ORGANIZATIONAL MEMORY SYSTEMS AS A SOURCE OF LEARNING
FOR NEW EMPLOYEES IN AN INNOVATION CONTEXT

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Abstract

Organizational memory is said to be one of the essential factors of organizational learning, particularly in a part that is concerned with knowledge flowing from an organization to its employees. Often viewed as a system of knowledge repositories, organizational memory is argued to be important in various contexts. The purpose of this study is to explore an impact of the organizational memory in two such contexts, namely in a situation of presence of new employees and organization involved in innovation activity. The importance of organizational memory for the new employees can be explained by the fact that it is through facing it they socialize in the organization. Organizational memory also influences innovative behaviour of employees.

This researched is performed in a form of a case study: where the object of study finds itself in a combined context – new employees of R&D department learn from different organizational memory systems. The data for this case study were collected through qualitative interviewing of both the newcomers and their supervisor.

The results show that new employees face a range of memory systems, and this range does not depend on the innovativeness of the work they are involved in. It was found possible to look separately into the systems and methods the newcomers accessed them. The most important access methods in this case turned out to be personal communication and IT-enabled means, however a number of other methods were also found relevant for the case.

Focusing on how this knowledge can support innovative behaviour of the new employees, this study has found several ways in which both incremental and radical innovations can be enhanced. The memory systems have been found to affect innovative behaviour of the newcomers by demonstrating expectance of this behaviour, by providing “old” knowledge, as well as hints where one can possibly find “old” and “new” knowledge.

In general, the findings suggest that looking into memory systems separately from the ways to access them might give valuable insights for rethinking how properties of the memory systems have been defined so far.

Keywords: organizational memory, knowledge repositories, new employees, innovation, case study
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1. Introduction

1.1 Problem background

Both academic and managerial literature widely recognizes organizational learning as an important pre-requisite of organization’s survival and successful performance, especially in environment that is complex and ambiguous (Lant & Montgomery, 1987), turbulent (Carmeli & Sheaffer, 2008), as well as competitive (Garvin, 1993). It is through learning firms obtain opportunity to multiply the scope of their strategic choices, create and sustain unique capabilities and core competences (Kang & Snell, 2009). Organizational learning includes processes of creating or acquiring knowledge, its sharing and integration into group and organizational context (Crossan, Maurer & White, 2011; Argote & Miron-Spektor, 2011). Through these processes knowledge flows between individuals, groups and organization itself; and there are two possible directions of this flow: from an individual to an organization and from organization to individual (Crossan, Lane & White, 1999). The first direction implies transmitting the learning and its outcomes from an individual level to the organizational one, which creates new knowledge for the organization (so-called “feed forward”). The second direction means disseminating organization’s “old” knowledge to individuals (so-called “feedback”).

Crossan, Lane and White (1999) note that although there might be a strong temptation to associate organizational learning with the “feed-forward” process, the “feedback” one is as important, since it enables organization to exploit results of its previous learning. This brings up an importance of accumulating knowledge in organizations (ibid), for which a term of “organizational memory” is often used. The existing literature provides different perspectives on the essence of organizational memory. Lehner and Maier (2000) refer to two metaphors: organizational memory as a “machine” that stores data and as an “organism” that not only keeps knowledge in memory, but can also reflect on it, or forget it. Wexler (2002) mentions four models of organizational memory, with each of them focusing on a specific dimension of collective memory. For example, the “storage bin” model emphasises such aspects as where the knowledge is stored and how it will be retrieved in future. This perspective is rather widespread (c.f. Ungson & Walsh, 1991; Argote, 1999; Olivera, 2000; Huber, 2001; Wilson, Goodman & Cronin, 2007) and defines organizational memory as “means by which organizations store knowledge for future use” (Olivera, 2000, p. 813).

The “old” knowledge stored in organizational memory defines emergence and scope of organizational learning (Lehner & Maier, 2000; Huber, 1991). It is through organizational memory experience of the past can guide organization’s present (Sutton, 2001). Thus, knowledge obtained by people from their experiences in organization is seen as a valuable asset which organization should strive to retain (Kransdorff & Williams, 2003). In fact, the need to capture individual knowledge and benefit from it in spite of turnover was realized as far as in the beginning of the XXs century (Argote, 1999). The scientific management movement, for instance, suggested to “seize” employees’ experience through reporting systems, and to put the knowledge into action by documenting rules and codes (ibid).

Actuality of organizational memory in relation to turnover is still high today. A study of Rusaw (2005) demonstrates how losing knowledgeable employees due to turnover can negatively affect organization’s problem solving capacity. However, a developed organizational memory is believed to moderate negative effects of turnover on organization’s performance (Argote, 1999; Olivera, 2000). Other benefits of organizational memory include improved learning capabilities (Wexler, 2002); access to previous experiential knowledge which makes it possible to re-apply proven solutions and to avoid past mistakes (Kransdorff & Williams, 2000); accumulation and storage of the “best practices”, which can be integrated, analysed and adapted to other situations (Nilakanta, Miller & Zhu, 2006). Organizational memory can even be used for purposes of coordination and organizational reconstruction (Yates, 1989 and Campbell-Kelly, 1996, as cited in Olivera, 2000).
1.2 Problem discussion

The literature demonstrates different types of the “places” where knowledge in organization can be stored, so called organizational memory systems\(^1\) such as employees, electronic databases, organizational culture, technology, etc. (Argote, 1999; Ramanujam & Goodman, 2011 and others). Argote (1999) has noted that while some authors accept that individuals can be these repositories, others argue that the main criterion of organizational memory is its independence on individuals. In a discussion what characteristics distinguish “true” organizational memory systems Olivera (2000) raises an issue of access to these systems; which, however, was neither supported nor developed in the following research.

Among the contexts in which organizational memory is involved, two are especially interesting for a scientific research. The first context is related to employees facing the organizational memory and retrieving knowledge from it. Although knowledge can be captured on organizational level, it is people who actually learn, and further search, access, select and use the stored knowledge (Ungson & Walsh, 1991; Hatch & Dyer, 2004; Cacciatori, 2008). Thus, people are important actors in processes related to organizational memory. When these people are new in a company, they have to face organizational memory not just to obtain some old knowledge which they might have stored before (e.g. as it is described in Markus (2001)). On the contrary, the main goal is that they would be able to socialize in the company through learning its “old” knowledge (Wexler, 2002; Ashforth, Sluss & Saks, 2007).

The second context where influence of organizational memory is important deals with organization involved in innovative activities. Some authors argue that having accumulated “old” knowledge will improve company’s ability to realize value of external knowledge (Cohen & Levinthal 1990; Adams, Bessant & Phelps, 2006); and that systems that capture, store and organize knowledge will have a positive impact on performance of innovation projects (Lynn, Reilly & Akgün, 2000). Others note that over-reliance on the “old” and “local” knowledge limits organization’s ability to search for “new” and “external” knowledge that is necessary for successful innovation (Miller, Fern & Cardinal, 2007). Chang and Cho (2008) suggest that the lack of conformity on effect of organization’s memory on its innovative efforts can be explained by the fact that the researchers tend to generalize the effect of a single type of organizational memory to all the types. Moreover, these authors suggest that innovative nature of the researched projects is often disregarded in studies.

1.3 Purpose and Research questions

Taking in consideration all said above, the purpose of this study is to explore usage of organizational memory in two contexts: new employees and organization involved in innovative activities. For this, a combined situation is studied. Special attention is to be paid to methods of accessing the memory systems. In a part related to innovation, the effects of the memory systems are considered in relation to the behaviour of the new employees that has a potential to contribute to organization’s innovation\(^2\). Moreover, due to general interest to success factors, I focus only on those effects that are positive for innovation and will not consider negative effects. However, the main focus of this study is to be on the organizational memory; thus, the new employees and innovative activity are seen as contexts in which different issues related to the organizational memory expose themselves. Therefore, it is the topic of organizational memory that gets the deepest elaboration.

The Research questions are formulated as follows:

1. What memory systems do new employees face and

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\(^1\) The literature provides a range of other terms, such as “storage bins” or “repositories” of organizational memory or knowledge. This work will mainly rely on the term “memory systems”, with eventually using “repositories” as a synonym.

\(^2\) This behaviour is discussed in detail in part 2.3.2 Effects of organizational memory on innovation behaviour of its members.
2. How do they obtain knowledge from these systems?
3. How do the memory systems they face support individual behaviour of the new employees in relation to innovation?

The work will be structured in the following way. First, I will present the Theoretical framework main part of which is based on the literature on organizational memory types. Implications of organizational memory in contexts of innovation and presence of new employees will be discussed in respective subsections of the Theoretical framework. The Method part will present the choice of research strategy and description how the data were collected. The Empirical part will present the case background and answer to the Research question 1, while the Discussion part covers Research questions 2 and 3. Finally, conclusions will be made, and directions of future research will be proposed, along with managerial implications.

2. Theoretical framework

This section starts with a description of characteristics that are relevant for all the memory systems, which is followed by existing typologies of the organizational memory systems. It is necessary to explain the characteristics in the first place, since the later discussion on particular types of organizational memory systems will refer to them. Finally, as the research questions deal with innovation aspect and new employees, special subsections will be dedicated to these topics.

2.1 Organizational memory

The knowledge created in organization should be stored somewhere in order for the learning process to continue over time (Ramanujam & Goodman, 2011). Ungson and Walsh (1991), for instance, argue that the content of the organizational memory is composed of information about previously made decisions and solved problems. The "means by which organizations store knowledge for future use" is often referred to as organizational memory (Olivera, 2000, p. 813). Examples of the organizational memory systems are personal memory of organization's members, their roles and tasks, electronic databases, technology, organizational culture3, etc.

2.1.1 Characteristics of the memory systems

Olivera (2000) proposes to define memory systems by using three characteristics: the systems' content, structure and operating processes. The content refers to the type of knowledge the system is capable to capture. The structure deals with the organization of the knowledge location. Finally, the operating processes include those by which the knowledge is collected, maintained and retrieved (ibid).

2.1.1.1 Content

In relation to the memory systems, knowledge is often considered from a perspective of its tacitness/explicitness (c.f. Wilson, Goodman & Cronin, 2007). While explicit knowledge can be easily expressed and thus codified, the tacit one – due to its intuitive nature – is hard to formulate and formalize (Argote & Ingram, 2000; Gourlay, 2006). Tacit knowledge can still become explicit through a process of codification – i.e. expressing the knowledge in either words or texts, charts, pictures, special codes, etc. (Schulz, 2001). Codification does not only help shape knowledge in words, but it also enables to separate knowledge from a situational and local context and to make it applicable in other situations and by other units of organization (ibid).

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3 The types of the memory systems will be discussed in detail in the chapter 2.1.2 Typology of organizational memory systems.
2.1.1.2 Structure

Olivera (2000) describes two basic characteristics of the structure of memory systems, namely: where knowledge is located and how it can be indicated. According to him, the location can be viewed as either centralized or dispersed. In the first case knowledge is “placed” to a single location which is available to anybody in the organization; while in the second case it is spread to several locations, and access to these locations varies by certain people or groups.

Indexing can be considered as a tool used by both knowledge contributors and knowledge seekers. Wilson, Goodman and Cronin (2007) state that the way the indexation is performed has implications for where the knowledge will be stored and how it will be retrieved in future. Olivera (2000) emphasizes that a system of indicators helps the knowledge seekers to map where the knowledge can possibly be located.

2.1.1.3 Operating processes

Filtering and maintenance of the knowledge stored in the memory system are the factors that to a large extent influence how this knowledge will be retrieved (Wilson, Goodman & Cronin, 2007). The goal of the filtering is to eliminate – before the storing - information which will possibly not be used. The maintenance of the storage systems is aimed to update and replace the knowledge (Ramanujam & Goodman, 2011). As regards the knowledge access, Olivera (2000) exemplifies it with access being done either through people or through computer technologies.

2.1.2 Typology of organizational memory systems

Table 1 presents a summary of typologies of the memory systems found in the literature. It is worth mentioning that the studies put together in this framework used different terms for their classifications, e.g. storage bins (Ungson & Walsh, 1991), knowledge repositories (Wilson, Goodman & Cronin, 2007), memory systems (Argote, 1999; Olivera, 2000). For instance, Olivera (2000) finds a difference between concepts of storage bins and memory systems. According to him, the memory systems are designed for purposeful knowledge storing and retrieval, contrary to the storage bins. He also argues that the memory systems are presented by real entities individuals can interact with. In addition, the concept of storage bins does not consider information technology as a form of organizational memory (ibid).

Table 1: Memory systems in organizations

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<td>Members</td>
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<td>Organizational level</td>
<td>Artificial systems</td>
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<td>Archives, databases</td>
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<td>Structural repositories</td>
<td>Culture, structures, procedures</td>
<td>Roles and routines</td>
<td>Tasks; sub-networks of people, tasks and tools</td>
<td>Social networks</td>
<td>Structural storage repositories</td>
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<td></td>
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Being aware of possible conceptual differences, I still find it possible to unite different typologies for the theoretical framework in this particular research, addressing them as either “memory systems” or
“memory/ knowledge repositories”. The rationale behind this choice is that I would like to form a comprehensive theoretical framework that would cover all the possible knowledge repositories within organization. Moreover, the differences addressed by Olivera (2000) are out of the focus of this study4.

As it can be seen from Table 1, the yet existing literature tends to distinguish two levels of organizational memory where the knowledge can be stored, namely level of individuals and level of organization as a whole. Crossan, Lane and White (1999) suggest that it is young organizations that tend to rely mostly on the knowledge stored in individuals, and as the organizations mature they need systems to capture individual knowledge on a higher level. According to Argote (1999), knowledge embedded on the organizational level is more persistent and protected from forgetting. In addition, it is more appropriate for transfer to other units and tasks, since sharing of this knowledge for every certain task does not depend on the will of single individuals. However, even in case of the knowledge being embedded into organization's systems, it still originates from individuals; therefore, an organization has to rely on the individuals in sharing this knowledge with various memory systems. In this connection, Huber (2001) argues that what knowledge is shared with the systems and how it is done is often out of organization's control. Sometimes individuals do not realize importance of their knowledge for the organization. Besides, it is often the case that roles of individuals in the organization do not cover knowledge sharing (Bock, Sabherwal & Qian, 2008). According to Huber (2001), these two barriers explain why individuals might not be contributing to the system in a way they could have done.

2.1.2.1 People as knowledge repositories

Individual memory keeps knowledge acquired through people's direct experience and observations (Ungson & Walsh, 1991). This system allows preserving rather complex, sophisticated and tacit knowledge; however the amount of knowledge possible to store is limited by psychological and physiological factors (Argote, 1999; Wilson, Goodman & Cronin, 2007). Knowledge stored in individuals will be transferred through personal communication in future (Huber, 2001). Huber (2001) emphasizes that extensive communication might be required due to difficulty to codify the individual knowledge; while Argote (1999), on the contrary, proposes that such knowledge might be effectively transferred even without making it explicit - through application it to a new task.

Ungson and Walsh (1991) state that if an organization relies on the memory of its members as a repository system; length of service in the organization becomes a particularly important employee’s attribute. In order for other members to be able to retrieve this knowledge, the organization should create links to its "old-timers" (ibid).

At the same time, knowledge embedded in individual memory has several significant disadvantages. According to Argote (1999), it tends to depreciate faster than the one kept in other systems. Turnover makes it possible to lose the knowledge stored in personnel's memory (Argote, 1999). Moreover, individual unwillingness to share makes it dangerous to rely solely on these memory systems. Finally, inability to transfer profound knowledge to large amount of people is another shortcoming of individual memory as a storage system. Considering all these disadvantages, it makes sense for an organization to combine individuals' memory with other storage systems (Argote, 1999).

2.1.2.2 Artificial memory systems

Knowledge can be stored in artificial constructs that enable individuals to “contribute their knowledge and reuse prior knowledge” (Bock, Sabherwal & Qian, 2008, p. 536); which is believed to support organizational learning (Kane & Alavi, 2007). These systems make it possible for an organization to collect large amounts of information, with the latter, however, covering mostly explicit, easily codified, and concrete and less complex knowledge (Huber, 2001; Wilson, Goodman & Cronin, 2007). With computer technology development, these systems can take numerous forms, such as various electronic databases, project web-sites, and shared whiteboards, etc. (Bock, Sabherwal & Qian, 2008). Moreover, beyond storing, such systems might provide a broad range of functions, e.g. knowledge

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4 However, some of his considerations have implications for the analysis; which will be discussed in the respective chapter.
systematization and dissemination, organizing communication and even recording interactions (Olivera, 2000; Huber, 2001; Kankanhalli, Tan & Wei, 2005).

In general, the artificial systems separate contributors of knowledge from knowledge seekers, thus redistributing power in the relationships within organization; which, in turn, eliminates the ability of the contributors to benefit from the knowledge exchange (Bock, Sabherwal & Qian, 2008).

A range of factors have been found of importance in relation to efficiency of these systems usage. From a perspective of users’ satisfaction, easy search and valuable results play a role (Bock, Sabherwal & Qian, 2008). Kankanhalli, Tan and Wei (2005) discuss implications of the task nature for the intensity of the systems’ usage; with these characteristics being task tacitness (i.e. a degree of its reliance on tacit knowledge) and interdependence. Since the artificial systems are better suited for holding explicit knowledge, low task tacitness may stimulate the users to address these systems more often than in case of high tacitness. People also tend to rely more on the artificial systems when task interdependence is high and they need to obtain knowledge created by their co-workers (ibid). As regards suitability of a particular artificial system for a company's situation, Kane and Alavi (2007) suggest that level of turnover and environmental turbulence should define characteristics of this system.

According to Cacciatori (2008), the IT-based memory systems are usually looked at from a perspective of the benefits they provide for an organization by extending human memory. Kane and Alavi (2007) mention a positive effect of these systems on eliminating negative consequences of turnover. However, these systems are not without shortcomings; for instance, Kwan and Balasubramanian (2003) mention increased workload in relation to sharing knowledge with the system and the fact that such systems are primarily designed on storing some content without information about its context.

All said above is relevant for every type of the artificial memory systems. At the same time, one distinct type is worth to be discussed separately. Huber (2001) and Olivera (2000) mention “people finder” systems - that help to link individuals looking for particular knowledge to those who possess it. Olivera (2000) further specifies that the knowledge in question is experiential; which makes an individual a unique possessor of it. Therefore, the “final destination” of the seekers is individual knowledge, while the system providing a means to locate the actual knowledge repository.

2.1.2.3 Structural repositories

So-called structural repositories that represent rules, practices, culture (Ramanujam & Goodman, 2011), etc. make it possible to store both explicit and tacit knowledge, as well as complex information (Wilson, Goodman & Cronin, 2007). Argote (1999) gives an example of research of Grusky (1961) who concluded that managerial turnover in firms that relied on written rules and formal hierarchies was less devastating than in the firms that did not. Thus, the way of organizing other repositories moderates the effects of turnover on knowledge retaining.

2.1.2.3.1 Culture

Culture is defined as “a learned way of perceiving, thinking, and feeling about problems that is transmitted in the members of organization” (Schein, 1984, as cited in Ungson & Walsh, 1991, p. 63). It is characterised as informal, contextual and unofficial and therefore is hard to capture (Schall, 1983, as cited in Holton, 1996). Based on organization’s past experience, culture is situated in collective structures (Lehner & Maier, 2000), though transmitted through interactions with individuals (Ungson & Walsh, 1991; Holton, 1996). Culture can express itself through commonly shared language, conceptual framework, myths etc. (Ungson & Walsh, 1991). It can also manifest itself in people’s understanding of “how things are done around here” (Levitt & March, 1988).

2.1.2.3.2 Roles and tasks

Ungson and Walsh (1991) suggest that roles which are in fact particular types of behaviour expected from the organization’s members provide a link between organizational and individual memory. A system of roles within organization is said to reflect how tasks and control are differentiated within
the organization (ibid). Individual tasks as well as their sequences are also argued to represent a repository for organizational memory (Argote & Ingram, 2000).

2.1.2.3.3 Procedures and routines

Ungson and Walsh (1991) state that “transformations” of what an organization has as inputs into outputs have organizational knowledge embedded into them. These “transformations” include a wide range of procedures and systems, e.g. the administrative ones (ibid). Routines are defined as interconnected actions performed by more than a single actor (Feldman, 2000; Howard-Grenville, 2005). According to Argote (1999), knowledge that can be saved in routines is knowledge obtained through learning-by-doing. These systems hold knowledge that is apt to both depreciation and change (ibid). Rules, procedures and routines are preserved in organizations through systems of socialization and control (Levitt & March, 1988).

Although containing supra-individual memory, routines are still dependent on individuals performing them (Feldman, 2000). Organization’s members chose themselves which aspect of a routine to perform in a given period of time (Howard-Grenville, 2005). Every single activation of a routine is connected with other structures, such as culture, technology, etc. (ibid)

2.1.2.3.4 Subnetworks of people, tasks and tools

Argote and Ingram (2000) give examples of three subnetworks that contain organizational memory. The task–tool network keeps information about suitability of certain tools for certain tasks; and the member-task-tool network holds knowledge about which members are better in performing which tasks with which tools. The third and fourth subnetworks discussed by these authors, namely the member-task and member-tool ones which are also referred as transactive memory, has drawn a lot of scientific attention.

The essence of the transactive memory systems (TMS) is defined as referring to other people as to “external memory aids” (Hollingshead & Brandon, 2003, p. 608). Argote (1999) suggests that in case of the TMS knowledge is stored in social structures. While performing tasks members acquire knowledge “about who is good at what, how to coordinate and communicate effectively, and about whom to trust” (Argote, 1999, p. 83). Having this knowledge will later enable individuals to access the knowledge broader than their own and highly specialized expertise (Lehner & Maier, 2000). In some studies it is particularly stressed that TMS contain knowledge shared by all the members of a certain group working together (c.f. Moreland & Myaskovsky, 2000; Gino, Argote, Miron-Spektor & Todorova, 2010; Lewis & Herndon, 2011).

A perspective of social networks discussed in some studies can be applied to TMS. For instance, Borgatti and Cross (2003) argue that an actual decision to contact a certain person in order to obtain certain knowledge is influenced by relationships between the knowledge-seeker and other people who might form his or her opinion about value of the knowledge possessed by the focal person. Olivera (2000) notes that the organizational knowledge can be efficiently stored in the networks of people, and it is possible to obtain knowledge not only from own contacts but also from contacts of the contacts.

2.1.2.4 Technology as knowledge repository

Organizations are capable to retain its knowledge in technology and to transfer it between units and to other organizations (Hargadon & Sutton, 1997; Argote & Miron-Spektor, 2011). Technology of an organization includes hardware and software components; with the former taking a form of physical object, and the latter being an information basis for it (Argote & Ingram, 2000; Rogers, 2003).

Technology as a memory repository is considered to be especially good for capturing explicit (codified) knowledge (Argote, 1999). It prevents knowledge from fast depreciation and forgetting. Transferring of this knowledge is especially effective when complemented by movement of some individuals (ibid). However, the knowledge embedded in technology is not that flexible to changes, but is still apt to depreciation (ibid).
2.2 New employees and organizational memory

Entering a company, new employees undergo a process of organizational socialization which implies adjustment to their tasks, groups and to organization as a whole (Haueter, Macan & Winter, 2003). Degree of their adjustment increases as they obtain knowledge from the organization and as they pick up behaviour patterns that are expected from them in the organization (Jokisaari & Nurmi, 2009). Thus, learning is an essential process for people at a point they enter organization; since it is by learning they will integrate into organization; which in turn enables them to perform their job successfully (Ashforth, Sluss & Saks, 2007).

The yet existing research has found several domains which newcomers should learn about in order to integrate successfully in a company: company's values, norms and culture (Holton, 1996); people in the organization and especially own supervisor (Holt, 1996; Jokisaari & Nurmi, 2009); history (Chao et al., 1994, as cited in Klein, Fan & Preacher, 2006); roles, tasks and routines necessary for the job (Haueter, Macan & Winter, 2003; Branzei & Fredette, 2008; Jokisaari & Nurmi, 2009).

Holt (1996) argues that it is communication and interaction with other organization’s members that provide the new employees with largest amount of knowledge the organization possesses. Therefore, it is crucial for a newcomer to establish relationships with the “old-timers” and especially with his or her own supervisor (Holt, 1996). Relationships with supervisors, in particular, represent a channel “through which the organizational socialization of newcomers is negotiated and implemented” (Jokisaari & Nurmi, 2009, p. 530); and it is supervisors who contribute most to the newcomers’ learning by providing them with the most important knowledge.

While learning about the routines and obtaining skills needed to perform them, the new employees increase their mastery which in turn raises their belief in importance of own efforts (Jokisaari & Nurmi, 2009). It has also been found that newcomers tend to be highly motivated to follow organization’s rules and established routines, as they are striving to become accepted by new colleagues and management (Branzei & Fredette, 2008).

Taking into consideration all said above, it is possible to conclude that newcomers face multiple organizational memory systems, such as culture, roles and tasks, individual memory and others. Moreover, what knowledge they obtain from these systems as well as the amount of this knowledge will influence their integration into the company. Therefore, a range of issues related to the memory repositories are of utter importance for newcomers in organizations.

2.3 Propensity to innovation and organizational memory

2.3.1 Organizational memory and innovation types

Innovation is defined as “creating new possibilities through combining different knowledge sets” (Tidd, Bessant & Pavitt, 2005, p. 15) or as creation of new combinations out of existing technology (Miller, Fern & Cardinal, 2007). Thus, the knowledge innovation is based on does not necessarily have to be newly-obtained; on the contrary, it can be already at a company's disposal (Tidd, Bessant & Pavitt, 2005). In order to innovate successfully, companies have to develop search for both types of knowledge (Moornam & Miner, 1997; O’Reilly & Tushman, 2004). A scope of innovation strategies is often presented as a dichotomy of innovation types: exploitative (incremental/ knowledge enhancing) – explorative (radical/ knowledge destroying). Based on this classification, it is argued that a search for knowledge which is external and new for organization is a pre-requisite for explorative innovation; and a search for the knowledge that organization already possesses, its recombination and refinement is responsible for exploitative innovation (Miller, Fern & Cardinal, 2007). The described search types can have an impact on each other; in particular it is argued that paying too much attention to exploitation will most probably hinder exploration (March, 1991). It is logical to assume that the second type of search is directed towards knowledge stored in organizational memory.
2.3.2 Effects of organizational memory on innovation behaviour of its members

Relationships between organizational memory and company’s innovation are multifaceted and complex. From a project point of view, Chang and Cho (2008) note that in conditions of new product development, it is not only organizational memory itself that influences the project, but also innovative nature of the latter, i.e. whether the project can be defined as more radical (explorative) or more incremental (exploitative) innovation. At the same time, Hargadon and Sutton (1997) stress an importance of a fit between the “old” knowledge and requirements of new situations. According to them, an overall success of relying on organizational memory in innovation process depends on how well the solutions found in the past can be adapted to the requirements of the present.

When looking from a perspective of organization as a whole, Rogers (2003) states that organization’s propensity to innovation depends on - among others - internal characteristics, such as those of organizational structure. Organizations obtain stability through predetermined goals, prescribed roles, rules and regulations, informal patterns, and authority structure, etc. However, in spite of seeming opposition between stability and innovativeness, “[i]nnovation goes on all the time in organizations” (Rogers, 2003, pp. 404-405).

Finally, the relationships between organization’s innovation and its memory can be viewed from a perspective of behaviour and efforts of its employees. It is employees who take decisions and “make the work done” in any organization; therefore, it is their behaviour that forms organization’s innovations in the end. The current study adopts this perspective and is primarily focused on the impact of organizational memory on employees’ behaviour that can contribute to the organizations’ innovative activity. The behaviour that possibly contributes to innovation is often referred to as improvisation, creativity, or innovative behaviour. While improvisation is more related to a spontaneous action crossing a boundary between planning and opportunity-seizing (Crossan et al., 2005); creativity is mainly seen as generation of novel and useful ideas (Gong, Huang & Farh, 2009). Employee’s innovative behaviour is viewed as a broader category that includes not only idea generation but also its intentional implementation (Yuan & Woodman, 2010).

As it has been mentioned before, the previous studies tend to disregard differences in organizational memory systems in their influence on innovation (Chang & Cho, 2008). This fact limits a depth of discussion which can be developed on the topic here. However, a range of implications for an impact of different memory systems on employees’ behaviour can still be drawn from the yet existing literature. First of all, knowledge accumulated within organization is said to constrain its members’ improvisation and search for new knowledge outside (Crossan et al., 2005; Miller, Fern & Cardinal, 2007). This statement can be related to several memory systems. For instance, it has been argued that over-reliance on old knowledge stored in individual memory (Ungson & Walsh, 1991) and in databases (Kane & Alavi, 2007) hinders obtaining new knowledge. This new knowledge in turn could have been a basis for explorative innovation. In addition, Cohen and Levinthal (1990) suggest that in order to absorb new knowledge effectively, companies need to pre-possess some overlapping knowledge. Similarly, Crossan et al. (2005) argue that if improvisation still occurs, the “old” knowledge stored in organizational memory helps the “improvisers” to refine and develop their ideas. However, if the new and old knowledge overlap too much, it will hinder ability to gain new insights (Lichtenthaler, 2009).

Secondly, Moorman and Miner (1997) suggest that organization’s memory influences its innovation through two main channels: it defines ways by which employees interpret all incoming knowledge and it prescribes certain behaviours within organization. This description can refer to organizational culture, roles and procedures, etc. that represent so-called structural repositories of organizational memory. This view can be supported by findings of West and Farr (1989, as cited in Yuan & Woodman, 2010). These authors propose a list of factors that present reasons for employee's behaviour in relation to innovation. This list includes organizational factors, employee-supervisor relationships, job characteristics, social factors, and employee’s individual characteristics. Among these five, addresses to organizational memory can be found in organizational factors and job characteristics. Organizations can influence individual behaviour towards innovation through special climate and culture, e.g. through norms that favour change (Yuan & Woodman, 2010). In addition, if innovation is embedded in job or task requirements, an employee is given to understand that this is the behaviour expected from
him or her (ibid). It is noteworthy that R&D departments are seen as units where innovativeness is included into the job description (ibid).

2.4 Summary

Knowledge in organization can be stored in four types of memory systems: people’s memory, artificial systems, structural repositories and technology. There are probably different methods through which these systems can be accessed; however, the existing literature does not provide much information about this perspective. Therefore, an inductive approach is necessary for being able to find out what methods are used in practice in order to access the above-mentioned memory systems.

Two fields where organizational memory is particularly important are those related to socialization of new employees and to organization’s innovation. The memory systems present a basis for learning of the newcomers, which in turn defines further performance of the latter. The memory systems also determine success of different types of innovation implemented in the company. Based on the ways through which organizational memory systems are believed to influence innovation, it can be suggested that the former supports different types of employee’s innovative behaviour by providing old knowledge from e.g. personal memory and databases and by defining the direction of employee’s efforts through structural memory repositories.

3. Method

3.1 Research purpose, approach and strategy

This research has a purpose to explain relationships between different categories related to the defined problem in the research. The approach is combined. As the Research questions 1 and 3 are based on the existing theories, the approach for them is deductive (c.f. Saunders, Lewis & Thornhill, 2007). The Research question 2, however, calls for an inductive approach; since the issue to be studied has not been covered in a systematic way.

The method chosen is a qualitative study, with a single-case study as a research design. The qualitative strategy, particularly case study is most suitable when “how” questions are involved and if the phenomenon to study is closely connected with its context (Yin, 1994). The unit of the analysis, i.e. what is called “case”, is defined as one group within R&D department in a manufacturing company. The single-case study is chosen, since it allows conduct deep analysis of the relationships between the categories involved (c.f. Yin, 1994; Saunders, Lewis & Thornhill, 2007; Bryman, 2008).

3.2 Choice of the case

A detailed description of the unit of study will be given in the next chapter. As regards the reasons for such a choice, the R&D department of this particular company\(^5\) has been selected due to its commitment to constant product development and highly knowledge-intensive work. A particular group within the company’s R&D department has been chosen because two of its three members are new in the organization. Thus, this choice could provide all the settings designed for this study.

\(^5\) As the company preferred to stay anonymous, it will be presented under the name of Company N, and it will be impossible to provide certain data about its location, specialization and current projects.
3.3 Data collection method

In studies on organizational learning where research units are teams/groups, surveys on large samples are a usual method of data collection (c.f. Lynn, Skov & Abel, 1999; Van Der Vegt & Bunderson, 2005; Carroll, Hatakenaka & Rudolph, 2006; Janz & Prasarnphanich, 2009). Some scholars complement survey with qualitative interviewing (c.f. Lynn, Reilly & Akgün, 2000; Bresman, 2010). Overall, the studies on organizational learning tend to rely on self-reported behavior (Edmondson & Nembhard, 2009). Therefore, the current research also relies on the self-reported behavior of the members of the research unit. At the same time, the qualitative nature of the research questions and a small number of participants in a case study makes it irrelevant to use surveys as method of the data collection. Thus, qualitative semi-structured interviewing is the final choice; since it is through this method it is possible to obtain in-depth information about the studied phenomena and their context, according to Bryman and Bell (2007).

There were seven interviews conducted: two with a group leader and both new employees each, and one with a representative of the IT-department. While the former six aimed to capture information about the department, memory systems and innovativeness of their tasks; the latter was focused on clarifying certain information about company’s electronic databases. In general, my approach was based on the one recommended in the work of Saunders et al. (2007): to ask rather general than specific questions in order to let the interviewees talk freely about everything that comes into their mind. However, each question in the interview guides contained also a list of topics that I would expect to be covered by that question, and in case they were not – I used to ask additional questions. Moreover, if a respondent brought up a topic or answer that was not predicted, I went on with asking to tell more about it. This approach helped me avoid influencing the interviewee’s answers with a specific form of questions – which is a problem that is often discussed in relation to question formulation in interviews (Shuy, 2003).

3.4 Interview guides

All interview guides were constructed with a purpose to capture the categories discussed in the theoretical framework. Table 2 presents a sequence of all the interviews taken with focus of each.

Table 2: Summary of the topics discussed at the interviews

<table>
<thead>
<tr>
<th>#</th>
<th>The interviewee</th>
<th>Interview content</th>
<th>Interview guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group leader C</td>
<td>Overview of the group’s background, information about current projects and both newcomers</td>
<td>Appendix 1</td>
</tr>
<tr>
<td>2</td>
<td>Group member A</td>
<td>The interviewee’s background and his relation to the memory systems</td>
<td>Appendix 2</td>
</tr>
<tr>
<td>3</td>
<td>Group member B</td>
<td>The interviewee’s background and his relation to the memory systems</td>
<td>Appendix 2</td>
</tr>
<tr>
<td>4</td>
<td>Group leader C</td>
<td>Plan for newcomers’ integration, novelty of their work</td>
<td>Appendix 3</td>
</tr>
<tr>
<td>5</td>
<td>IT-representative</td>
<td>Company’s databases</td>
<td>Appendix 4</td>
</tr>
<tr>
<td>6</td>
<td>Group member A</td>
<td>The interviewee’s innovative contribution</td>
<td>Appendix 5</td>
</tr>
<tr>
<td>7</td>
<td>Group member B</td>
<td>The interviewee’s innovative contribution</td>
<td>Appendix 5</td>
</tr>
</tbody>
</table>

In order to establish mutual understanding with the interviewees, it was necessary to become familiar with the nature of their work, their own background and the group’s background. That was the purpose of the first interview with the Group leader C (see Appendix 1). Guides for the next two interviews were partly based on what the Group leader told about the work his team members are
engaged in. The second and third interviews were composed in a way to obtain information about what organizational memory systems the group members A and B have encountered, how they have done it and what knowledge they got from these systems. It is worth mentioning that the memory systems differ in respect to how easy it is to collect data about them. Personal memory and electronic databases are concepts that everybody understand in the same way; therefore, questions about them were asked directly. On the contrary, technology as a memory system and especially structural repositories are more complicated objects which it would be problematic to ask about directly. Therefore, I preferred to ask the respondents to talk about their work and to find mentions about the memory systems in their narrations (see Appendix 2). Semi-structured form of the interviews allowed asking additional and clarifying questions when necessary.

The second interview with the Group leader C (interview # 4) aimed to obtain information about to what extent the company N defines the ways in which the newcomers face the memory systems. This understanding was also captured through a set of indirect questions – about how the company influences integration of the new employees. At this interview I also wanted to find out how the newcomers' innovative contribution is seen by the company N; and to get additional information about the current projects (see Appendix 3). As regards the innovative nature of the work the group is engaged in, I intended to capture it through asking the interviewees to describe the projects, their goals and - sometimes - their technical details\(^6\). The interviews 6 and 7 were also intended to collect data about innovative nature of the work, but from the newcomer's point of view (see Appendix 5). As regards the interview with the person from IT-department, it was rather more structured than the other ones, since its main goal was to validate the information about databases I had gathered before (see Appendix 4).

4. Empirical findings

This part will present the empirical setting of this research, with the description of the tasks the new employees perform. Further, I will present the memory systems they come in contact with, which covers the Research question 1 of this study.

4.1 Case context

Company N is a large supplier of equipment for a processing industry. Its Swedish R&D department is divided on a platform base, where there are several groups; each specialized in its own technology. In a product development process, the organization forms a matrix structure with a product (project) leader collaborating with representatives of different groups (both from R&D and other parts of the organization).

Another specificity of the company is that its projects start without having fixed time constraints and a budget disposable for a project leader. Moreover, boundaries of the project teams are rather vague, with these participants being seen primarily as a reference group. However, for projects in near-completion phase large budgets are assigned and speedy implementation is required. As regards knowledge sharing in the company, it is rather focused; so that specific information is shared with a limited number of people instead of the whole company.

The current research is focused on one of the platform groups within R&D department, which consists of a group leader and two group members. The Group leader C is one of the “old-timers” in the company. His group is focused on tasks related to understanding the product performance, advanced measurements and calculations. Both of his group members are rather new in the organization, having

\(^6\) Due to commercial nature of this information, the questions regarding certain projects/ aspects of work are not included to the interview guides presented in the Appendices.
worked there for less than two years. Their competences are not interchangeable, and their tasks differ. The group member A performs a role of a project leader in two projects, while the group member B performs a range of tasks related to specific equipment, for both his own group and other internal customers.

While being used to the research work, A had no experience in manufacture before entering company N. Therefore, working with materials appeared to be new for him personally. Before entering the company, B has not worked with a certain measurement technology that is applied at the equipment he works with at present. However, B possesses a competence that is unique for the company; which enables him to perform some tasks that are novel for the company. Overall, both newcomers are engaged in activities that are not totally new for the company, since the basic principles of innovations are already embedded in the goals of their work. Nevertheless, both of them have an opportunity to vary the means through which they can reach these goals. Also, they can propose new experiments; which is still what they job requires. Further, I will describe in detail their tasks, as well as the ones of their group leader.

4.1.1 Group member A
Project 1 is dedicated to a development of a new generation of a product the company produces at present. The idea is to find a new way of manufacturing which will enable new or improved product qualities. These qualities, in turn, are to fulfill two goals: price competitiveness and improved characteristics that would give some advantages to the company's customers. The task implies finding out the "ideal" product structure and the way to produce it. This project started as a "skunk work" and became official some time before A joined the company. The idea of this project appeared as a necessity to develop a new product generation was realized by some units within the Company N.

Project 2 aims to improve a single characteristic of the current product generation, namely its wear-resistance. This task includes solving an issue of measuring the wear in short time, as well as producing more wear-resistant products. This project was initiated as a response to a problem identified by a unit involved into direct work with the company's customers.

In both projects, A is responsible for the actual work and presenting the information to the reference groups. Both A and the reference group can come up with ideas how to proceed with the work. The actual work implies a lot of testing, which A does primarily alone in Project 1 and together with a colleague from another unit in Project 2.

4.1.2 Group member B
The Group member B is engaged into tasks that deal with an advanced piece of equipment that is quite new for the company. These tasks cover evaluation and improvement of measurement methods available to the company. The goal of the measurement is to obtain deeper knowledge about the company’s products and their performance in working conditions. This knowledge can be used further by other departments within the company for different purposes, e.g. for convincing a customer. Although these tasks have always been important for the company, the new equipment that enables perform them faster and at a more advanced level is rather new for the company. The idea to make use of this equipment is originated from the Group leader C who had been screening the environment for new opportunities. As the group’s internal customers do not realize full potential of this equipment, it is often the case that the latter have to be informed about the results this machine can produce.

4.1.3 Integration plan
In order to become integrated into the company, the newcomers have to meet certain criteria: deep understanding of the products, their characteristics and specific of their performance; ability to work totally independently over tasks; deep understanding of the company's culture and the industry; and a developed internal network.

As the Group leader C points out, there are several domains of activity in an approximate plan of integration of his group members. First, there is a series of meetings with managers and manufacture specialists that both of the newcomers should take during the first month or two in the company. The lists of people whom they should meet differ slightly according to their tasks in the company. Second, both of them should see how the company’s equipment works at a client, and they should learn about
the process. The next step is to present their work to other employees in the company. They have already been involved to these activities to some extent. Moreover, a project that will help integrate the skills of A and B is planned. In this project the Group member B will do measurements, while A will be responsible for making calculations for these measurements with a special software.

4.2 Memory systems

This subsection will present the memory systems the new employees A and B have to deal with; which aims to answer the Research question 1. As it has been pointed out in the Theoretical framework, I find it necessary to separate the systems themselves as defined by the theoretical framework from the means through which systems can be accessed. The access methods that represent the Research question 2 will be covered in the Discussion part. Structure of this section follows the structure of the theoretical framework in a part of the organizational memory systems. Since both employees appear to face same knowledge repositories regardless the work they are involved in, I will not separate them in the text.

4.2.1 People’s memory

For both new employees people appear to be an important source of knowledge in the organization. Accessing the memory of other individuals, the new employees could obtain knowledge related to the other organizational memory repositories. As it has been mentioned above, the knowledge stored in the memory systems is separated from the ways these systems can be accessed, for the purpose of this work. Thus, the current subsection is focused solely on that knowledge stored in individual memory which cannot be connected to the other repositories. The knowledge about the other repositories will be discussed in respective subsections.

Both group members refer to their group leader as to an important source of knowledge about the field they work in. Not being able to communicate directly with their predecessors, the new employees have to rely on knowledge stored in other people in the organization. This is particularly important, since none of the newcomers has experience of working exactly in the same settings before. Thus, the group leader is the closest link to the knowledge that people at their positions should possess.

Other people in the organization can also have expertise in part of the tasks the new employees have to perform. Therefore, it is important to connect them from the beginning; and a range of meetings was arranged by the company’s management for that. At these meetings the “old-timers” told the “newcomers” about their specialization, so that the latter could form own understanding of who can be referred in case of what questions. The connection between the new employees and other company’s personnel has been established through their participation in common projects. In this case, the “old-timers” present a reference group for the “newcomers”; with the role of the former being to share the knowledge of what the company has done before as well as to provide some advice.

4.2.2 Artificial systems

It has been found that the new employees encounter several artificial memory systems in the Company N. There are at least five electronic databases available for everybody in the R&D department. It is the Group leader and IT-department to explain to the new employees how the systems function. Among different artificial memory systems, an electronic database containing reports of previous work turned out to be of utter importance: it is from this database the new employees obtain knowledge of what experiments their predecessors have done and what results they obtained. Comparing results of current work with the ones achieved previously, the new employees can understand how they have managed to improve task performance, as well as to develop existing measurement methods. Besides, they can see what has been done and what has not been done; which might give them ideas for new experiments. Moreover, looking into the work performed by their predecessors might demonstrate an example of what behaviour is expected from the new employees.

7 It also should be noted that organizational memory is not the only source of knowledge for the newcomers – both of them constantly address some or other external sources; however, the organizational repositories are extremely important for both.
However, when the new group members have a completely new task, the report database cannot be of use.

The system has functions of key-word search, search by author; and an option of full-text search has been added recently. It is also possible to search for a specific report by looking through their titles. In addition, a person responsible for the database sends out a quarterly list of new reports added to the system. All the reports are also available as hard copies in the archive that is situated in the R&D department.

4.2.3 Structural repositories

The new employees encounter various structural knowledge repositories which they access through working process and through communication with the group leader and other colleagues.

4.2.3.1 Culture

While learning about company's culture, they find out “how things are done around here”, which is sometimes rather different from what they have experienced at previous working places, or from what they have expected. For instance, the project organization adopted in the company N appears to be rather new for the newcomers, namely: absence of a dedicated budget, time constraints and real team work can strike them as they join projects on early stages. Moreover, the company takes a conservative approach which implies a large amount of testing before approving the product for larger-scale manufacturing. Therefore, it is vital for the newcomers to understand this way of doing things, in order to see what is expected from them in terms of work efforts.

In addition, informal communication is a prevailing way of communication in the company, which newcomers should also understand and accept. They should adjust to this way of processing and transferring work-related information, in order to be able to produce the outcomes expected from them. The new employees access company's culture by communicating with people both “within” and “outside” assigned tasks. In addition, they can obtain some knowledge of what behaviour is valued by observing behaviour of the group leader in different situations.

4.2.3.2 Roles and tasks

As regards the roles and tasks, both employees have “inherited” them from predecessors. The group member A occupies even the same “unusual” position in the project matrix as his predecessor. A's predecessor originally worked for a division responsible for developing the area in which Project 1 is currently held. During reorganization, this division was abolished, and this employee was assigned to the group where C was a leader. While officially the Company N did not intend to develop this area, some managers at the company's overseas units realized a need to work over a new product generation. Thus the group leader C and A's predecessor started Project 1 unofficially. Later, the project became official and A's predecessor became a leader for this project. According to the company's product development matrix structure, the project leader does not belong to any "platform" group; instead he or she serves as a link between other platforms and groups within organization. However, A's predecessor remained assigned to C's group, and so did A. This example demonstrates clearly how company's history can be embedded into a task.

Tasks of B partly come from the equipment he works with. Since this equipment is rather new for the company, internal customers do not possess knowledge of its full potential. Therefore, it is often necessary to experiment with operations on this equipment, and further share the results with those units in the company that might use them. This is a task in which the Group leader C is also involved, since it was his initiative to acquire this equipment. It is noteworthy that a great deal of the tasks that both employees are engaged in now were started by their predecessors, but the latter had not manage to do much.

4.2.3.3 Procedures and routines

The most evident example of routines and procedures the new employees face in the Company N as it appeared in this research is related to report-writing. The new employees do not only obtain knowledge from the report database as it has been described before, but they are also supposed to
contribute to the database with their own reports. Although it is not a formalized duty, all members of the R&D department in the Company N are encouraged to write reports which they will share with colleagues through this electronic system. Writing reports is to help the employees to organize their thoughts about the process and results of their work. The latter is especially important for the new employees because through this activity they can elaborate on possible value of their work for the project or company. The group leader C plays a significant role in educating his group members on the importance of this procedure.

4.2.3.4 Transactive memory system

Among subnetworks of people, tasks and tools, transactive memory system (a people-task subnetwork) appears to be the most evident repository faced by the new employees at the company N. There are two general ways the newcomers encounter this system: through communication with people and through IT-enabled tools.

While accessing the company's transactive memory system (TMS) through communication with people, the new employees get direct advice as to whom they can contact in relation to certain questions. The first person to be contacted is the group leader C. His role in directing the newcomers to people they needed was more important in the beginning. As time goes, the newcomers are gradually increasing both knowledge about specialization of other people in the company and their personal networks. The latter can also be used for finding out whom to contact.

In addition, there is a company-wide mailing containing a list of business trips made by the organization's members. This mailing is done quarterly. It is aimed to inform the employees about new knowledge that the others in the company might possibly obtain. Thus, finding out that somebody in the firm has attended an event dedicated to a specific topic, colleagues of this person can contact him or her in case they have questions regarding this topic.

Both employees had a set of meetings with managers of different R&D and production divisions, when they had just entered the company. At these meetings they learned about what activities the "old-timers" were engaged in. Thus, the newcomers had a chance to form their own opinion about which "old-timers" could be addressed for what questions.

4.2.4 Technology

The new employees obtain knowledge about the technology the group works with through communicating with people in the organization and working over assigned tasks individually and in group; they even can access some knowledge about technology through the electronic database. This knowledge covers utilizing equipment and working with related software. The equipment used for the work of the focal group is one of the most advanced among what the company's Swedish R&D department has.

As the newcomers did not have a chance to meet their predecessors, they had to obtain knowledge about how to work with the equipment and its software from the group leader who had also worked with this equipment. The newcomers were also encouraged to read manuals. Further, they could learn about the equipment and software by using them individually or together with some colleagues who had had experience with those. They also could find reports of their predecessors in the database and look into what settings the latter used. Overall, in case of the technology as a memory system, the knowledge communicated by other people was just a starting point for the newcomers’ own learning.

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8 I argue that this set of meetings, however, does not provide the new employees with knowledge about the TMS, as it will be further discussed in detail in the Discussion chapter.
4.3 Summary

Regardless of the tasks they perform both newcomers – A and B – face the same set of memory repositories in the Company N. These systems provide them with a wide range of knowledge, such as information about the field they work with, results of the previous work, instructions of how to work with specific equipment, etc. They also acquaint the newcomers with their tasks and expectations put on them in terms of working style. Besides the knowledge per se, these systems can give them certain hints where to find people who possess the needed knowledge. How the newcomers access all these memory systems, and how knowledge obtained from the memory systems helps in their innovative efforts, will be covered in the following section.

5. Discussion

This section aims to answer Research questions 2 and 3, therefore it will start with the discussion on how new employees access different memory systems, and continues with elaboration on what role the memory systems play in supporting their innovative behaviour.

5.1 How new employees access the company’s memory systems

Following Olivera’s (2000) statement that individuals can interact with “concrete entities”, but not with abstractions such as culture; I propose to look into the ways memory systems can be accessed – separately from the essence of these systems. As this issue has not been discussed much by the existing literature, I have taken an inductive approach to finding the ways through which the newcomers access the memory systems in the Company N. Table 3 presents the knowledge obtained from different memory systems, structured according to the way these systems have been reached. The knowledge obtained is also marked as tacit or explicit based on whether retrieval of this knowledge involved codification, or not.

Table 3: Knowledge obtained by the new employees through the organization’s memory systems

<table>
<thead>
<tr>
<th>Accessed through</th>
<th>People’s memory</th>
<th>Artificial systems</th>
<th>Structural repositories</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking a special series of introduction meetings</td>
<td>Who knows what (explicit)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Personal communication with the group leader and other people in the organization</td>
<td>Knowledge about the field they work in (explicit)</td>
<td>How to use the system (explicit)</td>
<td>Specific roles, tasks and procedures (explicit)</td>
<td>How to work with specific equipment and software (explicit)</td>
</tr>
<tr>
<td></td>
<td>Results of the previous work (explicit)</td>
<td></td>
<td>TMS – “Who knows what” (explicit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Culture (explicit)</td>
<td></td>
</tr>
<tr>
<td>Performing assigned tasks in group</td>
<td>-</td>
<td>-</td>
<td>Culture (tacit)</td>
<td>How to work with specific equipment and software (tacit/explicit)</td>
</tr>
<tr>
<td>Performing assigned tasks individually</td>
<td>-</td>
<td>-</td>
<td>TMS - “Who knows what” (tacit)</td>
<td>How to work with specific equipment and software (tacit)</td>
</tr>
<tr>
<td>IT-enabled means</td>
<td>-</td>
<td>Results of the previous work (explicit)</td>
<td>TMS – “Who goes where” (explicit)</td>
<td>Previously used settings (explicit)</td>
</tr>
</tbody>
</table>
5.1.1 Overview of the ways of accessing the memory systems

The Table 3 demonstrates that among the five ways of accessing memory systems identified in the case of Company N, personal communication with people in the organization is the only universal way to obtain various knowledge stored in organizational memory. This access method not only enables retrieval of personal knowledge, but also provides a link to the memory repositories on organizational level, such as structural, artificial and technological ones. Using this way to reach organization’s memory implies that people share their own knowledge about the systems through talking. As talking means expressing own thoughts, the knowledge that can be obtained through it is explicit. Findings of the current study demonstrate an exceptional role of the group leader in the way the newcomers retrieve knowledge through personal communication; which is in line with the literature on new employee socialization (c.f. Holt, 1996; Jokisaari & Nurmi, 2009).

If one uses variety of knowledge repositories as a criterion for ranging the access methods, the IT-enabled means should be viewed as the next-important way; since this way makes it possible to retrieve knowledge stored in electronic databases, structural repositories and company’s technology (see Table 3). The knowledge retrieved by the new employees through IT-technologies is explicit, which is logical to expect considering that this knowledge is saved in a codified form.

So far, it has been found that the two “most universal” ways of accessing organizational memory systems are personal communications and IT-enabled means. Interestingly, it is quite similar to what Olivera (2000) has posited as the ways of accessing knowledge in organization. As it has been discussed previously, Olivera (2000) does not distinguish between the memory systems and ways to access them, but he states that memory systems are “concrete entities” that can be reached directly, namely they consist of people’s networks and computer-based systems. Thus, Olivera sees these repositories also as access methods. However, the findings of the current study show that the access methods covered by Olivera (2000) are not the only possible ones.

As it can be seen from the Table 3, newcomers of the Company N obtain tacit knowledge embedded into the memory systems through performing assigned tasks individually or in group. Performing tasks in groups is more beneficial in terms of variety of repositories and knowledge types it gives access to. While doing task individually the newcomers face only technology as a repository; the group work helps them also form understanding about important structural repositories: the company’s working culture and transactive memory system. It is noteworthy that it is the only tacit knowledge they get – all other knowledge is explicit.

The four access methods discussed so far deal with continuous activity; and singular occasions have not been described. Nevertheless, the fifth way of accessing the memory systems found in the Company N presents a series of events that are not regular. On the contrary, this series of meetings is organized only once for each new employee shortly after their entering organization, and is not supposed to be repeated. These meetings are focused entirely on introducing “old-timers” to the newcomers, so that the latter could directly access individual memory of the former and to form their own understanding of who knows what in the company. Although the knowledge about “who knows what” represents the essence of transactive memory, I argue that the introduction meetings do not help the newcomers access the company’s TMS. As it has been defined by the existing literature (c.f. Moreland & Myaskovsky, 2000; Gino et al., 2010; Lewis & Herndon, 2011), TMS contain knowledge shared by all members of a certain group. In case of the introduction meetings the newcomers create their own, individual knowledge that was not shared with them by someone. Thus, this knowledge cannot be originated from the TMS.

5.1.2 Interactive and non-interactive access of the memory systems

When access methods used by the newcomers in the company N are considered from a more general perspective, they can be classified as either those involving interactions with people, or those that do not. The interactive methods that include introduction meetings, personal communication and group tasks are responsible for considerably higher number of knowledge types obtained by the new
employees. As it can be expected, the interactive methods give access to people’s memory, while the non-interactive ones cannot do that.

5.1.2.1 Personal communication as the most important interactive method

Among the interactive methods, personal communication with the group leader and other organization's members occupies an outstanding position, since it is the only one that provides access to all the types of the memory systems. Thus, it can be concluded that this way of accessing memory systems is the most important for the new employees in the company. A certain similarity can be found between people’s memory as a repository system and the personal communication as a way to reach repositories: both of them involve people and communication with them (c.f. Huber, 2001). Therefore, it is possible to see how what the theory says about people as the memory system can be relevant to people as the access method.

Firstly, the findings of this study demonstrate that - similarly to what is said about the people's memory (c.f. Ungson & Walsh, 1991; Argote, 1999) - communicating with colleagues can provide the new employees with rather diverse and sophisticated knowledge: about their field of work, organizational culture, their own tasks, instructions how to use equipment and company's databases, etc. Due to the discretionary character of the personal communication, Argote's (1999) discussion about possible unwillingness to share the stored knowledge can also be applicable here. Moreover, issues of turnover and length of service (c.f. Huber, 2001; Argote, 1999) can also be developed in relation to the personal communication. As people leave the company, they cannot serve as links to other memory systems. Thus, with the leave of "old-timers", the scope of the knowledge repositories that can be possibly faced by newcomers is changing. Also, such shortcoming of people’s memory as inability to share individual knowledge with a large number of people can be clearly seen as the one of personal communication.

Finally, it is possible to apply Olivera's (2000) notion of the individuals' memory as a dispersed system to the personal communication. When personal communication is the way to access the repositories, individuals can share their knowledge only with those whom they communicate with directly; which has at least two important implications. First, it means that the knowledge can be shared to a limited circle of people. Second, scope and relevance of knowledge one can obtain from others depends on whom one can connect and how. The latter consideration brings up an importance of networking within an organization where personal communication is a dominant way to access knowledge repositories. At the same time, newcomers do not have any networks when they enter company. Therefore, it appears to be especially crucial for the company to promptly build social networks for the newcomers, since it is through communication with these networks people obtain a large share of knowledge stored in different organizational memory systems.

5.1.2.2 IT-enabled means as the most important non-interactive method

While accessing organizational memory repositories without interacting with people, the new employees rely heavily on IT-tools. Due to similarities between databases as memory systems and IT-enabled means as an access method, it is possible to apply what theory says about databases to the IT-tools of access. Similarly to Olivera's (2000) statement about databases, the IT-enabled means can be characterized as centralized within the R&D department (the report database) and within whole company (the send-out with list of people's trips). Another distinct feature of the IT-tools is that no matter which memory system they are applied to, the knowledge they help access is very precise, detailed and to a large extent systematized (c.f. Bock, Sabherwal and Quian (2008) and others discussing properties of the artificial memory systems).

As regards access to the report database where one can obtain information about previous experiments and settings used on equipment, there is a clear-cut indexing and other search possibilities available to everybody in the unit. The advanced search possibilities are important in conditions of a large organization with intensive experimentation. In this case even an "old-timer" cannot remember details of every work done. The importance of the search possibilities is even higher in case of involvement of new employees. Since they do not have a personal memory of the previous work they first have to find out what types of work have been done, and it is not before that they can think about the details of this work.
When used to access transactive memory system, the IT-tools take a form of the “people finder” discussed by Olivera (2000) and Huber (2001). Thus, the access tool provides a link not to knowledge per se but to individuals that possibly possess it. In this case, all the data are presented in the same way for all employees – both new and old, so that they even do not have to use special search tools to find certain information. Thus, applying Olivera’s (2000) terminology, one might say that this method has even a higher degree of centralization than access to the database.

5.1.3 Summary
Most knowledge accessed by the new employees in the Company N is explicit. There is a higher variety of the ways to reach explicit knowledge, and lower variety to access the tacit one. In case of the Company N, personal communication appears to be the most important way of accessing the memory systems, since it provides links to all the types of such systems. The next most important access method is presented by the IT-enabled tools. In general, interactive methods that the personal communication belongs to are responsible for considerably higher number of the types of knowledge retrieval situations. While the above-mentioned methods can be supported by the existing studies, the current research has identified three more methods relevant for this case, namely performing tasks individually and in group, and a more formal special introduction event.

5.2 How knowledge obtained from the organizational memory systems can support innovative behaviour of the new employees
As it can be suggested based on the theory, knowledge retrieved from the organization’s memory repositories is best appropriate for supporting so-called “local search” defined by Miller, Fern and Cardinal (2007), or incremental innovation (O’Reilly & Tushman, 2004). However, further discussion will demonstrate that some of the memory repositories can be useful for the “distal search” as well. Interestingly, it has been noted that both newcomers face approximately same range of the memory systems in spite of the differences in the work they perform.

Table 4 demonstrates knowledge obtained by the newcomers from different organizational memory systems. Although it is suggested that all knowledge in the company somehow or other has a potential to influence their innovative behaviour through being used in their everyday work, Table 4 presents only the knowledge that that potentially has a direct impact on the innovative behaviour.

<table>
<thead>
<tr>
<th>Memory system</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>People’s memory</td>
<td>Personal knowledge of the field they work in</td>
</tr>
<tr>
<td></td>
<td>“Who knows what”</td>
</tr>
<tr>
<td>Artificial systems</td>
<td>Results of the previous work</td>
</tr>
<tr>
<td>Structural repositories</td>
<td>Tasks</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
</tr>
<tr>
<td></td>
<td>TMS: “Who knows what” and “Who goes where”</td>
</tr>
<tr>
<td>Technology</td>
<td>How to work with specific equipment/software</td>
</tr>
</tbody>
</table>

5.2.1 People’s memory
The knowledge obtained from individual memory of other people within organization provides a strong support for exploitative (incremental) innovation. As colleagues present and explain results of the previous work to the newcomers, the latter get an opportunity to base their further work on this
knowledge. They can also try to develop and refine the methods these results were obtained with, in order to improve performance.

Knowledge obtained by the new employees from this repository also has a potential to influence outcomes of their creative behaviour in the Company N. Members of other groups in the organization can provide the new employees with knowledge that their group does not possess, so that the newcomers can generate ideas about combinations of cross-divisional knowledge as it has been described in Miller, Fern and Cardinal (2007). Understanding of “who knows what” in the company would help the new employees map these people. In addition, if the newcomers have new ideas and communicate them to the “old-timers”, the latter can often refer to the past results to evaluate these ideas. In this case, findings of Crossan et al. (2005) that knowledge of the similar work done previously can help refining the new ideas and increasing their efficiency can be relevant. However, one should also understand that as the knowledge stored in people’s memory is apt to fast depreciation and forgetting (Argote, 1999), it might sometimes fail to support innovative behaviour of the newcomers.

5.2.2 Artificial systems

As the artificial systems can provide the newcomers with the results of previous work, the way they support innovation is quite similar to what has been described in the previous paragraph. In line with what theory says about the artificial systems (c.f. Huber, 2001; Wilson, Goodman & Cronin, 2007), knowledge about past projects stored in the report database of the Company N is more detailed and accurate than the same knowledge obtained from colleagues; besides the report database contains larger amount of information than any individual memory can grasp. Thus, the report database of the Company N provides the newcomers with knowledge that is of high quality and possibly diversity that they can use for proposing incremental improvements or supporting new ideas.

However, it might be problematic to rely solely on knowledge from the database. According to Moorman and Miner (1997), the past knowledge has to be adjusted for requirements of the present in order to be applied successfully for innovation. Therefore, it is often necessary to understand the context in which past knowledge was generated or used. As Kwan and Balasubramanian (2003) note, knowledge stored in artificial repositories usually lacks a contextual element. This component is what people would keep in their memory. Since the new employees can have very little own knowledge about what had happened in the company in the past, they would need “old-timers” to explain them the context of certain reports retrieved from the database.

5.2.3 Structural repositories

Among various structural repositories the newcomers face in the Company N, it is three that can influence their innovative behaviour: tasks, culture and the transactive memory system (Table 4). While tasks and culture create more prerequisites for exploitative innovative behaviour, the TMS gives knowledge that can help the newcomers equally well in local and distal search.

Seen from a perspective of West and Farr (1989, as cited in Yuan & Woodman, 2010), tasks assigned to the new employees A and B include innovation as a requirement. The findings show that both employees are engaged in experimentation. Considering that both of them belong to R&D department, it is logical to suppose that their work description implies a certain degree of change. Moreover, examples of tasks with embedded company’s history are clear indicators of what can be expected from the newcomers. In other words, since the new employees see that such innovative initiatives of their colleagues and predecessors as “skunk works” or acquisition of more advanced equipment have become supported by the company, they will believe that similar behaviour of their own would also be supported.

The newcomers’ tasks together with culture of the Company N also contain knowledge about what type of innovation is adopted by the company. Since the culture includes such principles as very thorough tests, checks and constant improvements, it can be concluded that focus on exploitative innovation is very strong in general. Out of three types of tasks the group members A and B are involved in, it is Project 1 that is closer to the explorative type of innovation. Unlike the other projects, it strives to find a new way of manufacturing the product, that would in turn, give the product new
qualities. However, even this project relies a lot on the “old” knowledge, and is in line with the company’s general orientation to the product development.

Information the newcomers obtain from the transactive memory system can be classified as either “Who knows what” or “Who goes where”. Knowledge of the first type helps locating people whose competences the company is already aware of, i.e. this competence is an internal knowledge for the company. Therefore, addressing colleagues found through such a search, newcomers can get knowledge that is “old” for the Company N. This “old” knowledge, in turn, can be used either for creating new combinations, including the cross-divisional ones, or for supporting improvements, as it has already been described in this section.

Information about “Who goes where” can turn out especially helpful for the distal search. This type of TMS can provide a link to knowledge new for organization, or knowledge that some of organization’s members have recently obtained but had no chance to use – so that it has not been shared with the organizational memory yet. It can become an additional source of the external knowledge search for the new employees.

5.2.4 Technology

As regards technology as a memory system, the new employees, the knowledge how to use equipment and software does not only determine their everyday work, but also can influence their innovative behaviour to a large extent. As their knowledge about the technology options grows, they are more likely to figure out how to use the options they learn about, how to combine them in order to refine their measurement results. Finding out about available equipment functions, they can suggest new experiments that are possible due to the mentioned functions.

In general, there have been found two ways of innovating based on the knowledge about company’s equipment and software. The first way involves finding various technology-based solutions for the tasks that come from internal customers, as it is the case with Project 2 for example. The second way is to learn about the equipment's functions and propose new solutions for the internal customers preemptively, as it is often the case with the machine the Group member B works with. While the first way implies mostly a search for a technology solution, the second one is focused on both experimenting with the technology and search for possible ways how the internal customers can use the found solution. Thus, both types involve idea generation and to a large extent its implementation (c.f. Gong, Huang & Farh, 2009; Yuan & Woodman, 2010).

5.2.5 Summary

The discussion above demonstrates that the main principles of innovation are embedded into the structural repositories of the organizational memory; which can be related to the mechanism through which organizational memory influences innovation described by Moorman and Miner (1997) and West and Farr (1989, as cited in Yuan & Woodman, 2010). Other systems can provide knowledge for the newcomers can use for their innovative efforts (c.f. Cohen & Levinthal, 1990; Crossan et al., 2005). Some of these systems (personal memory and TMS) can also provide links to individuals possessing certain knowledge, and this knowledge can appear to be new for the company. In the latter case, the memory systems provide a basis for the “distal search” (explorative innovation), while in general they support the “local search” (exploitative innovation).

It is worth mentioning that both newcomers also rely on sources of external knowledge and on their previous knowledge. Since they do not have experience in this company, the organization's internal knowledge and the knowledge they get from external sources can be equally new for them personally. Therefore, while doing a “distal search” or coming up with improvisation ideas, they cannot be sure if this knowledge is really new for the company. Unlike the company’s “old-timers”, the only “old” knowledge for the newcomers is their own knowledge. Combined with the notion that both newcomers appear to face the same range of memory systems regardless of the projects they are involved in; the previous discussion makes it possible to suggest that arguments of Chang and Cho (2008) might appear irrelevant in a context of new employees innovating.
6. Conclusion and limitations

This study has demonstrated four types of organizational memory systems which new employees face during a process of socialization. These systems, being accessed differently, provide the newcomers with various types of knowledge per se and certain hints how to find other knowledge. The main findings of this study call for separating organizational memory systems and methods of their access by academia; which in turn will provide new insights into the topic. Other findings of this study cover a range of ways through which memory systems support innovation in organization.

Firstly, as regards the methods through which memory systems are accessed, the current case demonstrates that these methods play an important role in defining what knowledge a new employee can retrieve from a memory repository. Moreover, the access methods appear to differ in their capacity to reach knowledge from diverse memory systems. Interestingly, the most “universal” ways (i.e. providing access to the highest variety of the repositories) discovered in the case of Company N agree to a large extent with the scarce literature that raised a topic of access to the memory systems (c.f. Olivera, 2000).

In addition, separating organizational memory from the ways to access it makes it possible to rethink some theoretical postulates about the memory systems, particularly the one that it is only obtaining knowledge from individual memory that depends on individual willingness to share knowledge (c.f. Argote, 1999). This statement is definitely based on a belief that it is only people's memory that can be accessed via communication with individuals. As the case of the Company N has shown, all four types of memory systems can be accessed through communication with people. Therefore, it can be said that the discretionary issue is relevant for obtaining knowledge from all the memory repositories, contrary to just one as the existing theory suggests. In general, when the separation between memory systems and access methods is taken into account, important characteristics of the memory systems described by the existing literature can be reconsidered. This appeared to be valid for a situation with new employees, but it can have implications for those cases where “old-timers” learn from organizational memory.

Secondly, focusing on how knowledge obtained from the memory systems can support innovative behaviour of the new employees; this study has found several ways in which both incremental and radical innovations can be enhanced. The memory systems can affect innovative behaviour, firstly, by showing that innovative behaviour is expected and rewarded; secondly, by providing “old” knowledge that can form a basis for more incremental innovation and a way to improve more radical ideas; and thirdly, by providing links for possibly new knowledge that supports the newcomers’ own search for external knowledge. These ways are in line with the existing literature on the topic (c.f. Cohen & Levinthal, 1990; Moorman & Miner, 1997; Crossan et al., 2005; Yuan & Woodman, 2010). However, in the case of the Company N, it turned out that neither the range of memory systems addressed nor the ways of accessing them differ by the innovative nature of the work the new employees are involved in. The latter finding appears to be contradictory to the discussion developed by Chan and Cho (2008).

The results of this study are to a large extent bound to its limitations. This research has been done in certain settings, namely new employees of an R&D department. While the former defines special relationships in terms of the knowledge novelty, the latter creates special attitude towards innovation within the researched unit. Moreover, this research has taken a perspective of knowledge as a product, and memory system as a static construct. Being aware of some critique expressed for ignoring the dynamic nature of organizational memory (c.f. Casey & Olivera, 2011), I still consider that dynamism of the memory systems is out of the focus of this research. In this case, the dynamism would mean that the knowledge repositories change after interaction with the new employees; so that the new employees would contribute with new knowledge to an organization. As this research aims to look only into how knowledge flows from organization to newcomers, the dynamic perspective seems to be irrelevant here.
7. Suggestions for future research

Future research might develop a line of separation between memory systems and methods of their access. For instance, it can be feasible to study this separation in different settings, e.g. involving companies’ “old-timers”. Another suggestion in relation to the access method might be to look for a set of such methods universal for all organizations, as it has been done for the memory systems. One might also to search for relationships between content of knowledge, memory system this knowledge is stored in and method this knowledge is accessed. For that, quantitative methods can be made use of.

It can also be of interest to compare contribution of organizational memory and external knowledge sources to innovative behaviours shown by new employees. One might also address an issue of perceived knowledge novelty. Being new in organization, employees face too much novel knowledge both from the organizational memory and from the external sources. Thus, facing some external knowledge or coming up with a new idea they cannot say if it will be perceived as “new” or “old” for the organization.

Another suggestion for future research would be to take a time perspective and to find out if the scope of the memory systems and methods to address them evolve as the employees become more integrated into organization. A perspective of power in knowledge sharing applied to the new employees addressing organizational memory can also give new insights into the situation.

8. Managerial implications

Memory repositories turn out to be important for a company in a range of situations. The reliance on these systems and their role must be higher in case of combined circumstances, such as in the studied case. Therefore, development of the memory systems and ways to access them can be only beneficial for a company in similar settings: it can foster socialization of newcomers and encourage their innovative contribution, to name a few benefits. The empirical data demonstrate that a larger proportion of the knowledge shared with the newcomers in the Company N is explicit. Previous studies show that explicit knowledge can be shared comparatively easily to a large number of people. Thus it is evident that the Company N has a potential for sharing the knowledge contained into its memory to its employees “better” in a way that it can move the knowledge sharing to a higher level of efficiency.

In situation when the largest part of the organizational memory is retrieved from people – either as knowledge repositories themselves or as access methods – it makes sense to think about the perils of over-reliance on people, such as forgetting, turnover, and impossibility to share knowledge with many. In addition, one must remember that what knowledge employees obtain depends on whom they connect with and how; which gives a certain degree of risk that they can miss some important knowledge by not being connected to the “right” people. Considering all said above, a company like N can focus its efforts on two dimensions: it can improve personal communication, and/ or develop memory systems and access methods that are not so dependent on the personal communication. However, it might be feasible to emphasize the first direction because knowledge sharing through personal communication is deeply embedded in N’s culture.

As regards the first way, it is possible to improve internal personal communication through its intensification, such as increasing numbers of group projects and involving more participants in these projects. On the other hand, more formal efforts can be made. For example, events similar to the series of meetings taken by the newcomers in the beginning can be organized in order to help newcomers speedily build their internal social networks. Another way would be to have a special integration programme. This programme, for instance, can include limited-time rotation of every newcomer through groups that perform similar or related tasks. The advantage of rotation over mere performing tasks for other groups is that a newcomer can establish contacts with all the group members; which in turn will fasten networking-building.
The second type of company’s efforts can be focused on grasping knowledge from individuals and storing it in the memory systems that are less dependent on people. The relevance of this method is of course limited, since it cannot be applied to all the types of knowledge and repositories. In this case, a general strategy to share more knowledge through formal and impersonal ways should be voiced on a company or department level, possibly with including this work into employees’ job description. Further, more forms of knowledge sharing can be considered, e.g. video manuals for equipment, or "learning histories" (c.f. Roth & Kleiner, 1998). It is important that newcomers know about existence of all these materials from the beginning, and are encouraged to use them. In this connection, company might think about an integrated search tool for all its databases and development of indexing options related to it.
References


**Appendices**

**Appendix 1**

Interview guide for the interview #1 (with the group leader C).

1) Could you tell me about the history of the group you are leading?
2) What is the group is specialized on?
3) Could you tell me about members of your team?
4) How do you and your team members get knowledge about the xxx technology?
5) Could you please describe briefly what work your team is doing currently?

**Appendix 2**

Interview guide for the interviews #2, 3 (with group members A and B).

1. Can you tell me about your background and your role in the company?
2. What work do you do?
3. Whom do you communicate with during your work?
4. How do you get knowledge about xxx technology or other technologies you work with?
5. Have you ever read reports at the company’s database? What type of information were you looking for there?
6. Tell me more about the project you participate in (Project 1 & 2 – for the group member A and usual tasks – for the group member B)

Appendix 3

Interview guide for the interview #4 (with the group leader C).

1) You have two group members that are rather new in the company. What do you think is necessary for them to become integrated into the company, or R&D department?
2) When they entered the company, did you have some plan how to integrate them here?
3) How did you acquaint them with the specific of the organization? (how the things are done here)
4) (How) Do you help them in building their own network within the organization?
5) How did you make them familiar with their tasks?
6) How was their learning about your technology and equipment organized?
7) Since they are here, have they done something which the company has never done before?
8) Talking about the 2 projects (1 and 2) how would you define their current stages?

Appendix 4

Interview guide for the interviews #4 (with a representative of the IT-department).

1) Could you tell me about the database with reports?
2) How people can find specific information there?
3) Is it so that this database keeps all the information since it was introduced, or is it possible to delete something which say lost its relevance?
4) Is it possible to count how often certain materials were accessed there?
5) Is it you who compose a special list which includes information who in the company goes where and attends what events?

Appendix 5

Interview guide for the interviews #6, 7 (with group members A and B).

1) Since you came into the company what has been a totally new for you?
2) While working here, do you do anything which you have not done before?
3) Do you think that working here, you do something that the company N has never done before?