

ICT performance in processes of knowledge sharing in organizations: A review of literature

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Abstract

The purpose of this paper is to theoretically explore in what ways Information and Communication Technology (ICT) corresponds with knowledge sharing in organizations. We will address the research question: "What notions and relationships have been proposed in the literature regarding ICT use and knowledge sharing?" In order to draw connecting lines between different bodies of literature, we developed two notions of ICT performance as a guiding principle in reviewing the literature. On the one hand, ICT is portrayed as a guide that moulds ways of knowledge sharing, and on the other hand ICT is described as a facilitator that follows existing knowledge sharing processes in organizations. The two types of ICT performance offer a tool with which approaches and perspectives on ICT in processes of knowledge sharing can be interconnected and displayed in one overview. This systematic research overview that connects separate notions and ideas coming from different disciplines results in a synthesis of research questions that are relevant for future research on the role of ICT in knowledge sharing in organizations.

Keywords: ICT performance, knowledge sharing, explicit knowledge, tacit knowledge.

Introduction

The increased use of information and communication technology (ICT) in various contexts is assumed to have an impact on contemporary society. Van Dijk (1999: 223) mentions that the globalization of the economy is intensified by ICT. De Haan and Huysmans (2002) argue that ICT may be regarded as a catalyst in a process of cultural change. At the same time, the technological development of ICT is influenced by society itself as individuals and groups use ICT in non-prescribed manners (e. g., Orlikowski, 2000; Verbeek, 2000). This mutual shaping of ICT and soci-

ety is the focus of the Dutch Council of Scientific Research program *ICT and Society* (NWO, 2000). One of the foci in this program, in which the authors are participating, is organizational use of ICT. Organizations are increasingly implementing ICT, which leads to an increased use among organizational members (e.g., Rice and Gattiker, 2001). A main reason for ICT implementation in organizations is the improvement of knowledge sharing. Although knowledge has always been shared, in modern economies acquisition of knowledge and the sharing of knowledge is increasingly considered to be a factor of outstanding strategic importance for organizational development. The assumption is that ICT is supportive to processes of knowledge sharing (e.g., Huysman and De Wit, 2000; Malhotra, 1996; Nonaka and Takeuchi, 1995; Senge, 1992).

In this paper we will discuss theoretical and empirical studies regarding ICT and knowledge sharing. We will address the question: "What notions and relationships have been proposed in the literature regarding ICT use and knowledge sharing?"

In order to address this question we selected literature in multiple stages. A systematic search and appraisal of the relevant literature was conducted by snowball sampling using ISI-web, Sciencedirect, Sage Journals On Line and Google Scholar databases. First we looked for studies on 'ICT and knowledge sharing in organizations.' Surprisingly, we did not find many results. Then we decided to make a distinction between literature on the impact of ICT tools and ICT use on organizations, and literature on knowledge sharing in organizations. That was more successful, resulting in a variety of theoretical and empirical studies. We identified main perspectives and theoretical discussions and added these titles which resulted in a representative body of literature on the main issues.

In order to analyze and sort out existing notions, we tried to reduce the complexity and diversity of the different approaches and perspectives on ICT use and knowledge sharing. We developed two different types of ICT performance or functioning in processes of knowledge sharing. In the first type ICT is portrayed as a guide: ICT characteristics mould ways of knowledge sharing in organizations. In this view on ICT, processes of knowledge sharing in organizations are hard to imagine without the use of ICT. Examples of ICT as a guide are sophisticated electronic repositories and powerful search engines that connect people to documents and give people new means to store and retrieve knowledge.

In the second type, ICT is portrayed as a facilitator: ICT use follows and interacts with knowledge sharing practices. In this view on ICT, processes of knowledge sharing can take place both with or without the help of ICT, although ICT can improve their efficiency or effectiveness compared to traditional means used for knowledge sharing. Examples

of ICT as facilitator are e-mail and videoconferencing that connect people to people, in order to exchange or create knowledge. The two types of ICT performance do not exclude each other and can be understood as two ideal types.

As stated above, a wide diversity of notions, approaches and perspectives were reviewed. By relating these different views to the portrayals of ICT tools and ICT use and knowledge sharing, being ICT as guide-type an ICT as facilitator-type, we develop a synthesis of notions into a new framework, which includes an overview of approaches and typical research questions. With this synthesis of theoretical notions we aim to connect two major bodies of literature: studies on the impact of ICT use and studies on knowledge sharing in organizations, that has been lacking so far.

ICT performance in organizations

In the literature two approaches are discerned in order to illuminate the role of ICT in organizations: the objectivist versus the subjectivist approach. In the objectivist approach it is assumed that characteristics are assigned to communication channels and tasks. Theoretical notions and empirical research developed in the field of Computer Mediated Communication (CMC), such as the reduced cues perspective (Kiesler, Siegel and Mc Guire, 1984), social presence (Short, Williams and Christie, 1976; Utz, 2000), and media richness theory (Trevino, Daft and Lengel, 1990) reside in this approach. In the objectivist approach it is assumed that ICT characteristics act on processes of knowledge sharing. Accordingly, in this approach attention is paid to new ICT infrastructures and the development of new ICT tools for knowledge sharing. The objectivist approach belongs to the first type of ICT performance in organizations: ICT as guide to knowledge sharing as according to this approach the value of ICT performance is assigned and effects of ICT are predicted beforehand.

In the subjectivist approach, on the contrary, it is assumed that individual users of ICT assign value and meaning to communication channels subjectively, based on own experiences during encounters with the channels. Within this approach several theoretical notions were developed such as the social information processing model (Walther, 1996; Walther and Burgoon, 1992), and the channel expansion theory which emphasizes perceived richness of media (Carlson and Zmud, 1999). As individual users of ICT assign value and meaning to ICT, the focus of the subjectivist approach is on knowledge sharing processes and how they steer or guide the use of ICT. It is obvious that this approach belongs to the second type of ICT performance: ICT as facilitator of

knowledge sharing as users define characteristics and value of ICT subjectively over time. The ICT performance in praxis does not necessarily have to match with the intended functions.

Büchel (2001) proposes three theoretical perspectives on the relationship between ICT and organizations: the impact perspective, the choice perspective and the emergent perspective (Büchel, 2001: 8). The impact perspective, which is close to the objectivist approach, considers communication as being a cause for changes in organizations. The impact perspective and the objectivist approach, are rather deterministic and assume that the outcome of communication technology implementation can be predicted beforehand. In other words: ICT guides knowledge sharing.

The choice perspective regards humans as agents who determine the technological design of organizations, whereas according to the emergent perspective the dynamics in an organization are seen as the result of interactions between communication and its organizational and human dimensions (Büchel, 2000). The choice perspective and the emergent perspective, which are close to the subjectivist approach, are echoed in the literature on the virtues of electronic communities in organizations (e. g., Lesser and Prusak, 1999; Van der Sluijs, 2001). Communities may well be the oldest form of human organization and modern organizations recognize them as units in which valuable processes of knowledge sharing, learning and organizational change take place. Van der Sluijs (2001) describes a dilemma that arises when (electronic) communities are strategically implemented in order to contribute to an improvement of organizational outcomes. The dilemma resides in the fact that communities flourish most when members are motivated for whatever reason to participate in developing the community, whereas managerial intentions of initiating communities in order to obtain some strategic purposes may generate the opposite effects. Probably few organizational members will be inclined to participate in a community that does not reflect their, what Rheingold (1995) calls, "community of interest". Generating beneficial effects from the virtues of (electronic) communities on behalf of the organizations requires a careful balancing between spontaneous developments in existing communities on the one hand, and organizational requirements on the other. Organizations benefit most when this balancing results in an optimal situation where communities possess a considerable amount of joint enterprise, mutual engagement and a shared repertoire (Van der Sluijs, 2001). In the subjectivist approach and the emergent and choice perspective, the second type of ICT performance in organizations can be recognized: ICT facilitates knowledge sharing. ICT has no meaning in its own but offers a platform, and actual use of ICT in interaction with knowledge sharing practices determines the role of ICT.

	Types of ICT performance in organizations	
	ICT as guide: ICT characteristics determine knowledge sharing.	ICT as facilitator: Knowledge sharing practices determines use of ICT.
Approaches to ICT performance in organizations	Objectivist approach: characteristics of ICT are assigned objectively - Reduced cues perspective - Social presence - Media richness theory	Subjectivist approach: characteristics are assigned subjectively over time. - Social information processing model - Channel expansion theory - Perceived richness of media
Perspectives on ICT performance in organizations	Impact perspective: outcome of ICT performance can be predicted beforehand	Choice and emergent perspective: outcome of ICT performance depends on users and context.

Figure 1. *Overview and synthesis of current approaches and perspectives regarding ICT performance in organizations.*

In this section we reviewed different approaches and perspectives on ICT in organizations.

The overview in Figure 1 represents the first step in our effort to synthesize different theoretical notions on the role of ICT use on knowledge sharing. Looking further into the different studies on the impact of ICT in organizations, there is some empirical evidence for both types of ICT performance. Sproull and Kiesler (1991) examined the effects of e-mail in organizations and labeled them “first level” and “second level” effects. First level effects represent the consequences of ICT use for individual tasks, such as gains in task- and communication efficiency and productivity. These effects are operational and often the intended ones while introducing a new communication system. Second level effects represent indirect and often unanticipated changes in the organizational structure, such as altered or new communication patterns, new roles in social networks, and new patterns of dependency between actors (Bouwman et al., 2002: 169). Typical second level effects of ICT include the bypassing of formal communication hierarchies, and the emergence of new and more external communication patterns (Van den Hooff, 1997: 53). The notions of first and second level effects of ICT shows that the impact

perspective underestimates the existence of unanticipated consequences of ICT. We can categorize these findings on first and second level effects of ICT in organizations in the objectivist approach and as ICT as guide: the effects of ICT on the organization and on knowledge sharing are point of departure in these research examples.

According to Büchel (2001) the role of communication technology for knowledge sharing has been overemphasized. She assumes that the value of ICT is twofold. First, ICT provides a starting point for knowledge development as it offers tools for establishing and supporting links between people. For instance the results of an experimental study by Ogata, Yano, Furugori and Jin (2001) show that a particular computer system facilitates users' encounters with cooperators and develops new helpful connections with the cooperators, by gathering, exploring and visualizing the social networks in the organization. Second, ICT can play a critical role in raising the consciousness of existing links within the organization, since its implementation and use requires renewed thinking about the entire process of information acquisition, distribution, interpretation and storage (Büchel, 2001: 102). In other words, Büchel emphasizes that the (only) potential of ICT is to connect individuals and (other) sources of information. These findings represent ICT as facilitator: ICT (only) connects people to people. ICT is rather ineffective in supporting information interpretation. Whereas the human act of interpreting information is essential to the development of knowledge. Traditional media, especially face-to-face encounters, are better at supporting this human act compared to ICT (Büchel, 2001: 101).

We conclude that ICT performance in knowledge sharing in organizations is portrayed in two ways in recent literature. Both theoretical and empirical investigations can be summarized by means of two approaches to ICT performance in organizations: an objectivist approach and a subjectivist approach. According to the objectivist approach ICT is an initiator of knowledge sharing by itself, leading to organizational development. Following the subjectivist approach ICT performance is relative and context dependent. ICT is contingent upon knowledge sharing as ICT use and knowledge sharing practices interact and the ICT performance in organizations is created overtime (see Figure 1). From this framework different types of research questions can be developed to study the role of ICT in knowledge sharing processes. From the ICT as guide perspective the following research questions are likely to be addressed: "What opportunities for sharing knowledge are offered by different ICT tools?" and "Are ICT design and architecture effective in moulding ways of knowledge sharing?" From the standpoint of ICT as facilitator a research question would be: "Which requirements have to be met by the

ICT tools, looking at the everyday practices of knowledge sharing in organizations?” and “Is ICT use effective, *vis-à-vis* the organizational context?”.

Knowledge sharing in organizations

Reviewing the available literature we came across several conceptualizations of knowledge and knowledge sharing within organizations. In this section we will discuss and compare these perspectives and approaches in order to connect them to the portrayals of ICT as guide or facilitator in processes of knowledge sharing.

The philosophical question of what is knowledge has been debated widely over centuries, actually “since the beginning of philosophy itself” (Ferne, Green, Weller, and Newcombe, 2003: 178). Although there is no ultimate answer to this question, there seems some agreement on the idea that knowledge is personal and can be defined as an individual’s ability to make judgments in order to draw distinctions within a collective domain of action, based on an appreciation of context or theory or both (Ferne et al., 2003).

Koskinen, Pihlanto and Vanharanta (2003) make a distinction between two epistemological positions on the nature of knowledge: the cognitivist versus the autopoietic epistemology. In these perspectives we recognize Littlejohn’s (1983) distinction between epistemological positions of rationalists (Worldview I) and constructivists (Worldview II).

According to the cognitivist perspective, organizations are considered to be systems which develop knowledge by formulating increasingly accurate representations of their pre-defined worlds. Learning in the cognitivist epistemology means taking knowledge from the environment and relating it to the previously acquired frames of reference. This position reflects Littlejohn’s Worldview I, in which our surrounding world is defined as a physical, knowable reality that is self-evident to trained observers (Littlejohn, 1983: 20). The ICT as guide-type fits into the cognitive epistemology to knowledge because ICT-tools offer the opportunity to transfer knowledge, independent of the context within it is stored and retrieved.

Autopoietic systems are self-producing and have a circular organization where the outputs of the system are its own inputs (Kay, 2001: 462). Autopoietic epistemology does not claim that the world is a pre-given. Knowledge can only be produced or constructed, not imported. This means that knowledge is context dependent and situation sensitive (Koskinen et al., 2003: 284). Littlejohn terms this position as “Worldview II”. In this view people take an active role in creating knowledge. “Knowledge arises not out of discovery but from interaction between knower and known.” (Littlejohn, 1983: 21). The ICT as facilitator-type

matches with the autopoietic epistemology, as ICT tools can (only) offer a platform where knowledge is created and interpreted, context dependent and embedded in people's subjective frame of reference.

In addition to knowledge in itself, knowledge sharing is also widely discussed. Knowledge sharing is often described as an interaction between individuals in which they mutually exchange existing knowledge and jointly create new knowledge (Büchel, 2001; Huysman and De Wit, 2000; Ruuska and Vartiainen, 2005). This characterization of knowledge sharing implies that a knowledge sharing process consists of both donating and receiving knowledge. Four types of knowledge sharing are discerned: knowledge storage, knowledge retrieval, knowledge exchange and knowledge creation (e. g., Hansen, Nohria and Tierney, 1999; Huysman and de Wit 2003). Knowledge storage and retrieval can be associated with ICT as guide, because these types of knowledge sharing depend more or less on ICT characteristics (sophisticated repositories and search engines). Knowledge exchange and creation can be linked to ICT as facilitator of knowledge sharing processes as these processes may take place independent of the existence of ICT, but may profit most when shared interpretation and frames of reference are taken into account.

In the literature, a distinction is made between a codification and a personalization strategy for knowledge sharing in organizations (Hansen, Nohria, and Tierney, 1999; Scheepers, Venkitachalam, and Gibbs, 2004; McMahon, Lowe, and Culley, 2004). The codification strategy relies on carefully codifying the knowledge and storing it in archives and databases, where it can be assessed and reused. In the personalization strategy, knowledge is closely tied to the people who developed it and is shared by personal face-to-face interaction (Ruuska and Vartiainen, 2005: 374). Several authors have investigated empirically the impact of these strategies on ICT infrastructure and ICT use (Scheepers et al., 2004). ICT can be supportive to the codification strategy when organizations invest rather heavily in an ICT-infrastructure that enables people to codify and store their knowledge and get easy access to it. ICT infrastructure may include sophisticated electronic repositories and powerful search engines to access codified knowledge (Scheepers et al., 2005: 204). Again we recognize ICT as guide to knowledge sharing as it connects people to documents and stored knowledge.

In order to stimulate the personalization strategy, which draws on interpersonal relationships to mobilize and share knowledge, organizations need a moderate investment in ICT-infrastructure. Organizations need an ICT infrastructure, such as e-mail systems, video-conferencing, online discussions and collaborative tools, to connect various experts in the organization (Hansen et al., 1999). In the personalization strategy ICT follows knowledge sharing as it connects people to other people.

ICT supports knowledge sharing processes but is not a prerequisite as these processes exist anyway. ICT improves knowledge sharing when efficiency and usefulness is proved over time. Scheepers et al. (2004) discovered in a case study that organizations that emphasize codification invest more in ICT infrastructure compared to organizations that emphasize personalization.

Types of knowledge: explicit and tacit knowledge

In the literature on knowledge in organizations we encountered the distinction between sharing explicit and tacit knowledge (Polanyi, 1966) and their relationship with ICT use. In the literature we reviewed, tacit and explicit knowledge are conceptualized differently by several authors (e.g., Baumard, 1999; Boisot, 1995; De Carvalho and Ferreira, 2001; Collins, 1993; Davenport and Prusak, 1998; Leonard and Sensiper, 1998; Nonaka and Takeuchi, 1995; Polanyi, 1966; Prencipe and Tell, 2001; Saviotti, 1998; Spender, 1996, 1998; Sveiby, 1997). Explicit knowledge is described as knowledge that can be easily expressed or codified, whilst tacit knowledge is personal and context dependent, and as such differs from explicit since it is very difficult to express, formalize or communicate (Fernie, et al., 2003). According to Koskinen et al. (2003) tacit knowledge is based on experiences of individuals and it expresses itself in human action (know-how). The only way of presenting it, is through metaphors, drawings and different methods of expressing not requiring a formal use of language (Koskinen et al, 2003: 281). Tacit knowledge is deeply rooted in individual's experience whereas "[...] explicit knowledge is the type of knowledge that an individual has acquired mainly in school and university [...] and implies factual statements that can be expressed in words and numbers." (Koskinen et al., 2003: 282). Goldblatt (2000), argues that explicit knowledge represents only the tip of the iceberg of the entire body of knowledge in organizations, leaving 80% of tacit knowledge underwater. Scholars hold different views regarding the relationship between explicit and tacit knowledge (Alavi and Leidner, 2001; Koskinen et al., 2003; Van Baalen et al., 2005).

Van Baalen et al. (2005) sketch two views on the relationship between tacit and explicit knowledge: the "near tangible view" and the "distributed view". In the "near tangible view", explicit and tacit knowledge are conceptualized as two separate concepts. Knowledge is either tacit or explicit, not two sides of the same medal (Nonaka, 1994). In processes of knowledge sharing tacit knowledge becomes explicit knowledge and explicit knowledge becomes tacit knowledge (Nonaka and Takeuchi, 1995). When codification of tacit knowledge is more or less achieved, tacit knowledge is transferred into explicit knowledge. ICT can guide these codifications.

In the “distributed view” it is believed that tacit knowledge is a component of all knowledge and as such cannot be converted into explicit knowledge. According to Tsoukas (2003) tacit knowledge and explicit knowledge are complementary. They are mutually dependent and reinforcing qualities of knowledge (Alavi and Leidner, 2001: 112). Polanyi (1966) conceptualized tacit and explicit knowledge as two extremes on a continuum (e.g., Dixon, 2000; Saviotti, 1998). In this view it is not the lack or impossibility of codification that frustrates tacit knowledge sharing as is the case in the near tangible view. When the knowledge source and the knowledge recipient share the same context and are engaged in the same practice the ‘transfer-costs’ will be relatively low (Van Baalen, et al. 2005: 302). Knowledge sharing or the personalization of both explicit and tacit knowledge is not a one-way activity, but a process of trial and error, feedback, and mutual adjustment of both the source and the recipient of knowledge (Von Krogh, 2003: 373). Alavi and Leidner (2001: 112) believe that tacit knowledge forms the background necessary for assigning the structure to develop and interpret explicit knowledge. ICT can only facilitate these personalization strategies, as interpersonal relations and shared interpretations are more important.

We think that the distinction between tacit and explicit knowledge is relevant for the understanding of the relationship between ICT and knowledge sharing. In the “near tangible view” we assume that ICT supports codifying tacit knowledge in order to convert tacit knowledge into explicit knowledge. Following this codification strategy, ICT is used in order to transfer tacit knowledge into explicit knowledge. In this conceptualization we recognize that the ICT performance in organizations directs knowledge sharing: ICT enables organization members to transform tacit knowledge into explicit knowledge, store explicit knowledge and get easy access to reusable explicit knowledge. By using sophisticated electronic databases and powerful search engines people get access to codified, explicit knowledge (Hansen et al., 1999). In other words ICT guides knowledge sharing.

In the “distributed view” on the relation between explicit and tacit knowledge, it is not the mutual convertibility of tacit and explicit knowledge that is at stake. ICT-as-facilitator constitutes a platform for sharing both explicit and tacit knowledge at the same time, using the personalization strategy.

The different views on the relation between tacit and explicit knowledge reflect the distinct worldviews mentioned above. The “near tangible view” comes close to the cognitivist epistemology (Worldview 1), because explicit and tacit knowledge are considered as two separate entities. Knowledge is directly transferable, especially when it is expressed in codes.

In the “distributed view” tacit and explicit knowledge are not separate entities and are interdependent and integrated. Knowledge is not directly transferable but history dependent and context sensitive (Worldview 2).

	Epistemological positions	
	Rationalist: ICT as guide	Constructivist: ICT as facilitator
(1) Approaches to knowledge	Cognitivist approach: accurate representations of pre-defined worlds (imported from the environment).	Autopoietic approach: produced, context dependent and situation sensitive.
<i>ICT performance in organization</i>	<i>ICT helps to optimize storage en retrieval of accurate representations</i>	<i>ICT only provides objects that still need interpretation in an organizational context</i>
(2a) Types of knowledge sharing	Knowledge storage & knowledge retrieval	Knowledge exchange & knowledge creation
(2b) Strategies for Knowledge sharing	Codification strategy: assessing and reusing codified knowledge, stored in data bases: <i>people-to-documents approach to knowledge sharing.</i>	Personalization strategy: face-to-face interactions as knowledge is closely tied to people: <i>people-to-people approach to knowledge sharing.</i>
<i>ICT performance in organization</i>	<i>ICT enables codification as it connects people to stored knowledge in information systems.</i>	<i>ICT enables personalization as it connects (dispersed) people to each other.</i>
(3) Views on tacit and explicit knowledge	Near tangible view: separate concepts that can be converted into each other.	Distributed view: complementary, interdependent and interrelated.
<i>ICT performance in organization</i>	<i>ICT enables people to convert tacit into explicit knowledge and to share explicit knowledge ICT.</i>	<i>ICT is a platform which enables people to share both explicit and tacit knowledge.</i>

Figure 2. Overview and synthesis of current approaches to knowledge, knowledge sharing and types of knowledge and ICT performance.

In Figure 2 different perspectives on knowledge, knowledge sharing and the relation between explicit and tacit knowledge are summarized in an overview of current approaches. Similarly to Figure 1, the two types

of ICT performance in organization establish a common ground of different approaches and perspectives.

Again, these different epistemologies on knowledge and knowledge sharing lead to different research questions. From a rationalist perspective on the role of ICT in knowledge sharing in organizations research questions are addressed that focus on how effective and efficient ICT tools are in transferring knowledge from one place to another, or in codifying, storing and retrieving explicit knowledge.

From a constructivist perspective research questions are addressed that focus on:

- how ICT tools offer a platform that enables people to create and share knowledge, within the organizational context and given existing knowledge sharing routines
- how ICT tools enable organization members to identify and contact relevant experts in order to personalize existing knowledge
- to what extent ICT use goes beyond the execution of individual tasks, for instance by storing and retrieving explicit knowledge, by being supportive to personalize tacit knowledge like norms and values held by other groups and within the organization as a whole

In this section we discussed conceptualizations of knowledge and knowledge sharing and the role of ICT. Again, the two types of ICT performance turned out to be helpful to display current approaches, perspectives and research questions.

Conclusions and Discussion

The purpose of this paper was to review literature on the relationship between ICT and knowledge sharing and to furnish theoretical notions of ICT performance in processes of knowledge sharing for empirical research. We addressed the research question: “What notions and relationships have been proposed in the literature regarding ICT use and knowledge sharing?”. In order to reduce the complexity and diversity, we tried to categorize different approaches and perspectives on ICT and knowledge sharing into two portrayals of ICT performance in processes of knowledge sharing, being ICT as guide-type and ICT as facilitator-type. Following the ICT as guide-type, ICT characteristics create ways of knowledge sharing in organizations. Consequently processes of knowledge sharing belonging to this type are hard to imagine without the use of ICT. According to the ICT as facilitator-type of knowledge sharing, ICT use follows and interacts with knowledge sharing routines. Processes of knowledge sharing that belong to this type, can take place

	Types of ICT performance	
	ICT as guide	ICT as facilitator
Approaches to ICT in organizations	Objectivist: ICT characteristics determine effects of ICT use	Subjectivist: usefulness depends on users and context.
Typical research questions	<p>“What opportunities for sharing knowledge are offered by different ICT tools?”</p> <p>“Are ICT design and architecture effective in moulding ways of knowledge sharing?”</p>	<p>“Which requirements have to be met by the ICT tools, looking at the everyday routines of knowledge sharing in organizations”</p> <p>“Are ICT tools effective, vis-à-vis the organizational context”</p>
Approaches to knowledge	Cognitivist approach: accurate representation of pre-defined worlds	Autopoietic approach: produced, context dependent and situation sensitive
Types of knowledge sharing	Storage & retrieval	Exchange & creation
Typical research questions	“Are ICT-tools effective and efficient in transferring knowledge from one place to the other”	“Do ICT-tools offer a platform that enables people to create and share knowledge, within the organizational context and compared to existing knowledge sharing routines”
Strategies for knowledge sharing	Codification strategy: connect people to documents.	Personalization strategy: connect people to people.
Views on tacit and explicit knowledge	Near tangible: separate concepts that can be converted into each other.	Distributed: complementary, interdependent and interrelated.

Figure 3. *Overview and synthesis of approaches, perspectives and research questions on ICT performance in processes of knowledge sharing.*

with or without the help of ICT. By reviewing relevant literature on ICT use and on knowledge sharing in organizations, a wide diversity of notions, approaches and perspectives were uncovered. We developed a synthesis of separated notions into a new framework, by relating these different views to the portrayals of ICT use and knowledge sharing, resulting in a list of typical research questions. With this synthesis of theoretical notions and research questions we have drawn connecting lines within these two bodies of literature (see Figure 1 and 2 respectively) and between them (see Figure 3).

In the section on the impact of ICT in organizations roughly two approaches were discerned, the objectivist approach and the subjectivist approach (see Figure 1). The objectivist approach can be linked to the ICT as guide type as according to this approach the value of ICT performance is assigned objectively and effects of ICT are predicted beforehand. The subjectivist approach represents ICT as facilitator-type as users define characteristics and value of ICT subjectively over time.

In the literature on knowledge and knowledge sharing in organizations two epistemological positions were found. The rationalist and the constructivist position reflect the nature of knowledge and how it is shared (see Figure 2). The rationalist position includes the cognitivist concept of knowledge, the codification strategy on knowledge sharing and the near-tangible view on the relation between tacit and explicit knowledge. This position fits into the ICT as guide-type: ICT enable people to store and retrieve knowledge and to convert tacit into explicit knowledge.

The constructivist position consists of the autopoietic concept of knowledge, the personalization strategy on knowledge sharing and the distributed view on the relation between explicit and tacit knowledge. We categorized the constructivist position into the ICT as facilitator-type.

Synthesis of different perspectives: a research agenda

ICT performance as guide versus as facilitator in processes of knowledge sharing needs to be examined in real life organizations in order to develop detailed understanding of how ICT contributes to the sharing of knowledge. This literature review resulted in a framework of research questions for future study into the role of ICT in processes of knowledge sharing, that take both the ICT as guide and as facilitator type into account.

Research questions formulated from the ICT as guide perspective address issues regarding technological properties, capacity and effectiveness, whereas research questions formulated from the ICT as facilitator perspective address issues of technology adoption and support of existing knowledge sharing routines. Both types of questions are essential in research projects that aim to contribute to our understanding of the role of ICT in processes of knowledge sharing in organizations.

When we look further into the different typical research questions in Figure 3, it becomes obvious that they are all relevant in efforts to obtain empirical evidence on the role of ICT in knowledge sharing processes. Questions do not exclude each other but are complementary. There is no reason to focus on research questions addressed from the one perspective, and neglect research questions addressed from the other, as usually has been done in research. As all questions have some common

ground, results from one question can be helpful to understand results of another. All in all, it would be wise to mix the different research questions in an integrated research program.

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