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TEAM MEMBERS AND KNOWLEDGE SHARING

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Abstract

This study explores issues that help team members to share knowledge in their work environment. In this study knowledge is understood as human action and therefore people as actors are emphasised in the approach. Literature describes knowledge with several concepts and knowledge is classified in versatile ways. In this article knowledge is explored with the help of a case study that opens the conceptual view of knowledge. In the exploration, several models described in prior study are explained. All the models emphasise interaction urge us to investigate how interaction is supported in teams. The empirical case promotes in understanding the theoretical approach and in so doing, it benefits in making evaluations of information technology as a tool of knowledge management. Likewise, the empirical description reveals the real settings where teams might work and thus it points out issues for the future design of information and communication technology, as well.

Keywords

Knowledge sharing, tacit knowledge, explicit knowledge, team work, organisational knowledge

1   INTRODUCTION

This research investigates the concept of knowledge with the help of a case study that realises how knowledge is shared between actors in a team. As knowledge often is discussed with definitions such as data, information and knowledge [9], this research adds more concepts into the discussion. In so doing, the study aims to increase understanding of how knowledge is created, bred and transferred in a small team to be used by other actors but its creators.

As knowledge is described as human-related concepts, e.g. a state of mind or skill or as an object or a process, knowledge is also classified in several ways, of which division into tacit and explicit knowledge is widely accepted [1, 3, 11]. We focus on tacit and explicit knowledge in our study and we explore how these forms of knowledge appear when team members share knowledge in their team. In so doing, we look at three models, namely ba [12], SECI [14] and CIP [16] that emphasise interaction in relation to knowledge creation and knowledge transfer.

Prior literature acknowledges knowledge as one of the key assets of organisations [1, 2, 10]. Therefore, knowledge should be supported and managed with best available tools. However, not all organisations have succeeded in using information and communication technology (ICT) as enabler or supporter in managing knowledge [9]. In this article we also question the usability of ICT in supporting knowledge management. Not all users' contexts are suitable for ICT use [8, 19] and instead of social, cultural, economic or political context the problem may lie in the work tasks that need presence and apprenticeship.

In his article of communities of practice Wenger [22] describes the challenges and singularities of knowledge that consists of competence and experience and their interrelation. He introduces encounters that could lead to increased understanding but that are difficult to explain and to express in words. In his article, communities of practice refer to sharing cultural practices and to reflecting collective learning. In our research the team appeared as a small community of practice. Furthermore, organisations differ from each other concerning their knowledge-intensity as some organisations such as biotechnology companies are seen more knowledge-intensive as others [20]. In our study the case team aimed to offer IT services in the organisation and it needed knowledge management and knowledge sharing it its daily work tasks but knowledge management was not its main priority.

We applied conceptual-theoretical analysis in our qualitative case study [21, 23] added with an experimental research methodology [4] that emphasises an integrated academic-practitioner approach. Content analysis [18] was used to choose and analyse the documents.

2   KNOWLEDGE

From prior literature we read that knowledge is human action, knowledge is an output of thinking, knowledge is created on-site, knowledge belongs to communities, knowledge circulates in communities in several ways, and new knowledge is created on the edge of old knowledge. (e.g. [5, 9, 11]). Thus, knowledge is human related and it is brought into organisations through the workers. Swart and Kinnie [20] use the concept of human capital that includes both tacit and explicit knowledge differing from social capital that refers to knowledge embedded within the organisational relationships and routines. Swart and Kinnie continue by noting how human and social capitals comprise the knowledge and skills of individual employees and the relationships between these employees. They also distinguish practice-based tacit knowledge that is driven by the culture in the organisation and is embedded for example in the application of a software code, that is, knowing the semantic of the comments around the code; and technical tacit knowledge that is embedded in knowing the code generally [20]. Practice-based tacit knowledge and technical tacit knowledge are intertwined and both of them are needed to enable critical skills to be developed in a company.

Knowledge can also be discussed by its levels such as cognitive knowledge, advanced skills, systems understanding and self/motivated creative knowledge. Quinn et al. [17] introduce these levels as "know-what", "know-how", "know-why" and "care-why". Know-what refers to the basic mastery of a discipline that professionals achieve when they train and certify themselves. Know-what is essential but not enough for, for example, commercial success. Know-how refers to the ability to apply the rules of a discipline to complex real-world problems in a professional skill level. Correspondingly, know-why is about deep knowledge of the web of cause-and-effect relationships in a discipline. It enables individuals to solve larger and more complex problems and to prepare for unintended consequences. Finally, care-why refers to skills of will, motivation and adaptability for success. Quinn et al. [17] clarify that besides in the brains of individuals, know-what, know-how and know-why can also exist in the organisation's systems, databases and operating technologies, while care-why might also be found in the organisation's culture.

In the next section we take a look at how knowledge is illustrated in literature. In so doing, we introduce three models, namely ba, SECI and CIP.

2.1   Ba

Ba is a Japanese concept introduced by Nonaka and Konno [12] and Nonaka et al. [13]. According to ba, knowledge necessitates a shared context or space before it can be created. Ba is to be created ever again and it explains the possibilities and predispositions that either inhibit or stimulate functions that produce knowledge [14]. Ba may appear in individuals, in teams or project groups that work together, in informal social contexts, in virtual space or in direct contacts. Ba is an existential space where participants share their contexts and where they create new meanings when they are interacting with each other (see Fig. 1).
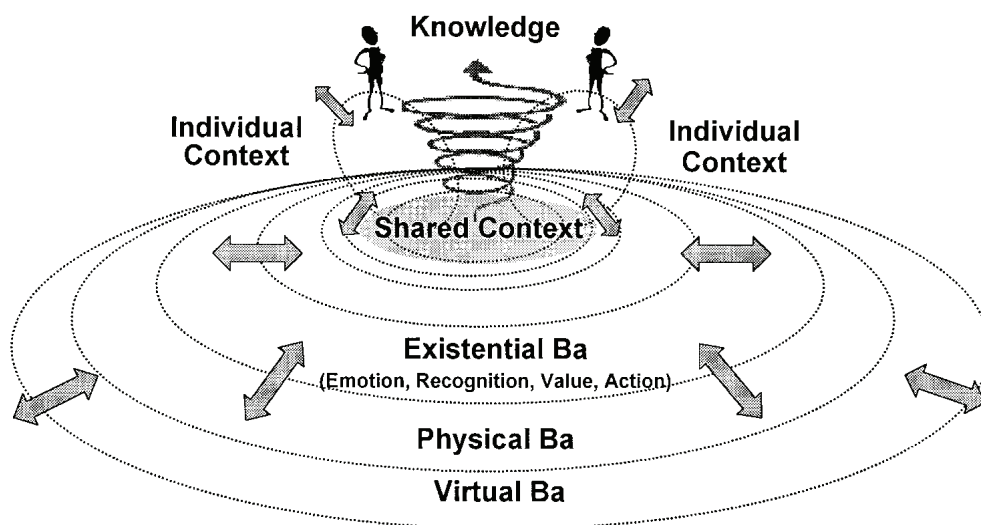

Figure 1. Ba [14], p. 7.

In ba, the supportive mechanisms can be seen as physical ba such as a meeting room; a virtual ba such as email; or an existential ba such as atmosphere or shared experiences. All the different bas together build a platform for the phases of knowledge creation and knowledge sharing. [12, 13]. Figure 1 presents ba as a platform where knowledge evolves from shared context through individual contexts. The arrows pose for interaction between the mechanisms of physical ba, virtual ba and existential ba that take place in the shared space. As seen in the figure, there is a lot of interaction in an active ba and part of that interaction takes place between individuals and the shared context while the rest of interaction happens in the shared environment.

Nonaka and Toyama [15] continue that an active ba necessitates contradictions, several contexts hold by the participants, a joint context and participants that are capable of dialectic thinking and actions that are needed to combine the contradictions. Ba is open and thus it lets all needed contexts in but ba also needs to be protected against other contexts. A good ba enables the actors to scrutinise given problem from different views. In ba, participants with differing backgrounds and approaches may achieve a joint view if they are capable of productive dialog. Thus, the role of interaction is emphasised all the time. In addition to between individuals, the dialog may happen between several organisations and bas.

2.2   SECI

SECI is about knowledge creation and knowledge transfer. It is a process where tacit knowledge and explicit knowledge act dialectic and evolve through four processes, namely socialisation, externalisation, combination and internalisation, see Figure 2 [14, 15].

Socialisation is about sharing experiences. New tacit knowledge is created through shared experiences in a social interaction. For the process of socialisation, it is essential that individuals extend their own existential limits and that they, for example, are able to feel empathy on each others or their customers. Tacit knowledge can be obtained by being together with other people, using the same language, by imitating and practising. Regular communication and observing help to create mental models and routines. [14, 15].

Externalisation is about expressing tacit knowledge as explicit concepts such as metaphors, analogies, hypotheses and models. In the externalisation process, individuals try to share their tacit knowledge with concepts, pictures and written documents. Contradictions between tacit knowledge and surrounding structure or several individuals' tacit knowledge are solved in dialogs. In externalisation, individuals aim to extend their own internal and external limits by committing to the group. The individual intentions and ideas will mix and integrate with the mental world of the group. Externalisation helps people to see a phenomenon in several ways and from opposite approaches. [14, 15].
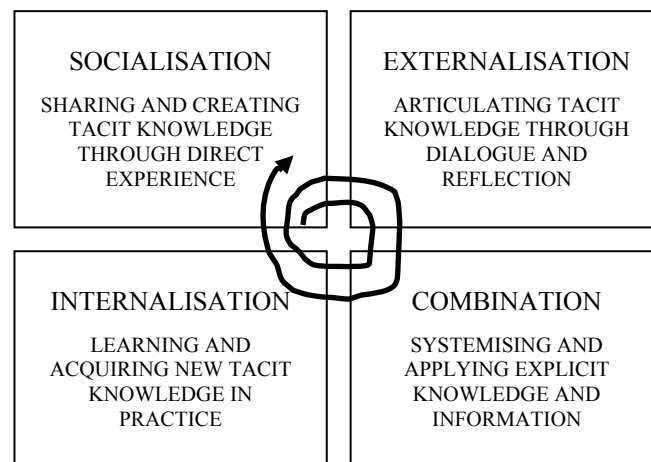

SOCIALISATION	EXTERNALISATION
SHARING AND CREATING TACIT KNOWLEDGE THROUGH DIRECT EXPERIENCE	ARTICULATING TACIT KNOWLEDGE THROUGH DIALOGUE AND REFLECTION
INTERNALISATION	COMBINATION
LEARNING AND ACQUIRING NEW TACIT KNOWLEDGE IN PRACTICE	SYSTEMISING AND APPLYING EXPLICIT KNOWLEDGE AND INFORMATION

Figure 2. SECI [15].

Combination is about organising explicit knowledge into a knowledge system by combining and processing different knowledge sources. In the combination process, explicit knowledge is transferred and delivered with the help of documents, meetings, emails and, for example, phone calls. When knowledge is categorised, it may lead to new knowledge creation. The use of ICT may benefit this knowledge process. The combination process

may also include splitting concepts into parts and thus lead to new systematic explicit knowledge. The contradictions are solved with logic instead of synthesis. [14, 15].

Internalisation is about changing knowledge that has been created and shared in the organisation, into individual tacit knowledge. In the internalisation process, individuals reflect by setting themselves into the context of the newly acquired new knowledge and environment where the new knowledge should be applied. The new knowledge is used in practice and it forms a ground for new routines. Explicit knowledge must be actualised in actions, practice and contemplation to be part of individual tacit knowledge. Thus, the internalisation process reminds learning by doing. . [14, 15].

As pictured in Figure 2, Nonaka and Toyama emphasise that the knowledge creation and transfer form a spiral instead of a circle. In addition, knowledge that is created in the spiral of the four knowledge processes may trigger a new spiral of knowledge creation that expands both horisontally and vertically when it passes through communities in interaction. Thus, the process of knowledge creation may extend the organisational borders.
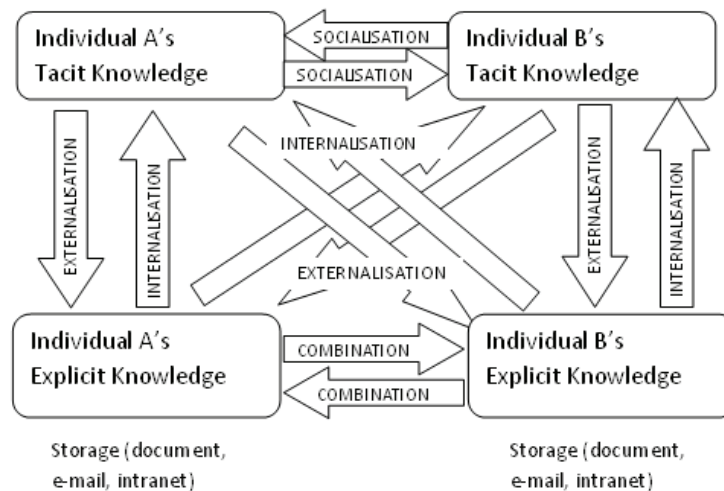

Figure 3. SECI [1], p. 117.

The SECI model was further developed by Alavi and Leidner [1] who aimed to explain how knowledge is transferred between individuals (Figure 3). They pictured the four knowledge processes introduced by Nonaka and Takeuchi [14] between two individuals (A and B in Figure 3) and suggested that the processes of socialisation and combination appear between individuals. To take place, the processes require communication between the individuals. The great number of arrows also express the active interaction that is needed to transfer knowledge. In Figure 3, the explicit knowledge is stored besides in individuals, also in physical storages.

2.3 CIP

Collective information processing (CIP) model describes knowledge creation and transfer in a group [16]. In the model, collective knowledge is created in social interaction. Collective knowledge processing can be defined as the level where information, ideas or cognitive processes have been shared or are shared between the group members and how information sharing between group members influences both individual and group level output [6].

In the CIP model, information and knowledge are analogical. When Propp uses the word information, he wants to emphasise how individual knowledge changes in the group-level communication into part of joint knowledge. According to Propp, communication is fundamental for understanding because information must be coded before the message is sent and again, it must be interpreted when received. When interacting, individuals also consider the interpretations by other participants. Thus, information combines both cognitive and communicative processes [16].

To be functional, a group needs shared joint knowledge and to share knowledge, the members need to interact. By interacting, the group may find a joint knowledge and individual knowledge may be shared with other group members. Propp notes that collective information processing comes up in three phases, namely seeking information; storing and searching information; and assessing and using information.

However, building collective knowledge is not always positive. Some group members may misinterpret the material they are given and others seldom amend the misinterpretations. The misinterpretations may later be accepted as facts. [6]. Information is assessed during its use and according to the assessment; the group decides how the information should be used. [7] On the other hand, interaction in the group may change the assumptions of the members and even of the group about the value and significance of the information [16].

The collective information processing is described with a model of four phases:

1) Individual knowledge basis comes with the individuals who enter the team and their knowledge bases differ in shape and size;

2) Collective group knowledge basis forms when the individual knowledge is conceptually overlapped;

3) Communicated knowledge basis requires interaction and seeking information, browsing and saving it, and assessing and using it and the context where knowledge is used influences the formation of the communicated knowledge basis;

4) Final information database allows the final conception of acquired knowledge with the help of the three earlier phases.

In the collective information process, the irrelevant and insufficient information will be fallen out and at the same time, the remaining information is evaluated [16].

3   THE RESEARCH APPROACH

The empirical material was collected mainly from emails sent in a small team that provided IT support in an organisation. As the research focused on knowledge sharing in the team, only documents shared in the team were included. However, they included emails sent to one member if the member shared the email with other members. In addition, memorandums and other informal notes other than formal organisational protocols were included in the research material because they belonged to the team-based interaction. The final research material included 161 emails sent to the team, 419 emails sent to a member in the team and 1153 documents in the intranet. In addition, two paper document files were examined.

In the content analysis [18], the documents were first sorted out keeping in mind the ways of transfer and store knowledge that formed a salient part of the team's functions. Those chosen documents were read several times in the analysis. An overall picture was formed and after that, themes were searched from the material. After that, typical incidents were identified and special cases were separated that illustrated knowledge sharing in the team.

The theoretical background was used when examining the research material. Both in the SECI model [14] and CIP model [16] interaction is emphasised when transferring knowledge. Therefore, the material was examined keeping in mind interaction that is used in creating and transferring knowledge in groups.

In addition, the material was analysed with the aim to find factors that would support or impede knowledge transfer. Especially informal ways of transfer knowledge were searched in the material. Furthermore, an interesting issue was to find out how the information about context was stored or was it transferred at all.

4   THE CASE OF IT SUPPORT TEAM

The main task of the team was to offer IT support in the organisation. Along with time, the need to store, share, find and transfer team-based knowledge had become ever more significant. The amount of emails and supported tasks had increased since 2000 and the importance to transfer knowledge was emphasised to enable new team members to get familiar with the functions in the team. The team transferred knowledge in several ways. In the team, information was transferred orally in phone, in meetings and in encounters in the corridors and coffee table. Along with the increased visits to their customers, the team had less time to meet each other face-to-face. Therefore, the written memorandums and notes that were stored in the team's joint database or in paper files

were perceived important. The memorandums and notes were about solving problems and incidents that some member figured out and reported to be used by the others.

Often the state of tasks-to-do was checked in the joint emails. Every member also collected knowledge in their own email accounts, into the workstations or in their heads about what they had done and how they had managed the problems. When stored, the documents and emails served in transferring knowledge from one member to others and at the same time, they supported in remembering the issues. Thus, ICT was needed as a tool.

However, knowledge had to be found and transferred from one member to another ever more systematic and quicker. Likewise, ever more important was to store knowledge about different happenings and situations. Unlike before, there was no more time to transfer knowledge face-to-face or immediately after the actions. Nor was there any systematic way to document the individual incidents to others. Therefore, there were occasions when some issue was taken care twice and some issues remained long waiting to be catered at all. In addition, it required time to find out if somebody already had taken care of the scheduled issues or what was the state of the problem. There were even situations when there was knowledge but the knowledge was not found. One member wrote:

> *"Yes, I had written a note of it and uploaded it into the file but I didn't find it any more ..."*

Due to the perceived workload the members sometimes expressed their uncertainty about work tasks and tried to get support from peers:

> *"Did it pass? I was thinking as it was in the file for Executed... I don't remember how we figured it ... We might have talked about removing it".*

The information was sometimes stored in two different media as expressed in an email:

> *"... Here's something to solve out for tomorrow. I'll add information into the files, too, so we'll remember to look at it."*

Every now and then the stored documents were updated if some member had gained new knowledge in service:

> *"... It's important to first press 'Test connection' and then continue. If it does not work as Student you need to repeat it as Admin and then try again as Student ..."*

This document also reveals that the externalisation process (see SECI, [14]) had taken place because tacit knowledge was made explicit so that it was possible to share it in the mode of concepts, pictures or written documents to others to be used as a basis for new knowledge.

Pictures were needed especially in cases when it was difficult to explain the situation or when using pictures was more helpful in future actions. Figure 4 represents how simple print screen was stored in the team's database to benefit the subsequent tasks when the same procedure had to be repeated maybe with other workstations or similar situations. At the same time, Figure 4 reminds the need to have such tools that accept several formats in the database. Furthermore, Figure 4 illustrates a situation where interaction was not enough to transfer knowledge.
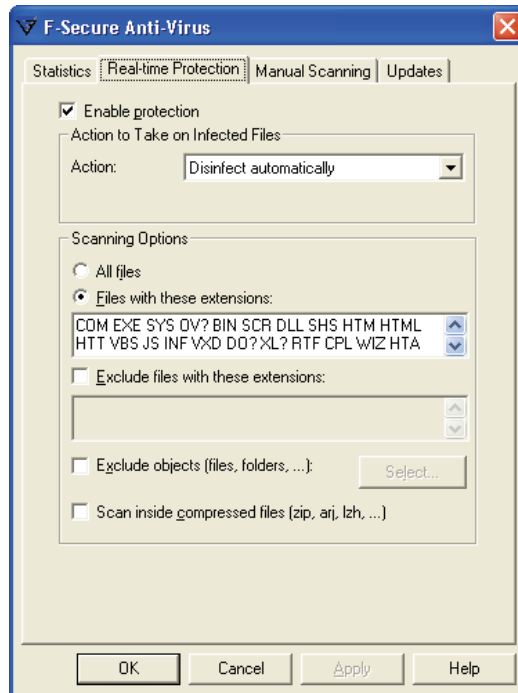
Figure 4. Illustration to support shared knowledge base.

Likewise, the team had discovered that in one screen they could add a lot of information about the context when an incident took place. Figure 5 illustrated how several dialogs were open on the desktop and the information about updating an antivirus software was stored in one document.
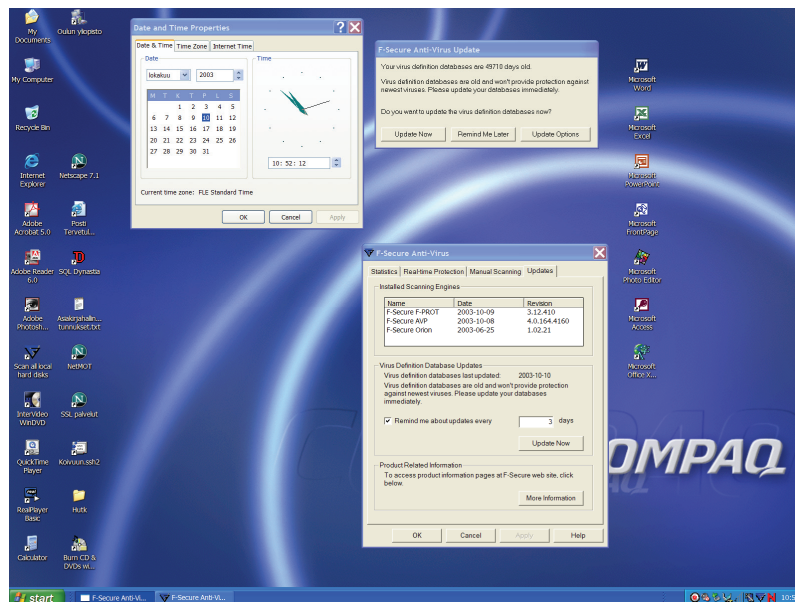

Figure 5. Desktop describing the context.

The team members had agreed to support each other as much as possible and this agreement was realised for example in commands that had to figured out when doing every-day support. The commands were also stored in the joint database to be used whenever needed. Despite the context-specific nature of the commands, the members were satisfied to get commands such as *"\\Vakka\SYS\Client\cli491sp2_2000_xp\setupnw.exe /acu"* ready-written as it speeded their working. Besides storing the ready-made commands, it was necessary to inform others when the learning had taken place. Therefore, additional information was included in the documents about

the context where the information belonged to: "*(this guide is made when transferring Eudora 5.1 -> 6.0.1.1 / RHH 22.1.2004)*". With these additional notes the members tried to transfer the context to be used later.

Sometimes the team received new members who were either trainees or substitutes. Naturally, they were not able to share the same knowledge base as the designated team members had. Therefore, the team members tried to transfer their knowledge with several means such as orally, by writing or with pictures.

"Will you please check also the team's joint email! The guidelines are in the document I left you – or in the shared disk."
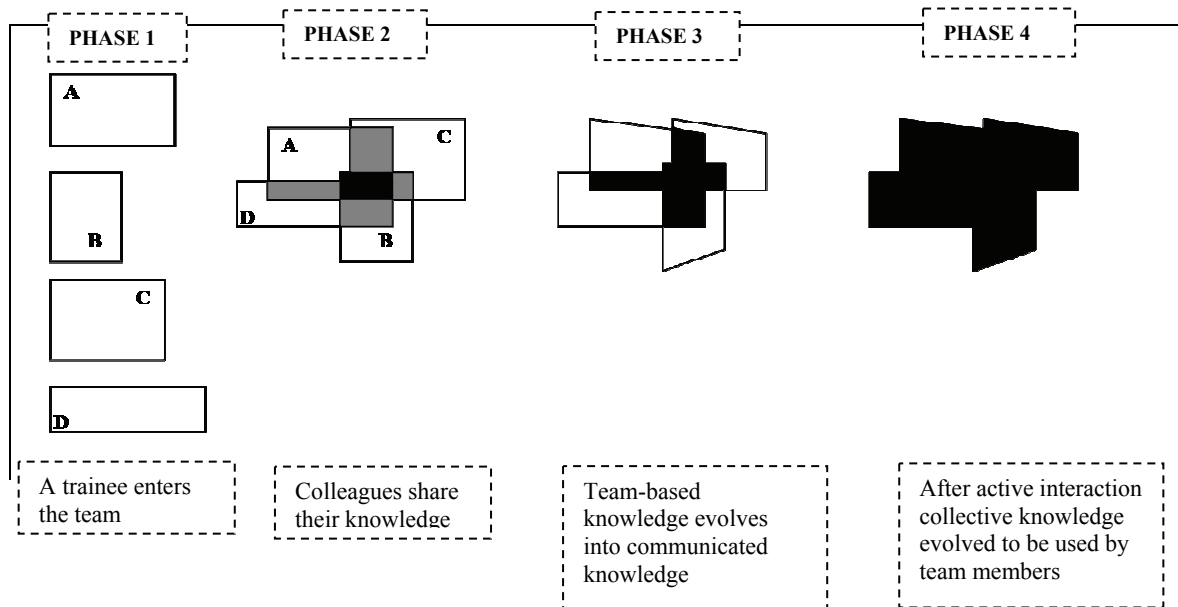

Figure 6. Collective knowledge creation with the CIP [16].

The CIP model [16] illustrates (Fig. 6) how team-based knowledge was created in situations when new members entered the group. In the first phase, the members have their individual knowledge that has been created in their previous work places or works tasks. Then, the team interacts and discusses the current task. In an active interaction the knowledge evolves into a shared knowledge base and its origin is no more identified. In the last phase, the new member is able to act as other team members and all of them are building a shared knowledge base.

5   CONCLUSIVE WORDS

As described in the empirical case, knowledge management is essential also in contexts when it is not the target of business. The case also showed that in a productive team the members tend to support each other and thus facilitate all the work in the whole team. Because some tasks were repeated or they had to be modified only some, it was reasonable to store knowledge instead of always creating knowledge starting from a clean table.

In addition, due to occasional changes in the membership, it was relevant to store knowledge actively and to share it quickly after knowledge was created. Along with the increased hustles the amount of face-to-face meetings were decreased. That was one reason why it was necessary to store knowledge quickly and in a mode that it would be quickly retrieved and found. The team also experienced situations when the existing knowledge was not found when it was needed. Therefore, new tools to support knowledge storing and knowledge transfer were needed.

In reality, not all knowledge can be stored. Instead, it can only be transferred directly between human beings. Specially, this happens when presence and actions are needed. In other words, creating knowledge is also about learning by doing as Nonaka and Takeuchi note. [14] Because knowledge is so important, organisations should provide possibilities to both store knowledge to be used later and to have face-to-face meetings especially in situations when knowledge can not be stored or transferred with the available tools.

The case also verifies how knowledge consists of competence and experience [22]. The team members had gained experience when working together in the team for several years. The work tasks had changed along with new technology being obtained in the organisation. The knowledge in the team was extensive and the level of knowledge may be evaluated to be "know-how" [17] as they had learned to know what and had gained experience to have knowledge about complex problems in their working context. Thus, we emphasise that the levels of knowledge as Quinn expresses them is dependent on the context the knowledge belongs to.

All in all, one can conclude that the team was able to find ways to transfer knowledge. The ways depended on current situations – for example, if a member was aware that a colleague would be present soon, the message could be left on a screen (see Fig. 5) as ICT enabled that kind of knowledge transfer. In case the workstation was not available at the moment, the message had to be stored in a document that was created with the same equipment, as well. Thus, we may note that the same hardware could be used in several ways when transferring knowledge in the team. In addition, it is notable that current technology made it possible to have print screens stored in files and thus transferred from one location to another even if the hardware itself was located elsewhere.

Finally, M.Sc. Elisa Laukkanen is warmly acknowledged for her contribution in the research.

6   IMPLICATIONS FOR FUTURE DESIGN OF ICT'S

Prior literature reveals that knowledge needs an environment to be created and developed (see ba, [12]). In our case, the environment was a small team that had developed its own ways to work, to gain knowledge and to share and store it. Furthermore, in our case we could identify that much of the gained knowledge had needed other members' presence to be shared. We find this situation very challenging from the ICT's point of view as one characteristic of ICT is that it looses from locality or time-dependent settings (see [8, 19]).

As significant knowledge – both explicit and tacit - may stay hidden in individuals or small teams in organisations, it would be worth studying how these lairs are found and connected with the organisational knowledge base.

Prior literature has also revealed that explicit knowledge can be stored as any other digitalised information. However, tacit knowledge is not easily, if not all, digitalised. We suggest that designers take a close look at their plans by keeping in mind that despite the shortages of information systems people tend to add or "glue" their tacit knowledge into the knowledge management systems. In our case, the team members tried to avoid the deficiencies in formal tools by adding small notepads or using different colours and layouts in the documents to wake other members' attention.

7   DIRECTIONS FOR FUTURE RESEARCH

Our empirical case introduced a small team that offered IT services in the organisation it was part of. Thus, the core function of the team was not to foster knowledge but to serve other people who worked in the organisation. However, the role of knowledge was essential as the service was highly knowledge dependent and especially sharing knowledge was perceived important by the team members as they thought that all of them had to be able to act whenever they were needed.

Therefore, we want to highlight the importance to understand the importance of knowledge management as a supportive necessity in the organisation to keep the functions in action. In practice, the responsible people in the organisation should enable the actors to foster and develop knowledge environment by giving possibilities and resources. In our case, the team perceived that they had problems with knowledge management as they did not have as much time to meet each other face-to-face as they felt they needed. This is a challenge that the responsible people may response.

We also believe that the environment (see ba, [12]) is important. In an active ba knowledge is created and communicated to be used for the good of the organisation. Not even in small teams should knowledge be lost and with different tools knowledge should be made available to the surrounding organisation, as well.

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