Knowledge Work in Distributed Teams
The Influence of Office Environments, Virtual and Social Space

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ABSTRACT

Increasingly, knowledge workers are engaged in distributed collaborations, which challenges the use of the workplace. The purpose of this study is to identify factors which affect the future workspace. In this literature review the physical, virtual and social dimensions of the workspace have been investigated, and it was found that the importance of the interplay between the dimensions is increasing as the mobility of the workforce rises. It is concluded that a human-centred design approach is essential to meet the needs of the employees; since mobility and flexibility affect the way we work.

KEYWORDS: Knowledge Work, Distributed Teams, Physical Space, Virtual Space, Social Space

1. INTRODUCTION

The workplace is changing due to new technologies and solutions that foster expectations of higher productivity, and lower absenteeism and expenses. The new office environment is designed to increase productivity and decrease costs by facilitating effective collaborative knowledge work [1, 2, 3]. Application of non-conventional team structures is rising, and distributed and virtual teams of knowledge workers are increasingly common [4, 5]. All these elements influence the way we work and collaborate.

In 1980 IBM introduced the personal computer and the world of office work and office design was changed forever [4]. Today technologies such as e-mail, instant messages, and audio and video conferencing enable teams to work together even when they are not at the same location. In distributed teams the team members can be situated in different departments, office buildings or even different countries; and still they are expected to communicate and collaborate [8].

The last decade we have seen an increased interest in collaboration and facilitation of new ways of working [3, 6]. Accordingly, the design professions, consulting community and furniture industry have developed new workplace concepts, tools, and furnishings intended to support collaborative activities [7].

Heerwagen et al. [7, p511] stated: ‘Unfortunately, the burgeoning body of research on collaboration is highly specialized and not readily available to designers, workplace consultants and manufactures. As a result, the design of contemporary office environments is often based largely on intuition derived from personal experience or from highly simplified accounts of the academic literature applied without reference to this literature’s underlying association of physical design with the nature of work’.
According to Davenport [8] knowledge workers are responsible for sparking innovation and growth in the organization. This implies that effective, well-performing and satisfied knowledge workers are essential for organizations that emphasize novelty and growth. To design workplace environments and solutions that benefit such organizations and intrinsically satisfy the employees’ working needs, is accordingly important. In order to do this, the designer has to understand the variable challenges and needs of each knowledge worker, which depend on both physical and psychosocial aspects, as well as the type of work process and task.

With respect to the work culture and ethics of the 21st century, Michael O’Neill, senior director of workplace research for Knoll, Inc., states that there will be a ‘massive shift’ in workspace design as Generation Y, born around 1980 onwards, takes on the work life [9]. Generation Y’s use of technology in interaction undermines the importance of lengthy meetings and formal spaces, according to O’Neill. O’Neill conjectures that the shift will happen within eight years. Other research reveals the same trend, and there is accordingly a need for investigations of the new ways of working and the consequences for workspaces design.

This article aims to identify key aspects, activities and behaviours associated with collaborative knowledge work in distributed teams, based upon three different dimensions of the collaborative workspace: the physical, virtual and social dimensions. Furthermore the article will discuss these dimensions in light of workspace design and the changing attitudes of the workforce.

The article is divided into eight sections. The first section gives an introduction to the topic of investigation, while section two explains the research method. Section three gives an introduction to knowledge work, whereas section four discusses teamwork. Section five discusses workspace from three different perspectives; physical, virtual and social. In section six findings from the previous sections are further elaborated taking into consideration a wider variety of context and applications. Section seven presents a discussion of the findings and the consequences for the design of workspaces, whereas an overall conclusion is given in section eight.

2. RESEARCH METHOD

An extensive literature review, using different sources, such as journals and books, has been adopted as the main research method to build up a systematic argument for finding what aspects are essential to consider when designing workspaces for knowledge workers engaged in distributed collaborations. These aspects have been investigated from different perspectives; Human resource management, business management, work psychology, information and communication technology, and architecture, design and facility management. Search words, such as collaboration, knowledge work, office environment, workplace, workspace, employee performance and well-being, have been used in various combinations. The information is further used to give an overview of aspects which affect collaborative knowledge work.

3. KNOWLEDGE WORK AND WORKERS

3.1 What is a Knowledge Worker?

In organizations worldwide the importance of the knowledge worker is increasing. The term ‘knowledge work’ was introduced by Peter Ducker in Landmarks of tomorrow (1959) to describe work that primary comprise mental processes rather than physical labour [7].

A knowledge worker is described as anyone who creates, develops, manipulates, disseminates, distributes or uses knowledge in order to produce complex, intangible results to provide a competitive advantage or other benefits contributing towards the goal of the organization [1, 4, 10].
According to Davenport [8, p10] ‘Knowledge workers have high degrees of expertise, education or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge.’ Davenport [8, p10] said further that knowledge workers think for a living. They live by their wits, and ‘any heavy lifting on the job is intellectual, not physical’.

The rise of knowledge workers has occurred with a shift from validations based on tangible to intangible assets. The focus on intangible assets has increased with competitive pressure in the knowledge economy [4].

Ducker saw the importance of knowledge work already in the 1960’s. He stated in The Age of Discontinuity (1969) that: ‘To make knowledge work productive will be the great management task of this century, just as to make manual work productive was the great management task of the last century’ [cited by 8, p8].

In 1997 Ducker claimed in the article ‘The Future That Has Already Happened’ that: ‘The productivity of knowledge and knowledge workers will not be the only competitive factor in the world economy. It is, however, likely to become the decisive factor, at least for most industries in the developed countries’ [cited by 8, p8].

According to ambiguous definitions of knowledge work and knowledge workers, it is impossible to specify the number of knowledge workers in the world. However, one can be almost certain that there are more knowledge workers in advanced economies, such as Europe and the United States, regardless of the definition of the term [8]. Davenport [8] argues that knowledge workers comprise between a quarter to a half of the American workforce.

3.2 What do Knowledge workers do?

In the last twenty years the productivity and performance of knowledge workers has been investigated through numerous studies (Davenport et al., 2002; Davenport 2005; Bosch-Sijtsema et al., 2010, Dul et al., 2011). In order to make knowledge work a resource and a competitive advantage for the organization, it has to be shared with others. As knowledge work is highly cognitive and highly social, knowledge workers have to collaborate to achieve the best result possible [7].

Research shows that knowledge work is typically accomplished in four different modes. Nonaka and Takeuchi first described these modes in The Knowledge-Creating Company (1995) [cited by 12, p2-3]. The architect and industrial design offices Gensler and Steelcase both emphasize these four modes; learning, collaborating, focusing and socializing, when designing workplaces.

Learning is about building knowledge. In today’s economy the ability to build knowledge is a criteria for successful businesses [13]. According to research by Steelcase [12, p2]: ‘When thinking is made visible to others, learning is accelerated and becomes a part of the organizational culture’.

Steelcase’s research conjectures that knowledge intensive work often is done in collaboration with others rather than individually. The benefits of working together are emphasized and when the collaboration is ideal, contributions from all team members are respected and brought together to leverage the group’s shared mind [12].

Focusing is a necessity for knowledge workers, as they need uninterrupted time to concentrate and attend to specific tasks. To focus effectively, employees need to be free of distractions and in there own ‘mental zone’ [12, 13].

Socialization is key in order for knowledge to be fully internalized and useful. When employees communicate and work together in both formal and informal manners, learning and trust are built [12, 13]. Socialization is therefore essential in collaborative knowledge work.
4. COLLABORATION AND TEAMS

4.1 What is Collaboration?

Bedwell et al. [14, p130] defined collaboration as ‘an evolving process whereby two or more social entities actively and reciprocally engage in joint activities aimed at achieving at least one shared goal’. Collaboration is in short defined as ‘working together towards a common goal’ [7, 12], but effective collaboration necessitates both individual focused tasks and interactive group work [7].

According to Erhardt [6], team-based knowledge work is a multidimensional construct consisting of three different processes: knowledge sharing, knowledge creation and team learning. Knowledge sharing comprises the exchange of both tacit and explicit understanding through various means of interaction, such as formal or informal meetings, either physical or virtual. Knowledge creation includes ‘expanding on an individual’s understanding and creating new knowledge’ [6, p90] and applying it, which is a highly social process. Errors and obstacles in knowledge creation enable team learning: a process, which team members engage in [6].

Harrison et al. [7] stated that there are indications that collaborative work is increasing as a proportion of work time, and that it yields the highest value for an organization compared with other activities. Complementary research show similar results. For example, at top-performing companies, workers see collaboration as being twice as important as their individual focused work [13]. This implies that collaboration is a vital aspect of a knowledge worker’s weekday.

Knowledge work is by all means highly collaborative. According to Davenport [8] knowledge workers are dispersed across the organization’s structure, locations and even the globe. Additionally the art of their tasks require knowledge workers to collaborate effectively with others in various functions, physical locations, time zones and organizations [8]. A team’s structure depends on the location of team members and the team interaction. The next paragraphs introduce four different team structures.

4.2 Co-located and Distributed Teams

In co-located or conventional teams employees work together from the same location and communicate face-to-face, whereby engagement in most interactions are done synchronously [15]. According to by Heerwagen et al. [7] teams benefit from co-location because it aids on-going interaction, information sharing, crisis management and spontaneous meetings. At the same time it is important to remember that not all teams are able to meet face-to-face, even if they prefer it.

In distributed teams, on the other hand, employees operate from different locations. According to Ware [16] any of the following three conditions characterize distributed teams: i) Individual workers are in different physical locations, ii) Most normal communications and interactions are asynchronous, and iii) Not all individual workers are employed by the same organization, or they are working in distinctively different divisions of a parent organization.

Allan states in ‘Managing the Flow of Technology’ (1971) that team members who are situated more than 30 meters apart are distributed, and that they communicate in a different manner than teams who are situated closer together [cited by 7, 17].

In global organizations it is common to generate teams that are not co-located to encourage diversity and exploit the competences of the employees. This trend is made possible by mobile technologies such as videoconference and collaboration software, which have granted work from being bound to a particular place and time.
4.3 Virtual Teams

A virtual team is characterized by the fact that a considerable part of the team’s communication is through the media, and usually the team members are distributed in space or even in time. Being virtual is a matter of degree; a virtual group, team or organization is not necessarily a definite form, but a structure of relationships depending on time, space, culture and organizational boundaries [18].

According to Martins et al. [5] virtual and conventional face-to-face teams perform differently in different task types. Face-to-face teams perform significantly better than virtual teams for negotiation and intellective tasks. Virtual teams outperform face-to-face teams in brainstorming and idea-generation, due to no interruptions from other team members when talking. However, no differences were found in decision-making tasks. Further research on the influence of social context on team performances showed that virtual interaction increases the amount of time required to accomplish tasks [5].

4.4 Mobile Workers and Mobile Teams

Randy Howder, a design strategist with Gensler, stated that at any given time in a typical North American office, 60 to 70% of the desks are empty [13]. Employees can work from different locations within the organization’s office building being campus mobile or outside the office working from a customer, at home or while traveling [10]. This is in accordance with an overall trend where employees choose where they want to work from, which Davenport et al. [1] emphasized as an essential measure to keep knowledge workers’ satisfied.

The term ‘mobile’ is often used to describe and discuss units that can be moved freely or easily, within different contexts of individual work and teamwork. According to Andriessen and Vartiainen [18, p6] ‘mobile workers are employees that work at and move between different workplaces’. Although the term mobile is often used to describe individuals, teams can be mobile to a certain extent, when all or some of the team members are physically mobile during the work [18].

4.5 The Different Team Structures

The nature of the different teams is complex, due to the various overlapping features. A co-located or conventional team can work virtually, although the team members are situated at the same location. Similarly, a mobile virtual team is distributed, but a distributed virtual team is not necessarily mobile [15]. The four different team structures and their main characteristics are presented in Figure 1. Määttä [15] categorized the team structures as either conventional or non-conventional. The terms ‘telework’ and ‘remote team’ are also used to describe non-conventional team structures. Harrison et al. [4, p158] defined teleworking or remote working as ‘work practices where individuals conduct work away from the main office using computers and telecommunication’. Thus, virtual, mobile and distributed workers can be characterized as remote workers.

![Figure 1: Different team structures and characteristics (Määttä, 2012)](image)
5. THE WORKSPACE

Team structure and work process largely influence collaborative knowledge work. One other important utilization for collaborative knowledge work is the workspace, which refers to the environment and context of the work.

As an example, Martins et al. [5] underlined the impact of social context when using virtual workspace. This is in accordance with the findings of Vartiainen [19], who has studied the workspace of multi-locational knowledge workers. The term ‘workspace’ refers to the combination of physical and virtual space used in knowledge work. In addition, Vartiainen addressed a ‘mental or social space’, which includes employees’ shared thoughts, cognitive constructs, ideas, beliefs and mental states.

According to Vartiainen [19] the job of knowledge workers is compound and blurred. Employees work alone and in collaboration with others; asynchronously and synchronously, virtual and face-to-face. Heerwagen et al. [7] also painted a picture of knowledge work as complex, opportunistic, non-linear and improvisational work. Davenport et al. [1] emphasized the complexity of knowledge work and that the employees have different needs associated with different work processes. The needs for support from the physical, virtual and social space depends on several factors, such as the type of task, team structure and personal preferences.

5.1 The Physical Workspace

According to De Croon et al. [20] there are three dimensions of which describe an office concept: The office location, the layout of the office and the use of the office. The office location is accordingly the place at which the employee carries out job activities. The employee might work from the organization’s office, or from home or other locations through the telework office, being virtual. The office layout refers to the arrangement of workstations in the office. Whether the workplace has an open-office plan or cellular workstations affects the office layout. The office use refers to the manner in which a workstation is assigned to an employee, or if the workstations are shared among colleagues. A fixed workplace is a workplace dedicated to one employee, while a shared workplace is assigned to a range of employees.

The physical workplace has a significant impact on the productivity, performance and well-being of knowledge workers [1, 7, 10, 11]. The office plan, whether it is closed or open, with dedicated or unassigned desks, affects the work and interactions of knowledge workers. The intention of the open office, which was introduced about sixty years ago [21], is to increase interactions, flexibility and collaboration [3]. Cost considerations are also an important aspect, since an open office solution usually allows increased density of desks.

According to Davenport et al. [1, p25] ‘fad, fashion and faith drive most decisions about new work environments for knowledge workers.’ Additionally Davenport et al. [1] emphasized finance as an important aspect when deciding on an office plan.

The architect office Perkins + Will [22] organized workplace strategy concepts into six different...
categories; private office, collaborative workstation, shared workstation, unique work process station, non-territorial work setting and remote workstation. The categories are mutual exclusive, but they are often used in co-occurrence to match different work processes and needs of employees.

The traditional private office concept refers to a specific, dedicated workstation or office, where an individual works independently.

A collaborative workstation is a collaborative concept, where a group of people are assigned to a flexible setting within an enclosed or open space. The workstation is assigned to the team for various durations, depending on the requirements of the team and task.

The term shared workstation is used when two or more employees work in a ‘specific, dedicated work setting either at the same time or at different times (as in shift work)’ [22, p3].

When a team is working in a dedicated setting that is designed specially for their task, it is called a unique work process station. These workstations often house specialized equipment and furnishing.

In non-territorial work settings the employee works in one of a pool of unassigned workstations. The workstation is allocated to the employee on a temporary basis. In some organizations the employee reserves a workstation through a formal process, while other organizations adopt a first-come, first-served practice.

When the employee works at an off-site location, but communicates with the main office through ICT, it is called a remote workstation. The employee can work from home or other locations, such as a customer’s office or the organization’s satellite offices.

The last decade the concept of mobile employees in a non-territorial or remote work environment has been applied in numerous organizations. These new solutions have been carefully discussed, and researchers conjecture that there are connections between the physical work environment and performance, creativity and efficiency [7, 11, 12, 13, 17, 26].

According to Backer and Sims [21], finding the right solution for the physical workspace requires an understanding of the context, purpose and nature of work being done. ‘We don’t buy a Porsche to haul a piano. We by (or rent or borrow) a pickup truck’ [21, p10].

For mobile workers the organization’s office might not be the main workspace. In these situations it is essential to have an efficient virtual workspace to spark and ease collaboration.

5.2 The Virtual Workspace

The virtual workspace is the combination of communication technologies, such as e-mail, real-time chat tools (instant messages), virtual meeting rooms and teleconference software, which enables teams to collaborate without conventional face-to-face meetings [23]. The virtual workspace is an electronic work environment, based on the Internet or an intranet, where a team can work together, store, exchange, view and edit documents, and send massages. The team communicates and collaborates as avatars or as themselves [18].

Physically distributed and mobile teams often interact through such digital infrastructures and mobile tools to perform their tasks, and in these situations the teams can be characterized as virtual. Today, most co-located teams also utilize the virtual workspace to some extent when collaborating.

For teams that are not able to meet face-to-face, a well-executed virtual workspace is essential to maintain a natural workflow. Additionally, social presence is an important aspect of the virtual workspace for providing the team with easy
interactions and natural workflows. Wilson [24, p139] described social presence as ‘the extent to which a technology makes people feel a personal connection with others’. Social presence is important for gaining trust, which is an essential factor for top-performance collaboration.

5.3 The Social or Mental Workspace

Collaboration in its true sense has several critical social or mental components that are essential to take into account when investigating teams. Collaboration includes both professional and private conversations, which require both intellectual and social processes [24].

According to Wilson [24] there are three concepts related to teamwork; trust, mental model and team boundary, which have special relevance to collaboration in distributed and virtual teams. Trust is an essential aspect of collaboration, and it occurs on different levels. The team members have to trust each other in order to peak their contributions and performances. The trust of inputs from other team members and the reliability of communications are essential factors. An additional display of trust has less to do with the professional aspect of the team and more to do with the trust of support and comprehension from colleagues. This is in accordance with Nonaka and Takeuchi, who stated that the work mode socialization is essential for building trust among colleagues [12]. Wilson [24] conjectured that trust is even harder to build in a virtual team than a co-located team, since there is a lack of face-to-face and day-to-day interactions.

A team mental model is a clarification of the ‘types of beliefs, perceptions and knowledge that might be held across a whole team’ [24, p137]. A shared mental model can be described as the extent to which team members have parts of a mental model in common. A shared mental model implies that the team members have a common understanding of problems, and that task and functions can circulate without decreasing its performance. A distributed mental model is sometimes preferred, where the team members differ in their model. By bringing the different views and perspectives together, the team has a strong basis. Wilson [24] stated that distinguished investigations are required in order to know how a team mental model should be supported.

The team boundary and its management is the third concept of importance when considering virtual collaborative work, according to Wilson [24]. How the team acts upon external input, how it interact with others, and how the circulation of team members is accomplished influence the team boundary.

6. A COMBINATION OF SPECIAL FIELDS

There has been an increased focus on collaborative knowledge work the last decade, largely due to the rise of distributed, virtual and mobile teams. Researchers from all over the world are investigating the new ways of working, and its consequences for the individual and the workspace. The topic is investigated from different perspectives; among them work psychology, human resource and business management, architecture and design, and ICT-development, as shown in Figure 3.

Figure 3: The special fields involved in development of collaborative workplaces
Studies from architecture and design journals often regard how the physical work environment affects and facilitates collaborative knowledge work, and take office layout or ergonomics into account. The independent Norwegian research organization SINTEF has a department dedicated to research offices and work environments. Companies, such as Steelcase and Gensler, continuously investigate the needs of the office worker in order to improve the workday of their customers. Both companies publish their findings in different journals and magazines.

Articles from ICT journals mainly focus on the virtual space and supportive technologies, and how these affect the employee’s workday. There are also studies that investigate collaborative knowledge work and the utilization of the workspace from a human resource management and business management perspective. Hereby work psychology is considered an important contributor to the investigation of collaborative workspaces. To elaborate on the psychosocial dimensions of collaboration with respect to office settings, the following issues are readdressed before proceeding to the discussion. These issues are the influence of the physical workspace, aspects to consider when designing the physical workspace and the new employee: Generation Y.

6.1 The Influence of the Physical Workspace

Numerous studies indicate that there are correlations between the design of the workspaces and work environments, such as team structure and office location, layout and use, and team or employee performance, effectiveness, satisfaction and creativity.

Davenport et al. [1] have studied how organizations handle knowledge work and knowledge workers’ performance, and suggested a framework for improving knowledge worker performance from a business management perspective. According to the study, it is essential to recognize that knowledge workers are not a homogenous group of employees. Knowledge workers from different organizations, but also within a team, differ in terms of work processes, status and influence, and work environment. Additionally the degree of choice is important, regarding inter alia from where and how to work. Providing knowledge workers the opportunity to decide some aspects of their workday increases satisfaction, which is important for performance [1].

Heerwagen et al. [7] reviewed the body of research on the links between physical space and collaboration in knowledge work settings in order to make already known facts more accessible. According to the study, the social dimensions of collaborative knowledge work include three main components: awareness, brief interaction and collaboration (here defined as ‘working together’) [7].

According to Heerwagen et al. [7] awareness refers to the on-going process of knowing what is happening in the surrounding space. This is knowledge of co-workers’ location, activities and intentions, and is perceived through peripheral channels. Brief interaction involves both social interactions, such as quick personal exchanges and joking, and functional communications such as asking questions, checking facts and passing on information. Collaboration refers to the sessions where the employees actually work together. These working sessions can be both planned and spontaneous, and have various durations, from minutes to hours.

Heerwagen et al. [7] stated that in order to facilitate collaborative knowledge work through workspace design, attention has to be brought to these social dimensions. This is in accordance with Vartiainen’s [19] focus on the three components of the workspace, where there are strong relations between physical, virtual and social space. The four modes of knowledge work presented by Nonaka and Takeuchi [12] also have correlations to these social dimensions, as the ability to communicate on different levels with colleagues is emphasized.
Heerwagen et al. [7] drew attention to the difficulties of distributed teams regarding social dimensions. According to Hindis and Kiesler [cited by 25, p104]: ‘In distributed work, there is considerable uncertainty about others’ behaviours. To reduce uncertainty, group members need information about the remote work and what other group members are doing’. The statement coincide with the focus on awareness of other team member and on going processes, introduced by Heerwagen et al. [7], in addition to the importance of trust, which Wilson [24] emphasized.

6.2 Aspects to consider when designing a distributed workspace

The three components of the workspace; the physical, virtual and social space, have to be investigated and regarded when designing a work environment. Fruchter et al. [17] have investigated the challenges of knowledge workers in high tech global project teams through the ‘bricks-bits-interaction’ framework presented by Fruchter in Bricks & Bits & Interaction (2001) [17]. The framework is based on the conjecture that to be able to understand the needs of knowledge workers, the physical space (bricks), ICT and virtual tools (bits), and work processes, practices and communications (interaction) have to be considered. The three components of the knowledge workspace presented by Vartiainen [19] are in accordance with the bricks-bits-interaction framework for investigating workspaces.

The study by Fruchter et al. [17] conjectured that the continuous adjustment to new places to work, and a tension between perceived collocation and actual geographic distribution in collaborative knowledge work affects the productivity and performance of knowledge workers.

These findings are in accordance with research by Bosch-Sijtsema et al. [10] on how mobile desk offices influence the effectiveness and work of knowledge workers. The research showed that the perceived productivity and effectiveness of mobile desk workers was significantly lower than of employees with a dedicated desk. Other revealed obstacles where i) general navigation in the office, ii) problem finding and reaching colleagues, iii) distractions and interruptions, and iv) lack of identification with the team and colleagues.

When developing a distributed work arrangement there are four essential factors which have to be considered according to Roper and Kim [25]: i) The organization and its objective and culture, ii) the worker and its preferences and abilities, iii) the work type and processes, and iv) supportiveness from ICT and the office. Roper and Kim [25] emphasized a human-centred approach when developing workspaces, since people are the most important asset of any organisation, especially in knowledge work. People’s social and psychological needs have to be recognized and met.

Investigation by Karoui et al. [27] emphasized two aspects that affect efficient collaboration in virtual teams: the context and style of the collaboration. The collaboration context refers to the complexity of the task, the team’s size and history, and to which extent the team is virtual. The collaboration style relates to the convergence between chosen medium of collaboration and the adopted managerial approach of the virtual team. Context and style are accordingly closely linked [27]. These aspects are related to human resource management and business management, as they emphasize the regard the team’s composition.

6.3 The new employees - Generation Y

As Roper and Kim [25] emphasized, the worker and its preferences and abilities have to be considered when developing a workspace. The generation called the Baby Boomers, born between World War 2 and the mid 60’s, and Generation X, born in the late 60’s and 70’s, constitute the largest portion of today’s workforce [9, 28]. Generation Y, born around the
1980’s onward, has just started to take on the working life. This generation has a different perspective on communication, technology and interaction than former generations. According to Johnson Control [28, p45]: ‘The Generation Y do not just adapt to new ways of doing things in the digital realm, they internalize them and make them their own’.

Therefore, Generation Y has other needs and preferences, such as quick shifts, instant interactions through various media and increased social openness. Eight years from now, this generation will make a distinct mark on the workforce [9, 29]. Hence, the characteristics of employees are in constant change. It is however important to remember that even if Generation Y is an increasing part of the workforce, Generation X and the Baby Boomers are still working. Although Generation Y prefers open offices and are comfortable working in the virtual space [28], the other generations also need attention to their demands and preferences.

Research shows that it is essential for Generation Y to identify with and feel that they own their workspace in order to be satisfied [28]. According to Johnson Control [28], 56% of the Generation Y workforce prefer flexible working hours and work locations. This implies that collaborative knowledge work in distributed, mobile and virtual teams will continue to increase in the future.

7. DISCUSSION

This section will discuss context, elements of knowledge work and the importance of trust with respect to distributed and co-located collaboration.

7.1 Context

Through the review of literature from the special fields presented in Figure 3, several factors that influence workspaces for collaborative knowledge work were revealed. The most suitable workspace solution for a team depends on the team’s structure, and its work processes and tasks. To be able to use the insights provided on collaborative work environments is essential in order to create workplaces that encourage the employee to peak performances. According to Davenport [8] it is important for organizations to keep their knowledge workers satisfied in order for them to perform.

There are studies today, which combine these special fields and aim to improve the collaborative knowledge workplace. More research is however needed to examine how the workplace affects different types of knowledge work and how to facilitate the new generation of employees.

Generation Y will within 2020 comprise about 50% of the workforce [9]. Studies on how their attitudes, behaviours and preferences will affect the working life are significant. These studies must be combined with knowledge from the special fields presented in Figure 3, to ensure that the workspace is prepared for the future.

7.2 The components of knowledge work

The four components of knowledge work; learning, focusing, collaborating and socializing, has to be considered when developing solutions for distributed teams, since the mobility of the workforce is increasing. Within this context Generation Y emphasizes flexibility and the opportunity to decide from where and when to work. The need for flexible work conditions contra the increased mobility affects the four components of knowledge work.

Generation Y emphasizes collaborative learning, and has high expectations when it comes to learning [29]. To design a workspace that facilitates learning as a collaborative activity is becoming increasingly important, as collaboration and learning will co-occur in the future workspace. Consequently, the workspace has to be flexible and multifunctional to an extent which allows for both activities to foster.
As the workspace increase in flexibility and the employee increases his mobility, the need for a place to focus might rise. At the same time the employee can choose a remote place to work from, when deep concentration is required. The workspace has to prepare for both scenarios through the design of physical and virtual space.

Whereas Generation Y is known for not clearly distinguishing boundaries between personal and professional life, the component of socialization has to be carefully considered when designing a workspace. Therefore, continuous investigations and updates on how social interactions and relations should affect the performance and workflow of knowledge workers are needed.

It is, however, not enough to keep Generation Y satisfied as long as preceding generations also are partakers in collaborative work. The employees’ preferences and abilities largely affect the use of the workspace. To find the solution that best fits the organization and employees’ needs requires patience and willingness to test non-conventional solutions. Generation Y might be more flexible to try these new solutions than former generations [28]. To pay attention to the employees’ needs when designing the workspace indicates acknowledgement of the employee and its contributions to the organization, which is vital for building trust.

7.3 Importance of Trust in Distributed Teams

To build trust within a team is essential in order for the team to perform [24]. The team members have to trust each other, but also the support from the workspace, especially the communication tools.

Collaborative knowledge work is designated as highly social [7], and the ability to trust colleagues on a personal level, as well as on a professional level, is increasingly important. Borders between professional work and private activities are less defined in the Generation Y era [9]. This implies that the social aspect of the working life is changing, and that the workspace has to meet these changes.

To design workspace solutions that foster the social dimensions of collaboration [7], is accordingly essential. For conventional teams the social dimensions can be met by both the physical and virtual workspace. For a distributed team, on the other hand, the virtual workspace might be the most important, or only, enabler for social interaction and trust building.

With respect to the previous paragraph, the assurance that team members are doing their part of the job is not as easy to contain in a virtual team, but essential for building trust. In order for team members to do their part of the project and give their best, they have to be reassured that the others perform accordingly. Therefore, team management, team style and managerial boundaries, are indispensable in facilitating collegiality and work ethics in this complex virtual workspace.

8. CONCLUSIONS

In order to develop and design workplaces that benefit the organisation by fulfilling the needs of its employees, knowledge from different special fields has to be integrated. The workplace has a physical, virtual and social dimension, and all these three dimensions have to be considered when designing solutions for either dimension. Special fields such as work psychology, human resources and business management, facility development, and ICT have to be regarded in order to design workspace solutions that foster peak performances and satisfaction.

Knowledge work is complex and non-linear, and work type and process will vary among industries and even among organizations within the same industry. Understanding about typical industries and organizations that are implementing new workplaces is essential in order to gain ideas from theories, concepts and past examples about
how a collaborative knowledge work culture has been implemented in workplaces

Designing an appropriate workspace for a team requires insights on the constellation of specific teams, its structure and processes. Hereby, a human-centred design approach is desirable in order to find the needs of the employees as well as the overall needs of the organization.

On a final note, selected studies have been conducted, which addressed knowledge creation and facilitation within the physical, virtual and social workspace. At the same time the workplace is facing a massive shift as Generation Y takes on the working life.

More research is needed to examine how this shift in collaborative knowledge work can be better understood within a distributed team. This understanding should lead to the institutionalization of guidelines and recommendations, which can be adopted in real-life practice. Important factors, which need to be considered in further research are:

- Trust building
- Balancing professional and private routines
- The role of the office
REFERENCES


