

An Integrated Approach to the Ground Crew Rostering Problem with Work Patterns

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Causes of work-related stress and individual strategies in knowledge work



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ABSTRACT

Recent studies point to work-related stress as an increasing problem for knowledge workers. This is a critical and not fully uncovered problem. The working life in knowledge-intensive companies is often described as good and stimulating. This study shows that some aspects of knowledge work can have a negative impact on daily activities and cause frustration and work-related stress. The study also finds that few primary preventive activities have been initiated.

Based on an empirical study, the authors outline the characteristics of the job as knowledge worker and how it is being experienced. The study also points out the activities causing the problems, how the problems are managed, and the reason for the approach used. The study and conclusions are based on qualitative research in five knowledge-intensive companies.

Knowledge work is described simultaneously in both positive and negative terms – it can be both exciting and stressful. With regard to causes, it is evident that the strains of knowledge work are often caused by the organization and management of the knowledge worker. Autonomy and individualized responsibility causes both a formal and informal transfer of responsibility to the individual for his or her working life. Self-managed knowledge workers thus experience that they stand alone when it comes to work-related problems and stress. The stress intervention applied is characteristically short-term and focused on the individual. The individual perspective consequently affects the long-term prevention, which focuses on changing the organizational and managerial circumstances. It is however possible to change this approach, if both managers and employees become aware of the problems and see the impact of their consequences. If working processes were optimized, the various benefits could be reduced absenteeism and turnover, higher productivity etc.

1. INTRODUCTION

Work-related stress is a well-known phenomenon. At the turn of the century, the World Health Organization WHO stated that more than 50% of workers in industrialized countries complained about stress at the workplace (WHO, 1999). In Denmark, a survey carried out by The National Institute for Public Health has shown that about 44% of the Danish population have experienced stress (Statens Institut for Folkesundhed, 2003). The problem of job-generated stress is multifaceted and can affect the individual, the company and society (Cooper, 2001; Stavroula et al., 2003; WHO, 1999; European Foundation for the Improvement of Living and Working Conditions, 2007). It is also costly. Arnold et al. have estimated the costs to be about 10% of a country's GNP, due to sickness leave, high labour turnover, lost productive value, increased recruitment etc. (Arnold et al., 1998).

Studies focusing on strain, workload, work-related stress etc. typically concern industrial or traditional service companies, especially mass service, and rarely knowledge-intensive companies (European Foundation for the Improvement of Living and Working Conditions, 2007). The work of academics, including knowledge work, is typically perceived to offer a good and developing job with working conditions that are characterized by a high level of influence, control, flexibility, autonomy etc. Earlier studies find that such working conditions reflect a good psychosocial environment. These studies are typically based on the work of R. Karasek and T. Theorell and their job demands – job decision latitude model (Karasek, 1979; Karasek & Theorell, 1990b).

Despite employee control and influence, recent studies point out that work-related stress is an increasing problem for knowledge workers (Ipsen, 2007; Mogensen et al., 2008; Ipsen, 2006). Although the working life is often described as good and stimulating, several studies indicate that

knowledge work has characteristics that can cause frustration, work-related stress and reduced performance (Djøf, 2005; Stavroula et al., 2003; WHO, 1999; Ipsen, 2006; Buch & Andersen, 2008; Kalimo, 1999).

The share of knowledge workers experiencing work-related stress has been questioned. A Danish survey performed by the National Institute of Public Health shows that the number of people occasionally experiencing stress increases with their educational level: from 24% among those with less than 10 years of school and professional experience to 58% among those with more than 15 years of education (Statens Institut for Folkesundhed, 2002; Statens Institut for Folkesundhed, 2003). In addition, a survey performed by the Danish Association of Lawyers and Economists shows that every 10 of their members has had sick leave due to stress, and 28% are disturbed by stress (Djøf, 2005; Holt & Lind, 2004).

These surveys thus imply that knowledge-intensive work entails problems of organizational stress. However, systematic knowledge on prevention practices is still limited; it is therefore necessary to broaden the conceptualization of stress management, if preventive actions are to be applied in new areas like knowledge work.

Against this background, a study has been conducted with the overall objective to identify which stress management intervention options both managers and employees have and use in order to prevent work-related problems and stress in knowledge work. The study has been carried out in cooperation with five knowledge-intensive companies, based on a qualitative research methodology. The overall objective was reformulated into several research questions, to be investigated both in literature and practice in order to gain a more thorough understanding of the subject:

1. What characterizes knowledge work and the psychosocial environment in knowledge-intensive companies?
2. What are the organizational causes of the work-related stress problems, if they are present in knowledge-intensive companies, and are these causes interrelated?
3. What characterizes stress management interventions in knowledge-intensive companies, and what causes the actual routines?

In a forthcoming paper, options for primary interventions to prevent stress and the challenges in implementing them will be analysed.

2. KNOWLEDGE WORK AND WORK-RELATED STRESS

There are several theoretical and empirical conceptions of a knowledge-intensive company. One widespread conception is that in this type of company, knowledge transfer and knowledge sharing are crucial for survival and progress. Thus, knowledge has become the competitive parameter (Krogh & Roos, 1996). This definition covers many different branches and trades. In this study, the term knowledge-intensive company applies to a company characterized by non-material input and output, with the individuals as the primary bearers of knowledge ('pure' knowledge companies, (Alvesson, 1995)). Examples are consulting companies, law firms and universities, in contrast to companies where knowledge is also embedded in a technology (high-tech companies), such as biotech and IT-companies. In the work process, knowledge is acquired, processed, created, preserved and shared, and finally sold. The knowledge product that is developed and produced in projects is based on customer needs combined with professional and personal knowledge (Starbuck, 1992; Nonaka & Takeuchi, 1995; Alvesson, 1995; Newell et al., 2002).

Consequently, the employees become the competitive parameter in knowledge-intensive companies. This implies that in order to perform well the companies need educated and highly skilled employees with significant competences and experience. Specifically, general management and engineering consulting companies are studied, since they all fall within this framework.

Most of the literature on the management of knowledge explicitly focuses on optimizing knowledge production and what is necessary in order to accomplish this (Newell et al., 2001). Effects in terms of behaviour, working life etc. play a secondary role. However, within this type of literature, several issues can be identified which can affect the working life and thus represent potential organizational sources of stress. Such critical issues could be: conflicting conceptions of knowledge between managers and employees, the impact of reward systems, the fundamental dependency of knowledge in knowledge work, boundaries of organizational structures etc.

2.1 Work-related stress

The literature on work psychology and organizational stress present different understandings of stress problems and potential stress agents. In this study, the understanding of sources of work-related stress is based on Kristensen's identification of different organizational sources of stress, called the "Six Golden Grains" (Kristensen, 2004) (see Figure 1). The model lists six psychosocial factors that constitute the most suitable framework for a safe and sound job.

The Six Golden Grains
<ol style="list-style-type: none"> 1. Control or influence: The possibility to control working methods, work speed, breaks, tools, workspace design etc. 2. Predictability: Assignments, length of working day, future assignments etc. 3. Social support: Help is provided regarding complex and comprehensive tasks, praise is given, problems are made explicit 4. Meaning: The job performed is meaningful as others are helped, talents are developed, etc. 5. Demands: Quantitative demands (work load) and qualitative demands (degree of difficulty) must be reasonable and transparent. 6. Reward: The rewards (salary, development possibilities and appreciation) should match the effort performed.

Figure 1. Factors influencing work-related stress (Kristensen, 1999)

Earlier studies using this model conclude that good and developing jobs are characterized by the working conditions stipulated in the model. The model is well known and has been applied in numerous research projects (Kristensen, 1999; Hurrell & Murphy, 1996; Hasle et al., 2007). In this study, it provides a framework for understanding a job's actual situation and the related psychosocial conditions. In describing the characteristics of a job and the associated occupational health and safety issues, these factors are useful. However, the model encompasses a set of non-related organizational factors that are given equal status. This implies that mutual interdependencies and the relation to the basic elements in the organizational design are not addressed. A systemic approach is therefore added in order to develop an understanding of the basic organizational causes behind the risk for work-related stress.

Galbraith (2002) has presented such a model for such an approach (the "Star Model", see Figure 2). It consists of five interrelated aspects, which form the foundation for organizational behaviour, productivity and culture (norms and values). The model points out that by changing the organizational design, it is possible to change the behaviour of the employees and managers and the company's performance. In this effort, a central factor is to acknowledge the interrelation of the organizational parameters and make an attempt to align all five of them, in order to obtain the desired effect.

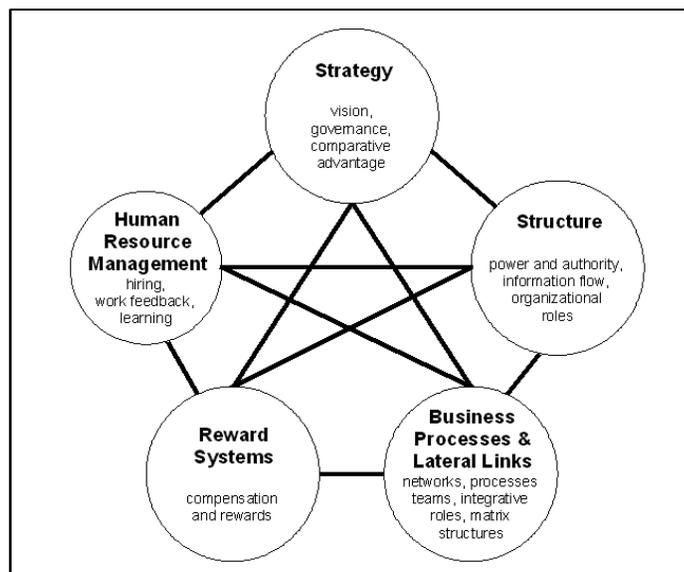


Figure 2. The "Star Model" (Galbraith, 2002)

So, by combining this model of organizational design with the "Six Golden Grains", we find it possible to aim at the work-related stressors in an attempt to reduce or moderate them in a process of a 'joint optimization'.

2.2 Three approaches to stress management intervention

Interventions to alleviate work-related stress can have numerous forms. Murphy (1988) has identified three approaches to stress management, named primary, secondary and tertiary interventions. They focus either on the organization (1°), the interrelation between the individual and the organization (2°), or on the individual (3°) (DeFrank & Cooper, 1987; Murphy, 1988) (see Table 1).

Primary intervention is characterized by stress-reduction activities aimed at stressors related to the workplace. This effort implies an identification of the organizational stressors and, subsequently, a change in the organizational structure or function. This approach is based on the assumption that the most efficient way to prevent or reduce stress is to eliminate or reduce the sources of work-related stress in the work environment, and thereby reduce the pressure on the employees. This approach is considered to be the most proactive approach to stress management intervention (Cooper & Payne 1998).

The *secondary level of stress management intervention* is also named stress management. The purpose is to create an awareness and acknowledgement of the influence of work-related stressors, and subsequently increase the employees' ability to reduce stress among themselves through a modification of cognition and behaviour. Stress management in a work-related context thus focuses on the relation between the individual and the organization and not on the work-related stressors as such. In practice, this strategy comprises meditation, relaxation, breathing techniques, conflict management tools, health programmes, and time management (Murphy, 1988).

The third approach labelled *tertiary stress management interventions* concerns treatment activities once the effects of stress-related problems have occurred. These activities contrast with a

preventive philosophy and are effective at the individual level, where they try to assist the employee. However, they tend to have a minimal impact at the organizational level. Employee assistance programmes are characterized by a number of company-initiated efforts, such as HR assistance, stress counselling, rehabilitation, return-to-work programmes etc. (Murphy & Sauter, 2003; DeFrank & Cooper, 1987). The purpose is often to help the employee cope with the stressors at work in order to be able to resume working.

Intervention level Definition and Description	Intervention Targets	Examples
1° — Primary Goal: Reducing potential risk factors, or altering the nature of the stressor, before workers experience stress-related symptoms or disease	Stressors at their source; organization of the work; working conditions	Job redesign, load reduction, improved communication, reorganizing the authority lines and restructuring of the organizational units, construction of a supporting climate, re-design or establishing reward systems
2° — Secondary Goal: To help equip workers with knowledge, skills, and resources to cope with stressful conditions	Employee responses to stressors (perceived stress or strain)	Cognitive behavioural therapy, coping classes
3° — Tertiary Goal: To treat, compensate and rehabilitate workers with enduring stress-related symptoms or disease.	Short-term and enduring adverse health effects of the job	Return-to-work programmes, occupational therapy, medical stress intervention

**Tabel 1. Three approaches to work-related stress
(Cooper & Payne, 1998; Lamontagne et al., 2007)**

Most activities, in practice, address the individual in order to improve the employee's ability to cope with stress (Kompier & Cooper, 1999; Murphy, 1988; Murphy & Sauter, 2003). The quan-

tivity of articles, self-assistance books and courses on worksite stress management indicate that this has been a distinct trend in recent years.

To conclude, the literature study shows that knowledge work focuses on the performance-oriented optimization of the processes and not on the joint optimization of performance and working conditions – and consequently, not on the psychosocial aspects and work-related stress. However, this kind of work comprises problematic circumstances which are potential sources of work-related stress. The work of knowledge workers or highly educated employees has been considered to be good and low-risk work and given priority by human factor specialists. Nevertheless, newer empirical studies and surveys indicate the opposite (Ipsen, 2006; Andersen et al., 2008; Buch & Andersen, 2008). There is thus a clash between the early findings and understandings and the theoretical study of knowledge work supported by the recent studies of psychosocial conditions among knowledge workers.

In order to address primary stress preventive actions, it is important to understand the relation between the sources of work-related stress and the organizational design of the workplace. However, this relation has not been analysed from a human factor perspective. This is a critical issue in a situation where a company chooses to initiate primary stress preventive actions, since valid activities can be difficult to define and perform, and consequently, the impact of the effort can be difficult to predict.

3. RESEARCH DESIGN & METHODS

With a hermeneutic and pragmatic starting point and an aim to analyse and explore and thus gain insight in the characteristics of knowledge work and the relation between knowledge work and the psychosocial environment, the qualitative research approach was chosen as the scope for the study. The basic premise in this study is to understand and examine a phenomenon and not to detect and document the prevalence of the phenomenon in this particular case the psychosocial working environment in knowledge intensive companies and the possibilities to prevent strains in the job. Therefore a multiple case study was conducted in five knowledge-intensive companies primarily based on interviews. Together with the multiple case study, a participatory inquiry approach was chosen. This is based on an understanding of ‘work’ as a central determining factor both for individual wellbeing and for the overall development of society- . The development of safe and sound jobs contributes to the overall development of the society. In other words the organisation of work and the working environment in terms of strains and preventive actions is of crucial importance as it has social and societal impact. In terms of organisational development it is a premise that collective reflections and actions are an integrated part in this process in order to secure sustainability of the new activities as the collective can generate more than the individual, as a responsible unit and as generators of ideas in a development process. (Mikkelsen, 1995; Kompier et al., 1998) These approaches and thus the methods were all chosen as they can provide the data basis which is relevant regarding the study’s objective.

Company	1	2	3	4	5
Company Type	Management Consulting	Management Consulting	Management Consulting	Consulting Engineer	Consulting Engineer
Size	> 100	> 100	> 100	> 100	> 100
Interviewees	•1 Knowledge Manager	•1 Knowledge Manager	•1 Knowledge Manager	•1 Knowledge Manager	•1 Knowledge Manager

	<ul style="list-style-type: none"> •1 HR Manager •1 Dept. Manager •3 employees •1 Safety Manager 	<ul style="list-style-type: none"> •1 HR Manager •1 Dept. Manager •3 employees •1 Safety Manager 	<ul style="list-style-type: none"> •1 HR Manager •1 Dept. Manager •2 employees 	<ul style="list-style-type: none"> •1 HR Manager •1 Social counsellor 	<ul style="list-style-type: none"> •1 HR Manager •1 Safety Manager •1 Dept. Manager
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Table 2. Qualitative interviews of key actors at various organizational levels

The methodological approach reflects the aim of the study, which is to analyse the mechanisms behind work-related stress and the dominating routines applied to handle such problems. The aim has not been to document the level and distribution of stress exemplified by work-load, stress measurements etc. within the enterprises. Therefore, the respondents have been chosen based on their insight into the characteristics of knowledge work and how critical situations are handled. All company levels are represented.

The companies were chosen among larger consulting companies with headquarters either in Denmark, the UK or USA. Contact was established solely with the Danish offices.

The smaller size of the population (26 respondents) offers the opportunity to focus on the depth of the collected data and acquire richness from each respondent. On the other hand the representativity might be questioned, therefore the scope of this study is to formulate hypothesis for future studies within prevention of work-related stress in knowledge work and for opening a dialogue with managers in knowledge intensive companies on preventive actions in accordance with general principles of hermeneutics.

3.1. Conducting the interviews

The interviews were conducted in during the winter of 2002 and 2003. An interview-based case study approach was used. The interviews were semi-structured and open-ended, and evolved

from a number of general questions rather than from specific ones. The questions varied depending on the respondent; however, all the conducted interviews focused on knowledge-work, how it is organized, derived problems, and the causes behind these problems, besides the dominating routines used to handle the problems (see table 3).

Employee Interview Guide
<ol style="list-style-type: none">1. What is your professional background?2. How would you characterize your tasks?3. How are your tasks organized and by whom?4. How would you characterize a typical day as a consultant?5. What are the advantages and disadvantages working as a consultant?6. What are the effects of having a flexible job?7. What are you good at in your department? And not so good at?8. Which problems would you state are typical problems as a consultant?9. What do you think causes these problems?10. If a problem arises regarding one of your tasks or in your job as a consultant – how are these problems managed and where?11. Which changes do you believe are plausible, if knowledge work is to be more effective, quality maintained and working life improved?

Table 3. Example of an interview guide used in the study

The interviews were all conducted face-to-face and took place in meeting rooms or the respondents own offices with only the interviewer and the respondent present. Typically the interview lasted for about an hour.

All interviews were recorded and transcribed afterwards. In addition, documents were analysed such as organisational strategies and diagrams, knowledge management strategies and HR-

reports regarding policies etc. presented by the respondents. Together with general workplace observations it all provided important background information which was used to develop an understanding of the respondent's perspective and understanding, which was used during the coding of the interviews and subsequent through the analysis. (Collis & Hussey, 2003; Kvale, 1994; Maaløe, 2002).

3.2 Model of analysis - organizational interrelations and causes

The overall purpose of the data analysis was to identify the organizational causes and interrelations of work-related stress problems through a cross-case analysis. As the study had an analytical and explorative aim, the search was for patterns of relations between personal experiences in the work and the characteristics of knowledge work with the aim to gain insight and familiarity with the area.

Using the programme "ATLAS ti.5" the data were structured according to a list of categories generated from the two models described: the "Six Golden Grains"(Kristensen, 1999), and Galbraith's "Star Model" (Galbraith, 2002). This approach, also termed "categorization of meaning", aims at coding an interview into categories, which are defined in advance or become apparent in the course of the analysis (Kvale, 1994). Besides the known categories unexpected findings were also found which resulted in new categories such as values, norms and performance.

• Working life	• Performance	• Values and norms
• Management of problematic issues	• Rewards	• Tasks and assignments
• Company strategy	• Knowledge work	• Organization
• Knowledge management strategy	• Knowledge sharing	• People Practice
• Characteristics of the knowledge worker		• Management

Table 4. List of categories used in the data analysis

After the first coding all the statements regarding one particular code were gathered in one document. All 15 documents were then systematically analysed using graphically displays. The data were thus clustered and interrelated with arrows where a statement expressed a connection between a personal experience of the work and the characteristics of the work. Thereby it became possible to identify subcategories and potential relations among the respondents' first-order statements. (Dahler-Larsen, 2002) This process resulted in four areas which were of relevance to the overall objective with the project.

- Organisational characteristics of the knowledge work
- Working life – the good and strain full conditions
- Causes to the personal experiences – organizational conditions of importance
- Management and interventions related to these experiences and the reasons for the particular actions/interventions.

A comparison of the models makes it clear that a related connection exists between the different organizational circumstances expressed in the Star Model, and the problems and strains experienced by the knowledge workers. It is a basic assumption that the organizational design determines the factors influencing the work-related stress expressed by the Six Golden Grains. If primary alignments are to be established, a joint optimization of production and working conditions has to be established. This opens for identification of potential primary intervention strategies.

Combining the models does not provide any instructions about how to solve the problems, but it opens for a dialogue about how the work is organized and the influence of the knowledge work on the design of daily practices and the organization, and thus the working life of the knowledge worker.

The analytical work resulted in uncovering misalignments that could explain the respondents' problems and challenges. An example is the inefficient knowledge sharing that is addressed in this article. The outcome of the analysis was verified via a first order communicative validity process (a Member Check), in which several relevant, experienced actors within the field of practice were presented with the results and asked to comment on them. This research activity was carried out in order to clarify the credibility and authenticity of the observations and conclusions (Dahler-Larsen, 2002). The Member Check showed general agreement and recognition of the picture presented regarding the characteristics of knowledge work and also provided our understanding with more nuances. As it cannot be expected that respondents can relate to or approve of a second order interpretation (Dahler-Larsen, 2002), the second order constructions were presented in different academic forums such as workshops in academia and conferences plus internal seminars with a reviewer. The aim was to test the validity of the analysis in relation to the theoretical and methodological scope of the study.

The methodology and axiology presented above provides a judicious scope for the study. However, it could implicate that individual and successful actions are not identified and credited as the study's focus is on the collective actions.

4. INDIVIDUALIZED KNOWLEDGE WORK

In general, the companies studied had a flexible organization of the knowledge worker. Based on a combination of visits, observations and interviews, it became clear that the employees were highly qualified and competent in performing complicated tasks. They were working within a system of autonomous conditions, but at the same time cooperating with customers and colleagues in order to solve specific tasks as part of the knowledge work. There was therefore a con-

tinuous interchange of personal knowledge with both clients and colleagues in order to develop new and acceptable products and knowledge. The close interaction with others constantly constituted new, unique and complex tasks to be dealt with and provide solutions for.

The organization was characterized by decentralization embedded in a matrix organization, where terms like individual freedom under responsibility and networking were emphasized in order to facilitate efficient knowledge production. The extensive network provided an internal and informal marketplace for trading personal competences, where the employees could recruit and be recruited to various projects. A central part of the job was thus to maintain a network.

Besides being part of various networks and teams, the tradition was also to understand and solve assignments individually by means of the employees' own qualifications and experiences. This implied that it was up to the employees themselves to seek the necessary and adequate information. Accordingly, employees had a mutual interest in a knowledge pool that is available to everybody whenever needed. It was also clear that knowledge was shared willingly and directly.

Knowledge was understood to be either structural or relational, depending on the respondent's organizational position (Blackler, 1995; Nonaka & Takeuchi, 1995; Spender, 1996). In simplified terms, it can be stated that the employees saw knowledge as a dynamic process in which the process to know was just as important as the knowledge. In contrast, the managers saw knowledge as objective and static. The impact of this dilemma is explained below. It also emerged clear that the personal exchange and verification of knowledge is of great importance when working with knowledge, but that the knowledge management systems supporting these processes represent a different approach.

The core in knowledge production was the non-material personal knowledge and competences of the self-managed employees. Therefore, the companies relied heavily on the intellectual capital of the workforce in order to meet market and customer demands. The strategy was consequently to develop and sustain the expert workforce by recruiting highly educated and competent people and providing them with challenging tasks and projects.

It is possible to distinguish between three types of rewards, all of which played a part in the daily management and organization of the companies (Bendix & Harbo, 2004; Netterstrøm, 2002). The *rational incentives*, such as the individual's salary, bonuses, responsibility etc., at first seemed to play a minor role in knowledge-work. It was rather the *cultural incentives* (company values, prestige etc.) and the *mental incentives* which were of great importance. The latter manifested themselves in terms of praise and the unofficial recognition and trust expressed by the social exchange of knowledge. The respondents required the challenges of difficult tasks and the creation of new knowledge, plus the possibility to contribute and make a difference for the customers. Thus, the employees see themselves as their own source of motivation. The study did provide evidence however that invoicing clients provided a rational incentive that had a serious influence on organizational and personal behaviour. This is explained further below.

The analysis confirms the picture that knowledge workers have a key position. In order to support the optimal outcome of their efforts, they are self-managed, autonomous, flexible, and responsible for their own working situation. The data gathered was used to analyse the effects of the individualization of knowledge work.

4.1 “Knowledge work - a sovereign job”

When questioned about their working life, the respondents revealed an interesting dilemma. It turned out that the working conditions that were highly valued and appreciated constituted at the same time a series of problems, which were found to be demanding and to have a severe influence on daily activities and personal experiences.

The first spontaneous response from both employees and managers when questioned about their working lives, however, was that working with knowledge was challenging and interesting. It was also understood to be an opportunity to be able to work together with competent young people who provide an inspiring atmosphere and are good friends. No two assignments or work-days were alike; there were no routines, and everyone was free to work wherever (home, headquarters or at the customers), whenever, and using whatever method on a self-selected assignment. Working hours had no set time limit, although a minimum number of hours had to be invoiced to the customers.

All together, as one consultant put it: *“Knowledge work is a sovereign job; it provides you with a lot of possibilities. It can be very frustrating and some people tend to be stressed but it is not a general problem.”* The companies also provided various services for the employees, for example children’s day care, good chefs in the canteen, organic food products, clubs, company cafés, family days etc.

Based on the analytical framework, it is possible to state that knowledge work comprises all the central aspects that support a sound and healthy psychosocial environment. This conclusion is in alignment with earlier studies of knowledge work, which conclude that active jobs have a healthy psychosocial environment (Karasek & Theorell, 1990a; Karasek, 1979; Kristensen, 1999).

4.2 “*Knowledge work – it eats you alive...*”

Besides being a sovereign job, the work also presents several obstacles. Evidently, the issues pointed out as supporting the feeling of having a sovereign job also have a downside to them.

One employee put it this way: “*Freedom is an essential part of the job; however, knowledge work eats you alive if you don’t know when and where to draw the line.*” And as another put it: “*Stress is a condition which comes with the job.*” These two statements represent a good illustration of the way the employees expressed their experience regarding knowledge work. Some stated it was stressful; and others found it frustrating always to be ahead professionally and never to be able to fulfil company demands or their personal goals within the set financial framework and deadlines. It was also frustrating to lose time due to insufficient systems, colleagues' unavailability, and the pointless search for knowledge that already existed. The lack of support and someone to complain to were also mentioned as disadvantages. The unpredictability of the tasks and customers, which was proclaimed to be a great incentive, caused at the same time a lot of stress, since it had an effect on personal performance and salary.

Traditionally, knowledge work is characterized and understood to be a privileged and active job, as stated above. Based on the experiences and statements of the respondents, it became apparent that there were two concurrent aspects of knowledge work, which constituted a paradox: the same issue could be experienced as both an opportunity and a challenge. It also became clear that individualized knowledge work had considerable impact on the daily management of problems which had long-term challenging effects.

4.3 Organizational causes of work-related stress in knowledge work

One of the major problems expressed in the study was the management, creation and sharing of knowledge. When questioned about the causes, the respondents pointed to two conditions: resources and responsibility. First, they felt that the amount of assignments did not match the resources available, in terms of money, time and hands; and secondly, they believed they had to improve their personal ability to plan their work in order to gain more time, which would lead to greater job satisfaction and better solutions. In other words, they felt that it was “*their own fault*” that these problems occurred, as one employee expressed it; thus, the problems are understood to be caused by the individual. Consequently, the solutions to the problems are primarily tied to the individual.

While acknowledging the personal influence on the problems mentioned, the focus in this study is however on the organizational factors. Using J. Galbraith’s *Star Model* (2002), it is clear that organizational conditions such as reward systems, strategy, people practice, structure and flow of information all have an influence on the knowledge flow and work performance (see Figure 2).

As knowledge creation and sharing plays an essential role it also constitute a serious problem, which has a negative impact on daily work. Employees experience that they are left on their own to seek necessary and adequate information when needed. This affects the quality and the effectiveness of their work and stresses the respondents, as their professional pride is hurt. From a manager’s point of view, this is a problematic situation as incremental innovation is neglected, posing a risk in relation to competitiveness.

Despite the willingness to share knowledge and acknowledgement of its core position, the typical *reward* systems are characterized by having an explicit focus on the individual’s per-

formance in terms of sales and producing hours. Internal tasks and processes, such as sharing knowledge and developing new concepts and knowledge, are not rewarded and are therefore not invoiced. Moreover, the individual's salary is related to the level of invoiced activities. Consequently, these core activities of knowledge work are not carried out, since they are not rewarded in practice, either financially (rationally) or culturally (in terms of prestige, promotion etc.).

The respondents stress the importance of this, as the lack of access to relevant and new knowledge causes frustration, stress, repetition of mistakes, and loss of time due to impeded retrieval of information among their colleagues. This again affects the workers' personal pride, but also the company's prospective competitiveness.

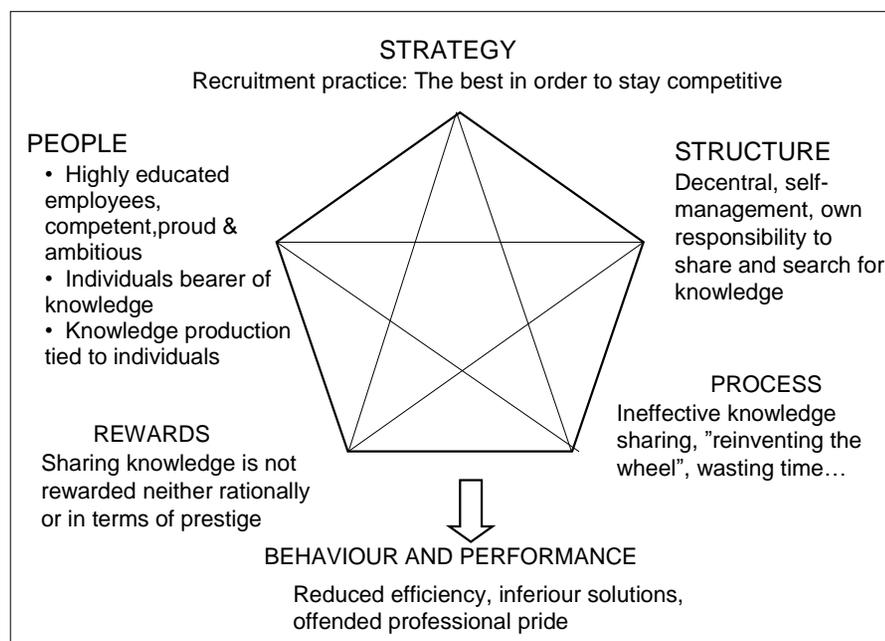


Figure 3. Organizational causes of ineffective knowledge sharing expressed via the “Star Model”

A closer look on the companies' organizational design shows that the structures mainly support self-management and individualized work, whereas collective and supporting structures that could prevent problems are missing. In combination with people's high qualifications and com-

petences due to the companies' strategic choice, the results are obvious; the organizational design is aligned in such a way that it supports individual behaviour and performance. The organizational parameters are not inherently inappropriate, but the combination of individualized structures, reward systems, strategy, highly educated and autonomous employees all contribute to a practice with a dominating focus on operations and deliveries, and less focus on activities such as knowledge creation and sharing. Performance is thus varying and fluctuating, resulting in reduced efficiency, inferior solutions, and employees who experience stress and frustration and offended professional pride etc. as part of their job.

From a company point of view, it is evident that the work processes are influenced negatively due to the mentioned problems and stress. As a result, development of new concepts, standardization of processes etc. diminish, and productivity decreases as valuable time and effort is for example put into searching for existing and relevant knowledge. Often the 'wheel' is 're-invented', which obviously has an impact on the quality of the jobs performed. Some of the managers in the study were aware of employee turnover, and in one company, exchange and recruitment of new employees had become quite costly.

Our analysis shows that the characteristics of knowledge work have both a positive and negative influence on the working life and pose potential organizational sources of stress. Accordingly, it is clear that a mutual dependency exists among the various conditions expressed in the Star Model and the employees' problems and strains. The solutions are therefore to be found in the organizational design and not simply in relation to the individual. It has also been shown that the Star Model could form the framework for greater systematization regarding the primary causes of work-related stress, with regard to the presented psychosocial factors that have essential influence on the working life.

5. INDIVIDUALIZED STRESS INTERVENTIONS

As part of the study, the intention was to identify the current management of problems with work-related stress within the knowledge-intensive companies, including the type of stress interventions carried out. When the interviewees were asked about how problems were managed, the typical reply was: *"Why handle - there are no problems. Stress is a condition and it is your own responsibility to draw the line if necessary"*. When the formally mandatory safety organization¹ was mentioned, this typically triggered a laugh and the following answer: *"To use the safety organization is out of the question; it belongs in the industry."*

It was however clear that in practice, issues of current interest such as work, organization, distribution of assignments, stress etc. were handled in an unstructured, incidental and informal manner by the employees themselves. They were primarily left to cope individually and it was their personal responsibility to draw the line. This left the employee with a sense of loneliness. The majority of the interviewees expressed that they had learned to cope with the dilemmas in their job and to balance the pros and cons.

In severe cases, the employee would take contact to the project or department manager, but on a purely informal basis. This was also what the managers encouraged them to do. The study also showed that any subsequent stress interventions typically focused on the individual in terms of individual stress management and strategies termed as secondary or tertiary interventions (Murphy, 1988). Examples of this could be coaching, mentoring, time management, cognitive coping strategies, physical exercise programmes etc. Therefore, most concrete activities were

¹ In Denmark, it is mandatory to establish a safety organization when a company employs more than five people. The objective of the safety organization is to ensure sound management of working environment issues within the company.

aimed at the individual, in order to improve the employee's ability to get back to work and be able to manage, resist and reduce the stress.

Finally, the study showed that the mandatory system was neither capable of dealing with issues regarding the psychosocial work environment nor expected to. As mentioned above, using the mandatory system was out of the question, as the safety representatives only dealt with ergonomics. So the problem of handling the problems was kept within the line organization.

The net result of the management and organizational design of knowledge work is that each individual is left with the full responsibility for his/her own job performance and working life, with a significant dysfunctional impact on both the development and acquisition of knowledge and also on the psychosocial working environment. Consequently, no preventive actions are initiated.

This conclusion is in alignment with recent studies which point at work-related stress as a critical and uncovered problem in knowledge work, affecting job performance, satisfaction, labour turnover, absenteeism etc. (Cox et al., 2000; Allvin et al., 1998; Newell, 2002; Mogensen et al., 2008; Buch & Andersen, 2008).

5.1 Causes of individualized management practice

In this study it becomes clear that self-managed knowledge work typically has a management procedure and practice characterized by personal initiative. One general explanation that becomes evident is that work-related stress is a personal problem. Several managers are inclined to blame the employee's personality and way of living before focusing on the factors for which the managers are responsible. The employee is in fact understood to be responsible for his or her own problems ("blaming the victim") (Singer et al., 1986), and solving the problems demands

“self-insight to reject assignments etc.” and *“freedom under responsibility”*, as one manager expressed it. As a consequence of this understanding, solutions are employee-oriented and employee-initiated; and therefore, in practice, a transfer and takeover of responsibility takes place.

This shift of responsibility could be due to the individualization of knowledge work. It is evident that the employees see themselves as the primary cause for the problems but also as the source of solutions. Developing competences in time management, learning to refuse projects, looking for knowledge etc. will solve their problems. So the self-managed, autonomous and flexible job with personal performance measures etc. seems to support a transfer of responsibility to the employee for his or her own working life, in addition to the responsibility for knowledge production.

This transfer is sustained by the lack of a shared forum for reflection and learning. The individualized management practice that leads to individual reflections and learning processes, concerning for example quality assurance, time management, customer characteristics and best practice, makes it difficult to make the process and the outcome explicit and collectively shared. This implies that all reflections regarding the organizing and management of the knowledge work, together with its strains remains primarily with the individual. Consequently, real preventive improvements are difficult to establish.

Another explanation for maintaining the individual approach in the present cases is the cost of organizational preventive changes. Most of the managers express that individual interventions are easy to implement and inexpensive as they involve less interruptions in an operation or in the organizational design. Besides, such an intervention can be designed to focus on each individual. In one of the companies, the HR manager expressed that HR-initiated structural changes were not welcome in the organization, as they would disturb the employees and accordingly decrease

their performance. In her mind, the employees had a “sacred status”. A similar understanding was expressed in another company, where employees were described as “kings”.

Finally, there seems to be a culture of denial in the companies studied, which constitutes a barrier for making the problems visible and for employees or managers addressing them. None of the participants would acknowledge the presence of these problems, although almost all the respondents had pointed these problems out. Instead, stress and frustration were understood as a condition of life for a knowledge worker.

All in all, the analysis indicates that the causes for work-related problems and stress in knowledge work are understood to be both private and personal in the companies studied. Evidently, most causes have their root in work-related problems, such as lack of time and resources, too many tasks, constant demands etc. This study also points to the effect of the organizational design. Evidently, there is a causal relation between the organizational work, managerial style and working environment in the participating companies. Decentralized knowledge work combined with assignment characteristics and an elitist community provide together a framework that does not support preventive actions and pro-active management of job-generated problems.

6. CONCLUSION

Optimizing knowledge work goes hand in hand with prevention of work-related stress. This study indicates, on the one hand, that knowledge work comprises working conditions that support a good psychosocial work environment. On the other hand, the net result of today’s form of management and organization of the knowledge work seem to leave each individual with the major responsibility for his or her own job performance and working life. Their scope of action is primarily on the secondary or tertiary preventive level. This implies that the organizational

sources of work-related stress are not reduced or eliminated. The analysis shows that the root causes of the problems are linked to the organizational design, and that they thus can be prevented if there is a collective focus on the organisation and management of the work. Following this new argument, future studies on prevention of work-related stress should thus focus on the improvement of the organizational conditions and alignment of the organizational design in order to improve the working conditions in knowledge intensive companies.

Reference List

- Allvin, M., Aronsson, G., Hagström, T., Johansson, G., Lundberg, U., & Skärstrand, E. (1998). *Gränslöst arbete eller arbetets nya gränser. Delstudie I* (Rep. No. 2:I). Arbetslivsinstitutet.
- Alvesson, M. (1995). *Management of Knowledge-Intensive Companies*. Berlin: Walter de Gruyter.
- Andersen, V., Ipsen, C., & Mogensen, M. (2008). Nye ledelsesudfordringer i forbyggelse af stress i videnarbejdet. In *Ledelse – brudflader og paradokser i ledelsesudfordringen*.
- Arnold, J., Cooper, C. L., & Robertson, I. T. (1998). *Work Psychology - Understanding Human Behaviour in the Workplace*. (3. ed.) UK: FT Prentice Hall.
- Bendix, H. W. & Harbo, A. (2004). *Videnledelse i praksis*. (1. ed.) (vols. 1.) København: Jurist- og Økonomforbundets Forlag.
- Blackler, F. (1995). Knowledge, Knowledge Work and Organizations: An Overview and Interpretation. *Organization Studies*, 1021-1046.

- Buch, A. & Andersen, V. (2008). Knowledge work and stress - beyond the job-strain model. In ODAM IX, International Symposium on Human Factors in Organizational Design and Management.
- Collis, J. & Hussey, R. (2003). *Business Research*. (2 ed.) New York: Palgrave Macmillan.
- Cooper, C. L. (2001). *Managerial, Occupational and Organizational Stress Research*. Aldershot, Hants, UK: Ashgate Publishing Company.
- Cooper, C. L. & Payne, R. (1998). *Causes, Coping & Consequences of Stress at Work*. Great Britain: John Wiley & Sons Ltd.
- Cox, T., Griffiths, A., & Rial-González, E. (2000). *Research on work-related stress* Nottingham, UK: European Agency for Safety and Health at Work.
- Dahler-Larsen, P. (2002). *At fremstille kvalitative data*. Odense: Odense Universitetsforlag.
- DeFrank, R. S. & Cooper, C. (1987). Worksite stress management interventions: Their effectiveness and conceptualization. *Journal of Managerial Psychology*, 2, 4-10.
- Djøf (2005). Stress fører til sygefravær - 2005. Djøfs Hjemmeside [On-line].
- European Foundation for the Improvement of Living and Working Conditions (2007). *Work-related stress*.
- Galbraith, J. R. (2002). *Designing Organizations. An executive guide to strategy, structure and process*. San Francisco, California: Jossey-Bass.

- Hasle, P., Kristensen, T. S., Møller, N., & Olsesen, K. G. (2007). Organisational social capital and the relations with work and quality of health - a new issue for research. In International Congress on Social Capital and Networks of Trust.
- Holt, H. & Lind, M. L. (2004). *Sammenhængen mellem organisationsformer og belastninger på 6 DJØF-arbejdspladser* Socialforskningsinstituttet.
- Hurrell, J. J. & Murphy, L. R. (1996). Occupational stress intervention. *American Journal of Industrial Medicine*, 29, 338-341.
- Ipsen, C. (2006). Knowledge work and work-related stress. In Congress of the International Ergonomics Association.
- Ipsen, C. (2007). *Vidensarbejderens særlige arbejdssituation og muligheder for forebyggelse af arbejdsrelateret stress i vidensarbejdet - Et kvalitativt studie af arbejdsrelateret stress i vidensarbejdet*. Department of Management Engineering, DTU.
- Kalimo, R. (1999). Knowledge jobs - how to manage without burnout? *Scandinavian Journal of Work Environment Health*, 25, 605-609.
- Karasek, R. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly*, 24, 285-308.
- Karasek, R. & Theorell, T. (1990a). Psychosocial Job Characteristics. In *Healthy Work. Stress, Productivity and the Reconstruction of Working Life* (1 ed., pp. 161-200). New York: Basic Books, Inc., Publishers.

- Karasek, R. & Theorell, T. (1990b). The Psychosocial Work Environment. In *Healthy Work. Stress, Productivity and the Reconstruction of Working Life* (pp. 31-83). New York: Basic Books, Inc.
- Kompier, M., Geurts, S. A. E., Gründemann, R. W. M., Vink, P., & Smulders, P. G. W. (1998). Cases in stress prevention: the success of a participative and stepwise approach. *Stress Medicine, 14*, 155-168.
- Kompier, M. & Cooper, C. (1999). *Preventing Stress, Improving Productivity. European case studies in the workplace*. London: Routledge.
- Kristensen, T. S. (1999). Challenges for research and prevention in relation to work and cardiovascular diseases. *Scandinavian Journal of Work Environment Health, 25*, 550-557.
- Kristensen, T. S. (2004). De 6 guldkorn. Arbejdsmiljørådet [On-line]. Available: www.godarbejdslyst.dk
- Krogh, G. & Roos, J. (1996). *Managing Knowledge. Perspectives on cooperation and competition*. London: Sage Publications.
- Kvale, S. (1994). *Interview. En introduktion til det kvalitative forskningsinterview*. (9 ed.) København: Hans Reitzels Forlag.
- Lamontagne, A. D., Keegel, T., Louie, A. M., Ostrup, A., & Landsbergis, P. A. (2007). A Systematic Review of the Job-stress Intervention Evaluation Literature 1990-2005. *International Journal Occupational Environment Health, 13*, 268-280.
- Maaløe, E. (2002). *Casestudier. Af og om mennesker i organisationer*. (2 ed.) Akademisk.

- Mikkelsen, B. (1995). Participation - Concepts and Methods. In *Methods for Development Work and Research* (1 ed., pp. 61-84). Sage Publication Inc.
- Mogensen, M., Andersen, V., & Ipsen, C. (2008). Ambiguity, identity construction and stress amongst knowledge workers: developing collective coping strategies through negotiations of meaning. In.
- Murphy, L. R. (1988). Workplace Interventions for Stress Reduction and Prevention. In C.Cooper & R. Payne (Eds.), *Causes, Coping & Consequences of Stress at Work* (pp. 301-339). John Wiley & Sons Ltd.
- Murphy, L. R. & Sauter, S. L. (2003). The USA perspective: Current issues and trends in the management of work stress. *Australian Psychologist*, 38, 151-157.
- Netterstrøm, B. (2002). *Stress på arbejdspladsen. Årsager, forebyggelse og håndtering*. (2 ed.) København: Hans Reitzels Forlag.
- Newell, S. (2002). *Creating the Healthy Organization. Well-being, diversity & ethics at work*. (1. ed.) Cornwall: Thomson.
- Newell, S., Robertson, M., Scarbrough, H., & Swan, J. (2002). *Managing Knowledge Work*. Palgrave.
- Newell, S., Scarbrough, H., & Swan, J. (2001). From global knowledge management to internal electronic fences: Contradictory outcomes of intranet development. *British Journal of Management*, 12, 97-111.

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge-Creating Company*. New York: Oxford University Press.

Singer, J. A., Neale, M. S., Schwartz, G. E., & Schwartz, J. (1986). Conflicting Perspectives on Stress Reduction in Occupational Settings: A Systems Approach to Their Resolution. In M.F.Cataldo & T. J. Coates (Eds.), *Health And Industry. A Behavioral Medicine Perspective* (1 ed., pp. 162-193). John Wiley & Sons.

Spender, J.-C. (1996). Organizational knowledge, learning and memory: three concepts in search of a theory. *Journal of Organisational Change*, 9, 63-78.

Starbuck, W. H. (1992). Learning by Knowledge-Intensive Firms. *Journal of Management Studies*, 6, 713-740.

Statens Institut for Folkesundhed (2002). *Sundhed & Sygelighed i Danmark 2000... & udviklingen siden 1987* København: Statens Institut for Folkesundhed.

Statens Institut for Folkesundhed (2003). Stress - et folkesundhedsproblem (Uge 5 - 2003).

Ugens tal for Folkesundhed - Sundheds- og sygelighedsundersøgelsen 2000 [On-line].

Available: <http://www.si-folkesundhed.dk/sundhedsportal/visnr.asp?nr=21>

Stavroula, L., Griffiths, A., & Cox, T. (2003). Work Organisation & Stress. Protecting Workers' Health Series 3. Switzerland, WHO.

WHO. (8-6-1999). The burden of occupational illness. WHO.

Recent studies point to work-related stress as an increasing problem for knowledge workers. The working life in knowledge-intensive companies is often described as good and stimulating. This study shows that some aspects of knowledge work can have a negative impact on daily activities and cause frustration and work-related stress. The study also points out the activities causing the problems, how the problems are individually managed, and the reason for the approach used.

The individual management practice consequently affects the long-term prevention, which focuses on changing the organizational and managerial circumstances. If working processes are optimized, the various benefits could be reduced absenteeism and turnover, higher productivity etc.

The study and conclusions are based on qualitative research in five knowledge-intensive companies.

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