland, 1971). These six factors, when present, lead to increased motivation. When absent, they will not further job satisfaction (which does not imply they will lead to dissatisfaction, or that they will decrease motivation). The plus sign in Figure 4 indicates the nature of this relation.

Herzberg's two-factor theory also appears particularly relevant when studying the factors influencing the motivation for knowledge sharing. When looking for reasons why people want to share knowledge, one almost automatically turns to the list of motivation factors, not to the hygiene factors. Bonuses ('air miles', money) or salary penalties, for instance, may lead to an increase in the use of knowledge-sharing technologies but they are unlikely to result in an increased motivation for knowledge sharing itself. Also, if knowledge is equal to status (a hygiene factor too) knowledge sharing is less likely to occur. Therefore, status can hardly be a motivator for knowledge sharing. Similar comments can be made about the other hygiene factors. They may frustrate knowledge sharing when absent, but it is not likely that they will enhance knowledge sharing. The six factors identified before as motivators also appear pertinent as triggers for knowledge sharing. Mindful of the model of knowledge sharing in Figure 2, one should make a

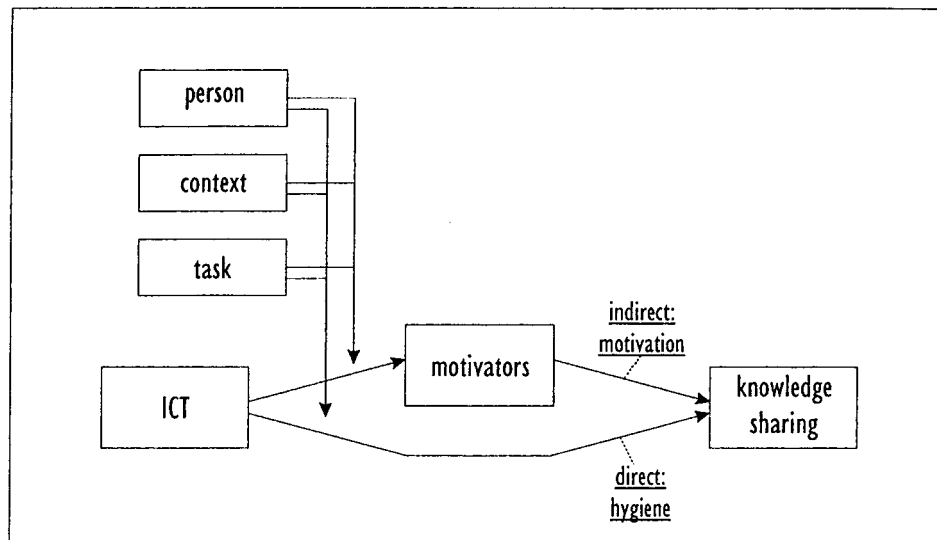


Figure 5 Research model of the role of ICT in motivating knowledge sharing

distinction between the motivation for knowledge owners to externalize or transmit their knowledge and the motivation of knowledge reconstructors to internalize or absorb knowledge. On the part of the knowledge owners, suggesting that two sets of factors are relevant to the motivation for knowledge sharing seems plausible. First, people share knowledge because they expect or hope for recognition and appreciation of their (knowledge) work, promotional opportunities or because of a sense of responsibility. Second, they share their knowledge because they expect or hope for reciprocity, that is, that others too will share their knowledge that may be useful to them. On the part of the knowledge reconstructors, the motivation for knowledge sharing is to be looked for in the reasons why people strive for knowledge. The challenge of knowledge work, operational autonomy as well as promotional opportunities and a sense of achievement are likely motivators here.

These assertions are also confirmed by empirical research. See, for instance, [Tampoe \(1996\)](#) who establishes that knowledge workers are triggered by personal growth, operational autonomy and task achievement (all of which are motivation factors) and not by financial rewards (a hygiene factor).

ICT AND THE MOTIVATION FOR KNOWLEDGE SHARING: A MODEL

The elements discussed in the previous sections provide the main building blocks for linking ICT to the motivation for knowledge sharing. [Figure 5](#) presents a model that may help understand the additional factors to be considered and the relations involved (the model is, partly, inspired by the model for assessing the effects of groupware proposed by [Nunamaker et al., 1993](#)). As discussed above, ICT is thought

to affect the motivation for knowledge sharing both directly (as a hygiene factor) and indirectly (by influencing the motivation factors). The way ICT was discussed in the third section primarily addresses the direct link (ICT as a hygiene factor). All four functions of ICT distinguished there, removing barriers, providing access to information, improving the process and locating knowledge carriers/seekers, refer to factors that, when absent, may deter knowledge sharing. For instance, people may be reluctant to share knowledge if the effort for finding interested parties is too great. An intranet may significantly reduce this effort. On the other hand, it seems implausible to sustain the argument that knowledge-sharing behaviour is directly motivated by ICT applications. People do not share knowledge because the intranet, or any other application, facilitates it. The indirect link between ICT and knowledge sharing will be discussed below.

Three sets of factors are to be distinguished upon which the influence of ICT on knowledge sharing is contingent. First, individuals may differ in their appreciation of ICT as well as in which motivators will affect them (e.g. see [Stott and Walker, 1995](#)). For instance, which factors motivate people are, among others, related to the stage in their career (e.g. see the discussion of the fulfilment, transition, developmental and plateaued stages in knowledge careers in [Tampoe, 1996](#)). Therefore, how particular ICT applications influence the knowledge-sharing behaviour of individuals also is likely to differ from one individual to another. Second, a broad class of variables is discerned related to the context in which knowledge sharing is to occur. These variables include the proneness to knowledge sharing in the organization, or what [Davenport and Prusak \(1998, pp. 96 ff.\)](#) describe as the 'culture of knowledge transfer'. A well-known fact is that people are reluctant to share knowledge if mistakes are not tolerated, or if certain groups are identified with knowledge which may be indicative of a

	sequential settings	parallel settings
sharing for knowledge application	I e.g., using CBR to ensure treating similar cases similarly over time	II e.g., using a co-authoring system for writing a multi-author textbook
sharing for knowledge development	III e.g., using intelligent agents to distribute knowledge about 'how and where to find ideas'	IV e.g., supporting brainstorm sessions in a group decision room

Figure 6 Modes of knowledge sharing and examples of ICT support

lack of openness in the knowledge sharing culture. Also, no matter how motivated they are, people do not share knowledge with those they do not trust (e.g. Boone, 1997). Third, it should be acknowledged that knowledge sharing is not a separate process that exists fully in its own right. Depending on the reasons why knowledge is shared, the process of knowledge sharing may take on a different form. The box 'task' in Figure 5 indicates factors that relate to the nature of the knowledge-sharing process itself.

A more thorough examination of the first two classes of contingencies ('personal' and 'contextual') is beyond the scope of this article. Only the third class ('task') will be considered in more detail. To link ICT and knowledge sharing satisfactorily, an appreciation is needed of the objectives and settings of knowledge sharing. A distinction has to be made between situations in which knowledge is shared with the purpose of an individual or group being able to apply existing knowledge as distinguished from situations in which individuals combine their knowledge to create new knowledge (e.g. see the knowledge spiral described by Nonaka and Takeuchi, 1995). In these settings, knowledge sharing refers to quite distinct processes. Sharing knowledge for the purpose of applying that same knowledge in new situations is likely to benefit from as extensive and accessible an articulation as possible (e.g. by extensively describing cases or projects or by documenting the knowledge in a video). Therefore, knowledge sharing for the purpose of application will probably benefit most from attempts to stimulate knowledge owners to present their knowledge in readily available formats. Sharing knowledge for the purpose of creating new knowledge, on the other hand, may be hindered by focusing attention upon explication and articulation. In these situations, knowledge is primarily relevant as the starting point and touchstone for creative new ideas, for new knowledge. Knowledge sharing

for the purpose of knowledge creation will probably benefit more from allowing individuals to tap into the creative powers of each other, which presumes a focus on the knowledge reconstruction side in Figure 2. Different perceptions of the meaning of 'knowledge sharing' thus occur when the different objectives of knowledge sharing are appreciated.

A second distinction has to be made between situations in which knowledge sharing occurs in a sequential setting (for instance, sharing knowledge through the organizational memory) versus a parallel setting (for example, a knowledge team working on a common problem; knowledge teams present a specific organizational form in which knowledge sharing is institutionalized, e.g. see Mohrman *et al.*, 1995; Fisher and Fisher, 1998). Combining these two distinctions results in the recognition of four different 'knowledge-sharing modes' (see Figure 6). The four quadrants refer to different concepts of knowledge sharing, and to possibly differential influences of ICT on the motivation for knowledge sharing.

ICT AND MOTIVATION IN DIFFERENT KNOWLEDGE-SHARING MODES

Although all four combinations in the matrix presented in Figure 6 are feasible, two of these combinations are likely to occur more frequently than the others. When existing knowledge is shared for the purpose of applying that knowledge in new situations, a sequential setting seems plausible. When knowledge is shared for the purpose of knowledge creation, a parallel setting may prove most fruitful. To assess the influence of ICT applications on motivational factors for knowledge sharing, these two 'knowledge-sharing modes' will be addressed here explicitly

Table 1 Rank order of motivators

Motivators	Group 1 (n=113) ^a		Group 2 (n=54)	
	Externalization	Internalization	Externalization	Internalization
Sense of achievement	30	19	36	28
Sense of responsibility	24	9	18	12
Recognition of job done	28	10	10	3
Operational autonomy	3	28	10	18
Promotional opportunities	12	20	2	3
Challenge of work	5	14	24	36
Total	100	100	100	100

^aGroup 1 concerns users of an intranet used for sequential knowledge sharing aimed at knowledge application (quadrant I in Figure 5). Group 2 concerns users of groupware used for parallel knowledge sharing aimed at knowledge development (quadrant IV in Figure 5). Respondents were asked to divide 100 points over the six motivators, to indicate how important they thought each motivator for their personal knowledge sharing. The scores in the table are the mean values of these individual assessments.

by presenting the outcomes of an empirical investigation¹. A short questionnaire was prepared and sent out to assess the relation between ICT use and the motivation for knowledge sharing in the two modes discerned. Three companies, including two ICT companies and one management consultancy firm, were approached using an intranet for storing and distributing 'best practices' or 'lessons learned'. The specific use of the intranet in these companies represents sequential knowledge sharing aimed at knowledge application (quadrant I in Figure 6). The questionnaire was delivered in the form of an HTML-document accessible through the intranet after approaching the 'best practices' database. The questionnaire resulted in 113 usable responses. To address the role of ICT in parallel knowledge sharing aimed at knowledge creation (quadrant IV in Figure 6) an evaluation was performed of three brainstorming sessions by commercial organizations held in the group decision room of the university. The questionnaire was introduced as the last item on the agenda of these meetings and delivered electronically (using the Survey tool of the GroupSystems software). All 54 participants in these three sessions participated in the evaluation.

A first set of questions in the questionnaire addressed the importance of the six motivators discerned in Figure 4 for the type of knowledge sharing concerned. A distinction was made between the motivation for externalizing (transmitting) one's personal knowledge and for internalizing (absorbing) the knowledge of others. People were asked to assess why knowledge sharing was important to them by dividing 100 points over the motivators (more

points indicate more importance). The results of this assessment are shown in Table 1. The results show, for instance, that a 'sense of achievement' is considered important in both sharing modes, particularly for the externalization side. 'Recognition' is clearly more important for sequential, application-oriented sharing, as are promotional opportunities. Particularly the 'challenge of work' triggers people to create knowledge in parallel groups, a motivator which is less important for knowledge sharing in mode I.

A second set of questions aimed to unravel how ICT (the intranet, the electronic meeting system) was considered to affect the motivators. The questions in this set were only presented for motivators with above average importance (a score on the questions in set 1 of 17 or higher). Ten statements were presented linking ICT to the motivation for externalizing and internalizing knowledge respectively (for two motivators, sense of responsibility and recognition, only their relevance for externalization was assessed). The outcomes of this assessment are presented in Table 2. They show, for example, a differential impact of ICT on operational autonomy. A clear decrease in the dependence on other people's knowledge as a motivator for knowledge sharing was reported in the groupware sessions, whereas no clear changes were reported by the intranet users. A possible explanation might be that, because of anonymity (see, e.g. Nunamaker *et al.*, 1993; Hendriks, 1998), the power base of participants is less prominent in the groupware-facilitated knowledge-sharing efforts. The fact that 'knowledge is power' may frustrate knowledge sharing. Groupware may, by furthering the equality of the participants, increase one's operational autonomy. Another striking difference between the two groups is that, on the whole, users of the intranet on most statements indicated a stronger impact on their motivation than the groupware users. It seems plausible to suggest that this difference relates to the fact that participating in a groupware session is already an act that shows motivation.

¹The empirical research described in this study was conducted for the sole purpose of providing illustrative material. As the selection of the cases was arbitrary and guided by ease of access rather than chance, the reader should be careful when generalizing the results. Also, the material should not be read as a test of the research model (Figure 5). The model was an inspiration for selecting the issues addressed in the investigation. The selection of issues is, however, too narrow as a significant representation of the model as a whole.

Table 2 Influence of ICT on motivators

Key concepts addressed in statements ^a	Group 1 (n = 113) ^b	Group 2 (n = 54)
<i>Sense of achievement</i> related to published knowledge	1.7	1.2
<i>Sense of achievement</i> related to received knowledge	1.0	1.0
<i>Recognition</i> of personal knowledge work	1.5	0.3
<i>Sense of responsibility</i> with respect to knowledge getting its value for the organization as a whole	1.5	0.4
Regulatory power of personal knowledge (<i>operational autonomy</i>)	0.8	1.0
Dependence on the regulatory power of others, associated with their knowledge (<i>operational autonomy</i>)	- 0.4	- 1.9
<i>Promotional opportunities</i> associated with published knowledge	1.3	0.2
<i>Promotional opportunities</i> associated with received knowledge	0.9	0.6
<i>Challenge</i> of publishing knowledge	1.2	0.9
<i>Challenge</i> of receiving knowledge	0.7	0.7

^aThe statements addressed the influence of the particular ICT application (intranet, groupware) on the concepts shown in the table; the motivators concerned (see Figure 3) are in italics.

^bSee Table 1. Items were measured on a 7-point scale, ranging from - 3 (=strongly decreased) through 0 (=not affected) to 3 (=strongly enhanced). The scores presented are the averages of the individual assessments.

Tables 1 and 2 indicate the differential setting that arises in different knowledge sharing modes, both in the sense that different weight is given to the motivators and in the sense that using ICT affects these motivators differently. The research model of Figure 5 should, be treated with a note of caution. Both personal factors and contextual factors were left out of the assessment. These, too, may account for some of the differences.

CONCLUSION

The simple equation that knowledge sharing is good for organizations cannot be sustained. Knowledge can be augmented if it is shared, knowledge sharing may also prove detrimental to knowledge. The first will occur if people truly learn from each other. The second is to be expected if inadequate representations of knowledge are transferred between people. Both the acts of externalization and internalization (see Figure 2) require that knowing subjects should recognize the value of the knowledge to be shared. Otherwise, there is no knowing how both these processes, that require active intellectual involvement of the knowledge sharers, are best constructed. The key to success in knowledge sharing is that the personal ambition should match the group ambition. Therefore, also the touchstone for successful ICT applications for knowledge sharing is the question how they relate to these ambitions, and to the motivation of knowledge workers to match them.

A specific bias may be noted with respect to how organizations go about motivating their workers to share their knowledge with the assistance of ICT. Prevailing motivation theories suggest that compensation and force are not effective to motivate human behaviour, whereas such factors as recognition and challenge of work are. Yet many instances can be found where measures are being used to further ICT-assisted knowledge sharing that aim at the

first class of factors, those that Herzberg (1987) designated 'hygiene factors'. Many organizations invest in reward and penalty systems for stimulating knowledge sharing (e.g. Quinn *et al.*, 1996; Hiebeler, 1996; DeLong, 1996). The main lesson of motivation theory is that whether or not these systems will really improve knowledge sharing is dependent on quite different variables. An informative inconsistency that illustrates the same point may also be found in Tissen *et al.* (1998). On the one hand, they call for management to motivate workers to share knowledge, and refer to such measures as force and control structures (p. 153) and changes in the pay structure (p. 35). To justify these selections they assert that '... compensation is a major motivating factor in this business' (p. 34). On the other hand, they establish that 'The only thing that really makes them [the professionals] run is the pleasure they have in their work' (p. 153). Perhaps part of this confusion is due to the fact that improving knowledge sharing is not the same as stimulating knowledge-sharing behaviour. The quantity of knowledge sharing may perhaps be enhanced with money. Its quality cannot.

The story does not end here. Gaining insight into the motivation factors of knowledge sharing is a first, essential step towards understanding how knowledge sharing can be managed. The use of ICT can be an important instrument in this respect, but certainly not the only or most prominent one. No attention has been given here to such questions as how this instrument relates to other instruments, and how the use of the instrument fits in with various management strategies to promote knowledge sharing (e.g. participative management, symbolic management, etc.; see Stott and Walker, 1995). These indicate some of the limitations of this study, along with those identified earlier. The lessons that readers interested in the management of knowledge sharing may reap from this article can be summarized in three points. First, the role of ICT for knowledge sharing can only be fully understood if it is related to the motivation for

knowledge sharing, and not just to maintenance factors (removing barriers, etc.). Second, knowledge sharing has to be recognized as an umbrella term for different concepts (cf. the knowledge-sharing modes in Figure 6). Both the motivation for knowledge sharing and the role of ICT may well vary with respect to these different concepts. Third, other factors, such as personal preferences and a knowledge sharing culture (see the research model in Figure 5), should be considered explicitly. ICT can make a difference for knowledge sharing. Understanding what this difference will be cannot be learned by looking at the technology only. The argument developed here suggests that the motivation for knowledge sharing provides the appropriate focus for conceiving the difference.

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