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Digital Work Environment Rounds – Systematic Inspections of Usability Supported by the Legislation

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Abstract. Digital tools are an essential part of the work environment of many civil servants working at public authorities. They should therefore follow the prevalent work environment legislation. This paper describes a method to conduct digital work environment rounds to assess the usability of digitalized work to assess work environment risks and identify improvements. The methodology used is following a participatory action research project in collaboration between users, union representatives, managers and IT experts. The case presented in this paper describes the development of the digital work environment round in collaboration with a court in Sweden. It was based on an international standard in the making and collaboratively developed and adapted to the situation at the public authority. Based on this work the public authority has now decided to make this method a part of their annual systematic work environment management and other organizations are following in their tracks.

Keywords: Digital work environment, digitalization, usability, work environment rounds

1 Introduction

Does your computer system prevent you from doing your work in an efficient way? Have you had the chance to influence the systems you use for your work? Would you consider your e-mail a work environment problem?

More or less everybody are using computers or other digital support systems as work tools today. According to Statistics Sweden [1] 78% of all working in Sweden uses a computer in their work. The share of females is slightly higher than men. 45% uses the computer more than half the working day. 58% of the PC users use computers more than half of the working day. 20% (for PC-users 25%) use computers more or less all the time. And the problems users experience in the use of computers are high and keep increasing: 35% of everybody working complain about pain in the upper part of the back or neck every week, 29% report that they every day are sitting still in their work more than two hours without a break and 7 % in more than 4 hours without a break. 40% experience such a stressful work that they do not have the time to talk with anybody or think about anything else than work during more than half the working day.

43% experience that they never or rarely are able to control when their tasks are supposed to be conducted.

How can we work in a systematic fashion to prevent usability problems to happen in the work setting and contribute to improving the digital work environments for everybody in an organization? Our hypothesis in this project was that this could be done, based on the systematic work environment management that is mandated through the legislation controlling labor.

The purpose of this paper is to show how the legislation can serve as a powerful tool and how systematic work environment management can leverage the union employer collaboration to improve the digital work environment. I will do that by demonstrating how the digital work environment round, by being supported by the legislation, can be a powerful way of improving the digital work environment for employees in an organization.

2 Theory and related work

In this theory and related work section I will go through the historical heritage of the work, from cooperative design methods through work environment related research. I will go through work environment legislation, systematic work environment management and digital work environment as a construct. The method of digital work environment rounds is introduced and related international standards work is presented.

2.1 Computer Supported Work and Cooperative Design

There is a lot of previous work done to develop our digital work environments by means of engaging directly with the user population, such as the Work-oriented design of computer artifacts [2], the concept of Cooperative design [3,4] and Participatory Design (PD) [5]. Bødker has also in her recent work showed how the concept of participatory design can develop in the public sector with the increasing use of digital tools for work [6]. One of the reasons for the role that Scandinavian countries has played in developing the theories on cooperative design is its historically strong collaboration with trade unions and the union representatives.

In more recent approaches, Pilemalm [7] has provided an extensive overview of the development of PD over the years and shown that participatory design approaches may be redesigned for the public sector to better reflect contemporary needs for more user-centered activities. However, with the recent digital development in the work setting and the ever-increasing need of user engagement in the redesign of work and IT, there is a need to develop new ways of addressing the user perspective with a renewed interest in union collaboration and the need to focus the digital transformation not only in the collaborative design of the digital tools, but also on the redefinition of the work tasks and organization of the work. In this case study we have developed the approach to digital transformation grounded in the concept of digital work environments and union-employer collaboration to meet the needs to adhere to work environment legislation and the need to improve the development of the digital work environment.

2.2 Work Environment and Computer Systems Development and use

There is not much research that has been conducted with the purpose of understanding the relationship between digital technologies and the work environment. Hoonakker [8] investigated the development and implementation of information and communication technology (ICT) and the impact it has had on the quality of working life and concludes that the recent development of the possibilities of collaborating through digital technologies has led to increasing demands from the work and unclear boundaries between work and leisure time. Bordi et al. [9] has also showed the increasing demands on communication that the digital technologies entail, resulting in a feeling of constant connectivity, an ever-increasing volume of digital communication, deteriorating quality of the contents of the communication, adaptation of new digital tools, technical problems and flexibility in communication may have an effect on the wellbeing, if it takes away the users feeling of autonomy and control. The relationship between the work environment and the usability of the computerized support tools have been clearly expressed in Sandblad et al. [10]. Many of the common usability problems may in a work setting lead to cognitive work environment problems. Work environment considerations have in the past been included in usability evaluations methods [11]. There is a need to develop mechanisms and routines that further supports the user in developing and growing its skills in the use of the systems and putting greater demands on the usability of the work supporting systems.

This study is based on a Socio-technical perspective emphasizing the importance of seeing the organization as a whole where technical and social functions are interacting and where both influences, and are influenced, by each other. The socio-technical values are based on the fact that the needs and rights of the employees must have as high priority as the changing technical and organizational structures in the system [12].

2.3 Relationship to Legislation: Case Swedish Work Environment Law

The national or international legislation can be a very powerful tool when it comes to ensuring a high-quality digital work environment. Legislation varies in different parts of the world but the worker rights are particularly strong in the Nordic countries. Nowhere else in the world the protection of the worker's rights and explicating the employer's responsibility for the work environment is as strong.

There is legislation in place to support high quality in the computerized work tools, even if they are rarely used to sue anybody. They are, however, strong when it comes to assuring strong support for the user perspective in the acquisition, adaptation installation and development of computerized work tools. According to the Swedish Work Environment Act [13] *"A work must be characterized by variation, social contact and cooperation, the connection between tasks, the opportunity for personal and professional development, self-determination and professional responsibility."* This means that Computer systems used in work settings should be designed to meet high quality criteria not only in the system design but in what it means for the design of the digital work tasks. This means that the organization need to ensure a working environment that does not expose workers to ill-health or accidents and which is satisfactory in view

of the nature of work and the social and technological development of society; and to encourage employers and employees to work together to create a good working environment. Ensuring means that the work environment activities should be conducted in a systematic preventive way.

The Swedish Work Environment Authority has also issued regulations that, although they were derived a long time ago, still are valid for judging the digital work environments. The regulation Work with Display Units AFS [14] states that: *"Work with display units that are strongly controlled or tied physically or mentally or are unilaterally repeated may not normally occur. Systems and programs should be suitably designed with regard to tasks and users, be easy to use, be adaptable to the user's knowledge and experience level, provide feedback on the work performed, display information in a format and pace that is tailored to the user. And, special attention should be paid to ergonomic principles that apply to the ability to perceive, understand and process information. Control of the worker's work through the system must not be carried out without his knowledge."* This means that the quality of the systems needs to meet high criteria, both in terms of how they are designed and how they eventually are implemented in the work situation.

The Swedish Work Environment Law also states that *"The worker should be given the possibility to participate in the design of his/her own work situation and in changes and development that concerns the work."* This means that the law can be used not only to assure usable computer systems for work but a user-centered development processes to ensure the individual users' rights to be involved in the development.

2.4 Systematic Work Environment Management

Systematic work environment management (SWEM) is based on the fact that employers, employees and safety representatives map what risks of ill-health or accidents exist in the workplace and work together to counteract them. According to Swedish Work Environment Act, all employers must have SWEM (AFS 2001: 1) in place. SAM is normally conducted through a four-step survey in which workplace risks are 1) investigated, 2) assessed, 3) addressed and 4) followed up. This should also be done before changes in the business or organization, if a serious incident occurs in the workplace or if an employee is exposed to health risks or accidents. Risks that are detected must be assessed and prioritized and must always be documented in writing.

Systematic Work Environment Management in Sweden is also subject to evaluations. In an evaluation report published in 2003 [15] about 40% of employers claim that SWEM has been introduced in the workplace and is functioning well. 65% say that they have investigated the work environment and made an assessment of the risks, while 70% say that they have a 'good' (or 'very good') knowledge of SWEM. However, about 40% think that SWEM demands too much administration resources. No studies have been made yet on the use of SWEM for the digital work environment.

There are other countries that has similar arrangements for assessing the work environment, as for example the Risk Assessment Guidelines (APV) issued by the Danish Work Environment Authority [16].

2.5 Digital Work Environment

Digital work environment can be defined as “*the work environment, with its problems and possibilities of physical, psycho-social as well as cognitive nature that is the result of the digitalization of the tools and support systems*” [17]. This definition means emphasizes the importance of digital tools for the work environment and that the digital tools used in the professional role are a dominant part of the work environment of the employees. Robertson [18] on the other hand, defines digital work environment as a holistic set of tools, platforms and work environments delivered in a coherent, useful and productive way. He believes that the digital work environment should be considered holistic as it includes all systems, applications, connections and the physical workplace and by looking at these together, as a whole, one can take major steps to change how and where the work is done. Robertson further describes that the digital work environment should be coherent in order to coordinate tasks and projects, be useful by delivering simple and seamless user experiences that fit their workflow and productive by being structured to help employees perform their work tasks [18].

The digital work environment is a whole that includes both the technical systems used in the workplace and the context in which they are located. By looking at how people use information and communication technology in their particular context, you can get a holistic picture that includes both technical requirements and information on how the technical solution can best be used in the specific context [19]. The employer has the ultimate responsibility for ensuring that the digital work environment complies with the Work Environment Act, but according to Berg and Gustafsson [20] there is often no clear management and responsible problem owners for the digital work environment as a whole among organizations. They call for organizational coordination and a holistic view of the digital work environment to solve the problems that exist with the integration of the individual systems in the digital work environment. They believe that the individual parts of the digital work environment are often overlapping and conflict with each other because they are not developed or implemented with the specific organizational context in mind [20].

Williams et al. [21] has analyzed the concept of digital work environment in a literature review by categorizing selected research literature that addresses the concept into the three categories of organizational strategy and design, people and work, and technical platform. The first category, organizational strategy, looks at how a company's policies and strategies should be designed to promote the digital work environment. The second category, people and work, has been developed because the digital work environment should enable people to be productive in their work. Finally, the authors of this literature review believe that contemporary definitions of digital work environment have a heavy focus on the underlying digital technologies that a digital work environment can consist of, often in the form of an integrated platform that provides all the tools and functions an employee needs in their work [21].

Köffer [22] conducted a systematic review of the academic knowledge base on the digital workplace, and he identified stress and overload as one of four main research topics that affect the digital workplace. Previous research has shown that the support

and training that the users may get reduce the perceived stress and overload from technology and also that a workplace culture that encourages employees to discuss and help each other on IT usage has positive effects. Changes in the digital work environment must take into account the individual differences. The circumstances surrounding the work, environment and personal characteristics of the employees affect how the digital work environment is experienced. Changes in the digital work environment that are based on the fact that employees are a homogeneous group with the same conditions and needs fail to deal with the challenges of a digital work environment. Therefore, many researchers propose a greater focus on individual solutions that fit the individual's preferences, tasks and approaches [22].

2.6 IT Protection Rounds

It-rounds – means that the hardware, software, equipment, overview, usability etc. are checked using a commonly agreed upon checklist. The concept of IT protection rounds started at Sahlgrenska university hospital where a group of colleagues started inspecting the effects of the digital work environments on the effects and outcomes of the work. It was unfortunately not subject to scientific studies but has been influential in Sweden as a point of reference. They developed a method called MedsITtning, a form of auscultation in which colleagues inspected the work of their fellow workers with a specific focus on the digital tools. Many organizations have developed corporate or union-based methods for IT protection rounds, but most of them are available in Swedish only, such as SuntArbetsliv [23], some provide general checklists, like Prevent [24].

2.7 Standardizing the IT Protection Round

The Swedish Technical committee SIS TK380 has developed a draft standard to systematize and further develop so-called IT protection rounds (IT rounds, innovation rounds, etc.), a practice that has emerged in parallel with the debate about the need to increase the influence of management personnel and users on how the interactive systems are designed, introduced and used. The usability round (as the standard has chosen to call what we refer to as digital work environment rounds) is a method where the users, within the framework of the systematic work environment management (SAM), identify usability deficiencies and improvement opportunities in interactive systems so that measures can be formulated in the short and long term. The purpose of the usability round is to improve the working environment and thereby help to increase the IT skills of the employees and the productivity of the organization.

The purpose of the usability round is to

- a) supplement the systematic work environment management with a method that focuses on the shortcomings and opportunities for improvement of the interactive systems
- b) reduce the risk of cognitive and physical overload, thereby helping to reduce stress and absenteeism

- c) increase and broaden the digital competence of the organization, thereby increasing the organization's efficiency, competitiveness and preparedness for the purchase and introduction of new systems
- d) contribute to a people-centered business development and thereby increase the social and economic sustainability of the organization
- e) contribute to increased efficiency and productivity and thus to the achievement of the organization's business objectives.

The standard has the preliminary title: “Ergonomics for information- and communication technology (ICT) – Testing by users of workplaces’ interactive systems – The Usability round”. It is based on the standard “SS-EN ISO 26800 Ergonomics - General guidelines, principles and concepts” [25] that describes the general guidelines for ergonomics and specify basic ergonomics principles and concepts applicable to the design and evaluation of tasks, jobs, products, tools, equipment, systems, organizations, services, facilities and environments. Furthermore, it is based on “SS-EN ISO 27500 The human-centered organization” [26] that explains to board members and management groups the values and beliefs that make an organization human-centered, important business and operational benefits that come with human-centered leadership and the policies they need to implement to achieve this. SS-EN ISO 27500 identifies the most important criteria that show that each principle has been met, the consequences for the organization if the relevant criteria are not met and what measures can be taken to reduce the risk thereof. Finally, it relates to “SS EN ISO 9241 Part 210 Ergonomics in human-system interaction - Part 210: User-centered design for interactive systems” [27] that describes six principles that all work with user-centered development should follow, i.e.;

- a) the design is based on an explicit understanding of users, tasks and environments
- b) users are involved throughout the design and development process
- c) the design is driven and refined through user-centered evaluation
- d) the process is iterative (it is repeated repeatedly)
- e) the design encompasses the entire user experience
- f) the design team has interdisciplinary knowledge and perspectives.

This work has made an attempt to apply the proposed standard and also worked to feedback the experiences from using the standard in the work to develop the standard.

3 Method

From an overall methodological point of view the project has applied an action-oriented research methodology in which researchers and the research subjects has collaborated in the development of the methodologies and specific research cases. To be able to critically examine and analyze the results we have closely adapted the quality criteria proposed by Klein and Myers [28].

3.1 Action Research

The project applied an action research methodology to adapt and implement a method to assess and correct the digital work environment in close collaboration with representatives from the organization. Action research is a research methodology that mixes reflection and observation with the actual activities undertaken in the project. It was coined by Kurt Lewin in 1946 [29] but has developed a lot since then. The researcher participates as an active change agent in the project and does thus work with the dual goals of managing the change in the organization at the same time as research on the case is conducted, hence the values and aspirations of the researcher also shapes the results. Action research is a cyclic process of planning, action, observation, reflection and redesign. The action research methodology is commonly used in other disciplines such as pedagogy, information systems or nursing, but not to the extent that one would expect within HCI. One of the few studies detailing how actions research would apply to HCI is conducted by Hayes [30].

3.2 Case Specific Details

This case was conducted in close collaboration with a court in Sweden, which is a form of public authority. There are more than 75 courts in Sweden and they serve under the Swedish National Courts administration that serves all courts with basic IT infrastructure and specific systems. One of their major impacts on the courts is the national case handling system Vera, that heavily influences the digital work environments at every court. Even if all courts are autonomous, they need the support of the National Courts administration.

3.3 Activities to Customize the Method to the Organization

The organization had during 2019-2020 identified its digital work environment as a strategic focus area for the development of the authority.

Pre-study and Townhall Meeting. With this strategy they invited to a staff townhall meeting to educate the entire staff on digital work environment. To manage a tailored townhall meeting we decided to conduct “speed field studies”, eight 30-minute contextual observation-interview studies from all parts of the organization from judges to people working at the registrar. Even if the speed field studies were extremely short, they were conducted with a semi-structured observation interview technique in which a lot of information was possible to acquire. The author of this paper was given the assignment of conducting the education program, something that was done late 2019 and spurred a lot of interest from the organization. The support was immense, from the top management of the organization to the union representatives. The HR staff was instrumental in planning and facilitating the collaboration in such an excellent way and the open and engaged collaboration from everybody in the organization made it a success.

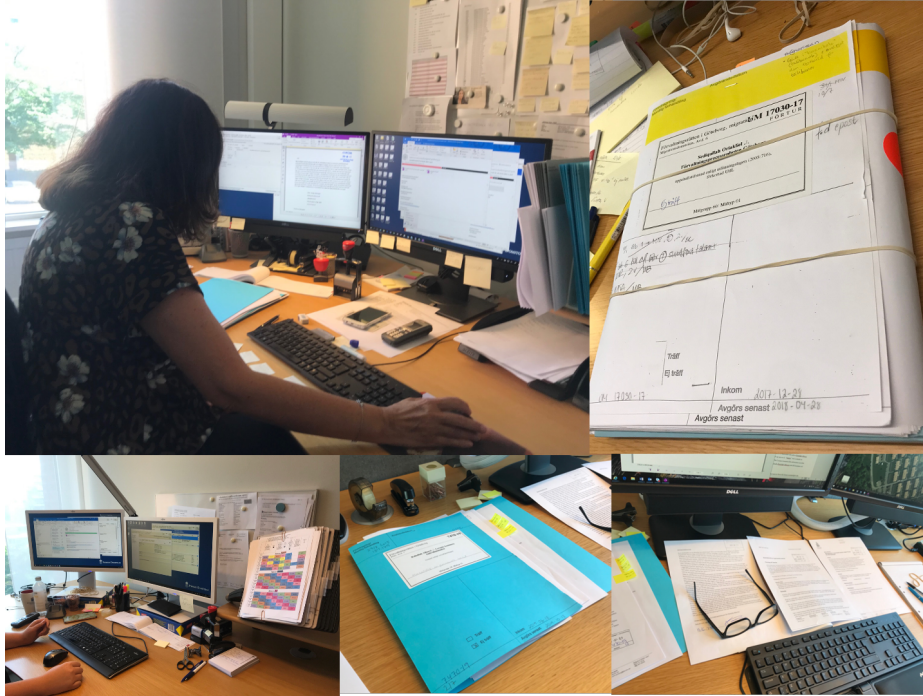


Figure 1. Eight 30 minutes “speed field studies” were conducted to get a flavor of the digital work environment at the public authority.

Workshop to Adapt the Method to the Organization. Based on the successful pre-study it was decided to apply a method to adapt the ISO standardized approach to the organization in a sequence of steps. This was conducted during two workshop days involving two senior managers, one workplace safety staff, two HR representatives, one representative from the local IT department and one representative appointed by the union. The workshop was planned and conducted by the main author who also made all documentation in close collaboration with the workshop participants.

Part 1: What are the most common digital work environment problems you expect to find in the workplaces being investigated? All participants were given the task to brainstorm the most common and serious digital work environment problems that they would expect to find during the studies. This was done to safeguard the proposed method to be able to assess whether or not the method would be capable of identifying the major usability problems in the process. See more on figure 2.



Figure 2. Brainstorming of potential work environment problems with all the representatives from the staff. Clustering of the problems based on similarity in scope and impact.

Part 2: Review of the criteria list. Systematically the workshop participants worked through the proposed list of criteria from the suggested standard in a joint group discussion. The participants were asked to interpret the criteria, suggest how the wording could be contextualized to their business and discuss potential rewordings of the criteria to meet their needs. In the beginning the discussion was thorough and critical but the further throughout the document we came the more pragmatic the discussion became and the more the language was understood and contextualized.

Part 3: Priority of the criteria. Early on we realized that the suggested list of criteria was too extensive and we needed to collapse and merge several of the criteria to make a tool that could be much easier to handle. Several of the criteria were also judged not to be relevant for the business at hand. All participants were asked to highlight which criteria they prioritize as the most important for being able to assess the digital work environment by marking each criterion with one dot. Everybody got the maximum of 15 dots to use. The question to ask was to choose which criteria they considered most relevant and not relevant to the organization (see figure 3).

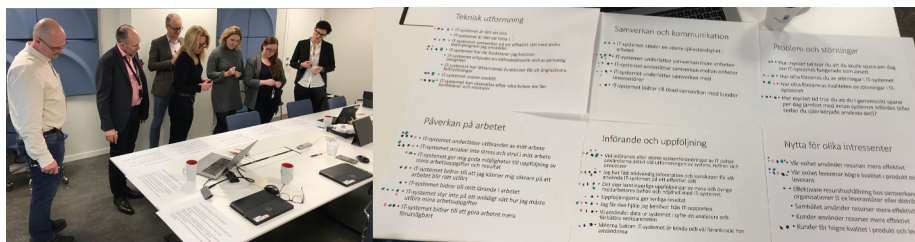


Figure 3. Choosing which criteria was the most important for the organization.

Part 4: Reorganizing the criteria. This task involved a card sorting activity in which the criteria were reorganized to make a better flow and more logical sequence and order of the criteria and categories. Below the criteria has been reordered to fit this logical flow.

Part 5: Matching the digital work environment problems with the criteria. Finally, the participants were asked to return to the digital work environment problems that had been identified in part 1 and group the underneath each category. In this way we would

be able to see if there was any category underneath which no work environment problems were placed and to help us further sharpen the formulation of the criteria and the categories. All participants were asked to place “their” work environment problems on the respective criteria (see figure 4).

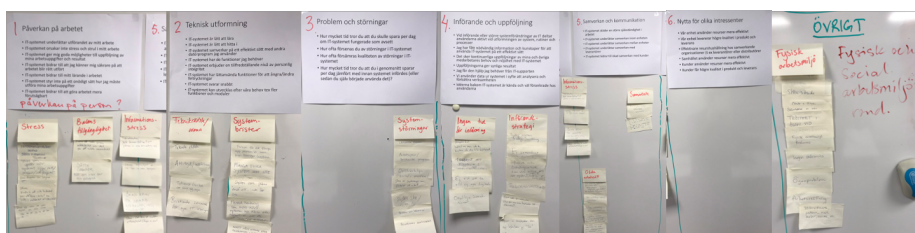


Figure 4. Grouping the usability problems from part 1 under the reordered criteria and categories. The category on AI were judged to be out of the scope for this work activity and were therefore omitted from the categories. The organization also identified the need for an extra section on physical and social work environment problems.

Part 6: How do you assess the rating scale? Next step consisted of a discussion about the ranking scale of all criteria whether or not it was understandable, self-explanatory and sufficient for the task. The rating scale can be found in figure 5. The ranking scale proposed in the standard was said to be appropriate for the task and adopted the way it was presented. Minor changes were proposed for the criteria that was about judging times saved, for example.

Headline / question	1 Fully disagree	2	3	4	5	6 Fully agree	Don't know	Not relevant	Comments
Influence on work									
The computer support supports me in conducting my work									

Figure 5. The proposed ranking scale with one example of a question to rank.

Part 7: Which people are most suitable for conducting the inspection? The final task was a discussion about which persons that would be the best suited to conduct the work environment rounds. There were concerns about the number of people conducting the rounds, that one does not want to overwhelm the interviewee, but at the same time a concern that all different skills present are needed to judge the work environment appropriately. There were also concerns about whether or not people would be willing to speak out freely in front of their boss, and therefore we chose to swap bosses so that the present boss was not the boss for that particular interviewee.

3.4 Digital Work Environment Rounds

Experiencing Digital Work Environment Rounds. During a trial period we conducted four digital work environment rounds in which four representatives from the organization participated (1 manager, 1 IT-representative, 1 representative from the

work situation and 1 safety officer). The digital work environment rounds were observed by two researchers and one person from the organization's HR responsible for work environment issues and the research project officer from the organization. It was organized as a semi-structured self-organized observation interview (see figure 6).



Figure 6. Digital work environment round conducted during the pilot tests.

Everybody took individual notes during the trial using the adapted checklist and all of these notes were collected. After the digital work environment rounds a short questionnaire was sent to the interviewee as well as a survey to make individual assessments of the questions in the questionnaire.

Assessment Meeting to Prioritize Findings and Decide on Actions and People in Charge. All the participants of the previous workshops were invited to a second workshop to go through and summarize all findings from the digital work environment rounds and the feedback collected from the participants. The staff together with the union representatives were gathered to discuss the results of the rounds and assess the power and efficiency of the method. The first step was to go through each criterium and look through everybody's collected notes and compare to the responses made by the interviewee in the survey. While going through them one of the participants documented the findings to arrive at a joint documentation. Attempts were made to discuss possible solutions to overcome the problems, but the fact that the interviewees need be involved to manage any good redesigns made it difficult to propose any final measures to overcome the problem, rather the problems were noted down for further investigations. We prioritized the actions and decide the way forward (including defining and distributing responsibilities). Finally, we evaluated the process and the results from the reviewers' point of view as well as the workers' experience of the round. We evaluated the result, the documentation and evaluated possible actions and the process for implementation. We discussed the reviewers' experience of the Usability Round and finally we discussed the possible integration of the method in the systematic work environment management at the organization.

4 Results

Generally, there are many bigger and smaller usability problems in everybody's work situation that people learn to live with and establish more or less inefficient work arounds to compensate from. Many workers report that there are from minor to severe usability problems that they are not reporting, because they do not have any experience that earlier reported problems have been corrected. And the expectation is not that the problem can or would be corrected. At the same time the experience reported from the IT department is that many of the existing usability problems could easily be corrected if they were only told about them. The earlier they would be informed about the problems the easier it would have been to correct them. Therefore, by allocating resources to correct problems and by introducing steps in the process to identify and prioritize these findings, many usability improvements could easily be made.

The general perception of conducting digital work environment rounds was positive and it was perceived as a useful and important addition to the existing methods in the organization to assess and correct the digital work environment. The fact that it was based on an ISO standard under production and the fact that the organization was an early adopter and pilot tester also contributed to the positive response towards the method.

4.1 Revised List of Criteria Adapted to the Organization

One of the major outcomes of the project was the revised checklist that was derived through the workshop with the representatives from the organization from management level to union representatives, from HR to IT. In comparison to the checklist presented in the ISO standard, this was significantly shortened by removing 30% of the questions and sometimes collapsing two criteria into one (see figure 7 and 8). The criteria were color coded with normal text and bold text to distinguish criteria with higher priority from normal.

Checklist usability round

Work place _____ Worker _____

Date _____ Responsible for the protocol _____

Digital work environment is the work environment, with its problems and opportunities of both physical, psycho-social and cognitive nature, which is the result of digitalisation of the work support system and tools. These may be deficiencies in IT support, inappropriate organization of work or deficiencies in knowledge or skills in order to manage the IT support. The purpose of the usability round is to identify the most common and / or most serious digital work environment problems with a view to proposing measures to rectify them through changes in IT support, changes in operations or through special training efforts. These measures will then be prioritized and a plan established for actions with clear responsibilities and deadlines.

This protocol summarizes the observations and assessments made in connection with the digital work environment at the workplace. Use the protocol as follows: Systematically review the questions in order. Ask the employees to evaluate each criterion according to the 6-degree scale and motivate the rating by exemplifying and showing cases that illustrate the criterion. You are encouraged to describe the problems so that others can understand them and also document by taking pictures. The documents will then be used by you during the assessment and prioritization meeting as everyone's assessments are reviewed.

Headline / question	1 Fully disagree	2	3	4	5	6 Fully agree	Don't know	Not relevant	Comments
Influence on work									
The IT support ¹ supports me in conducting my work									
The IT support does not cause stress and strain in my work									
The IT support gives me good opportunities to follow up on my tasks and results									

Figure 7. The revised protocol from the Digital work environment round derived from the workshop and revised after testing.

1. Influence on work	4. Introduction and follow-up
The IT support ³ supports me in conducting my work	When introducing new IT or introduce major system changes, representatives from the business actively participated in the design of systems, routines and processes.
The IT support does not cause stress and strain in my work	I have gained enough information and knowledge to use the IT support effectively
The IT support gives me good opportunities to follow up on my tasks and results	There is continuous follow-up of my and other employees' needs and satisfaction with the IT support
The IT support helps me to do the job properly	The follow-ups lead to visible results or other feedback
The IT support contributes to my learning in my role and to the learning about the management of the software	I get the help I need from the local IT support and from the central support
The IT support gives me the flexibility to decide how I plan my work	We use data from the system for the purpose of analyzing and improving operations
The IT support facilitates my own planning of the work	The purpose of digitization is well known and well-rooted with the users
2. Technical design	5. Collaboration and communication
The IT support is easy to learn	The IT support gives greater control of the work and the opportunity to manage the workload
The IT support is easy to navigate in	The IT support facilitates collaboration within the business
The company-specific systems interact effectively with other computer programs I use	The IT support facilitates collaboration between different businesses
The IT support has the functionality that I need	The IT support facilitates collaboration with external players
3. Problems and disturbances	The IT support contributes to increased collaboration with individual parties and the public
How much time do you think you would save per day if IT support worked in the best possible way?	6. Usefulness for different stakeholders
How often are you delayed by the IT support	Our digital solutions allow our department or group to use their resources efficiently
How often does the quality deteriorate because of disruptions in the IT support?	Our digital solutions mean that our department or group has high quality in product and delivery
On average, how much time do you think you save per day compared to before the introduction of IT support (or since you started using it yourself)?	Our digital solutions mean that we have more efficient resource management with the partner organizations as a whole (e.g. external players)
	Our digital solutions mean that the public and individual parties receive higher quality in product and delivery

Figure 8. The revised checklist protocol from the Digital work environment round.

The protocol was also used as a survey of questions asking individuals to fill out the checklist as a survey. This was highly appreciated by those users that were a part of our test and they all filled it out without prioritizing between those with bold text and normal text. However, none of the users made use of the comment field, most likely since it was not expressed that this was mandatory in the survey.

One important conclusion to draw is the importance of language and words. Careful attention needs to be paid on how to name things and the necessity of providing clear definitions of concepts used. It is also necessary to tailor the concepts to the general preunderstanding and language used in the organization.

4.2 Prioritized Findings from the Digital Work Environment Round

As a result of the discussion the major findings were grouped into three priority levels. And following is an attempt to generalize the findings.

Priority 1 – Vera. Emphasize the importance of modifying the general case handling system provided by the Swedish National Court Administration, to fit to the requirements posed by the local court (these have constantly been received less priority, given that the system has been designed for the general court and thus has severe usability

problems for this particular court). The power of such an initiative may have a huge impact as usability problems pertaining to this system is so common and frequently causing severe problems both in quality and efficiency. The responsibility for driving this would be on the managers that could take the opportunity when the Swedish National Court Administration gets a new general manager. There are also great contacts into the organizations since one of the major business developers in the court moved to the central organization and is very familiar with the problem. It was difficult to give a time plan as this is such an important task and every achievement that brings closer to a new take on this system would be very beneficiary.

Priority 1 – Uniform working methods. For historical reasons the ways of working at the different departments at the court varies significantly, Previous management has grown independent ways of working, thus creating flexibility and power. However, over time this has gotten out of hand and has thus led to sub optimization, with loss in quality and efficiency and with a lacking consistency in the way that things are handled. The general view is that this can be dealt with in parallel to the aforementioned needs to improve the case handling system. It can be done by collecting routines and checklists, and by collecting the specific processes from each department to make the managers agree on a joint process for conducting the tasks in support of the general manager. This task requires a project group to work with it and it needs a management decision to support it. It could be dealt with during the first half of 2020.

Priority 2 – Collected instructions. This is low hanging fruit, and could be achieved within a short period of time. It is more about communication and an infrastructure to share the collected instructions, than actually developing something new. A person from IT could be in charge of the infrastructure and a person from the management must drive the actual change.

Priority 2 – Continuous follow-ups. A clearly expressed need to assess and follow up the digital work environment on a regular basis. Can be achieved by incorporating Digital Work Environment Rounds as a part of the Systematic Work Environment Management in the organization. The Systematic Work Environment Management Group in the organization will be in charge of the mission and as Digital Work Environment is a prioritized area, this can be achieved as soon as possible.

Priority 2 – Digital ambassadors. A role to be some form of superuser that could help spread innovative ways of working in the organization. There is a need to formalize the role, appoint one or two per department or per category of workers, establish a network of digital ambassadors for experience exchange. The managers are responsible and resources needs to be allocated for it to happen.

Priority 3 – Continuous knowledge exchange

The strategy when choosing and prioritizing these activities was both to have an ambitious goal as this is a new activity for the organization and that it is necessary to show some results already from the start. The choice of activities was also to both prioritize long term initiatives that are important and quick fixes that can show a more or less immediate effect.

4.3 Assessing the Potential Time Savings if the System Would Work in an Optimal Fashion.

During the digital work environment rounds the interviewees were asked: “On average, how much time do you think you save per day compared to before the introduction of IT support¹ (or since you started using it yourself)?” When the interviewees were asked this question, it sparked a lot of discussion about the lacking functionality and usability of the system. The users spoke at length about their experiences with the system and why they needed to make use of cumbersome work arounds to manage their work, and many also noted that there was no point in complaining about it, since there is no mechanism to change based on comments received. The quantitative estimation of time savings to make ranged from 20 minutes per day to half of the working day. We heard testimonies saying that they could go from two to one person to handle the e-mail.

The second question: “*How often are you delayed by IT support disruptions?*” received answers ranging from less than once per day to up to 30 times per day. However, a comment in relations to the less frequent findings was that the interruptions could last for as much as up to 15 minutes.

The third question: “*How often does the quality of disruptions in IT support deteriorate?*” received answers ranging from never to 2 or 3 times per day and also comments about the interruptions lasting for a very long time and as frequent as once a week.

The fourth question: “*How much time do you think you would save per day if IT support worked in the best possible way?*” received answers ranging from 10 minutes per day up to 60 minutes per day.

In conclusion the potential gains from improving the digital work environments does not only mean that there is a potential for improved quality but also that there is a potential for increased efficiency leading to potential cost savings and possibilities for rationalizing the business. Seeing potential cost savings in addition to the improvements may help cost-justifying the efforts.

4.4 Assessing the Digital Work Environment Round from the User Perspective

The interviewees were very positive about their experience of having participated in the digital work environment rounds. Statements such as: “*I experienced that someone listened to me and it also gave me the opportunity to reflect on my digital work environment*” or “*the fact that someone actually turned to the experts working with the systems and asking our opinions*” shows the power of actually strengthening the user perspective and give the power to the users. One of the comments also constructively suggested an alternative approach in suggesting to hand out the questions beforehand

¹ For the study we used the concept of “IT support” to encompass the entire sociotechnical system of software, hardware and the organizational structure in which it is used. It should not be confused with the concept of support staff. Later on, the concept was changed to digital system, which in itself is an ambiguous concept as the interview subjects had troubles understanding it as the entire system rather than a particular computer application. Therefore, for this study the concept “IT support” was used to mark the entire sociotechnical system.

for the users to be able to prepare and show more of the common problems that actually happens in practice. One of the interviewees is quite critical given how the observation interview turned out, where she did not get a chance to actually show what it looks like and rather proposed a format more like could be expressed in an interview. Most likely the reason for this was that the pilot test for this particular person went a bit out of hand and the opportunity for actually making observations vanished.

4.5 Integrating the Digital Work Environment Round into the Systematic Work Environment Management

After the abovementioned activities to tailor the digital work environment rounds to the organization and the pilot test of the method the organization had its strategic meeting to decide on how to progress the integration of the method into the systematic work environment management in the organization. Based on the project a proposition was given to the management group of the organization on how to work in a systematic way with digital work environment in a more holistic perspective (individual, group and organization). The intention is to use the digital work environment round by first sending out the checklist broadly in the organization to gather more written comments before choosing a deepened interview with selected participants. As a complement the organization will use the Prevent union's IT stress survey to gather information on both individual, group and organization level based on identified risks to assess measures that needs to be taken on an organizational level and complement this with the Digital Work Environment Round on an individual level as a deepened investigation. This could be done for a specific identified part of the organization, on a particular software system or category of workers, or be used before and after to judge the introduction of a new IT support system. The organization believes that this will be an important asset in the systematic work environment management in the organization and they intend to follow up continuously.

5 Discussion

Digital work environment and digital work environment problems has received far too little attention in the research literature so far. Although there is a large number of studies focusing on developing usability evaluation methods for different types of contexts [31, 32, 33, 34], not much has been anchored in the overall work environment legislation [13,14] and developed as a part of the systematic work environment management mandated in the legislation. Also, the use of international standards [25, 26, 27] for the benefit of the development of the work tools, user skills and organization need to be further developed.

The purpose of this paper was to show how the legislation can serve as a powerful tool and how systematic work environment management can leverage the union employer collaboration to improve the digital work environment. I have demonstrated how the digital work environment round by being supported by the legislation could work

as a powerful way of improving the digital work environment for employees in an organization. There is a high potential in working systematically on improving the digital work environment. Lacking functionality and usability of the IT systems contribute to building several work environment risks and hazards that may have a severe effect on the health and well-being of the employees, may bring large costs to the organization and may contribute to insufficient quality of the work. Issues relating to the user perspective when introducing new IT systems at work are rarely if at all considered in the acquisition, development, introduction and maintenance of the IT systems for work.

5.1 The Importance of Legislation

Making use of the fact that work environment is something mandated through the national legislation is an extremely powerful tool. Even if the law was authored way before computers were widely used for work, much of what is written clearly applies to the digital work environment, as shown above. In our development over the years, we have gone from viewing usability work as a part of the IT development, to usability work as an asset for the HR work in the organization to finally anchoring usability work as strategic work on a management level. The fact that digital work environment is finding its way into the legislation as a concept of its own has been an important contribution to the grounding of the work and thus the Swedish Work environment authority should consider bringing digital work environment in as a core part of the work environment legislation in the same way as Psychological and Social Work Environment was introduced a few years ago. The current regulation on “Work with Display Units” (In Swedish: AFS 1998:5 Arbete vid bildskärm) dates back to 1998 and is in urgent need of modernization and adaptation to the current situation.

5.2 Making Use of the Mandated Systematic Work Environment Management

As Sweden has a unique situation of great collaboration between the worker associations and employers and that this is mandated through the work environment act gives us a tool to be able to argue for systematic work to improve the usability, not only by arguing the benefit and potential financial gains it makes, but also since it is the law. The Swedish Work environment legislation safeguards systematic collaboration between employers and workers on every issue that may affect the worker’s work environment and therefore it has a great potential to make use of the fact that everybody wants to obey the law as an argument for introducing systematic digital work environment rounds as a part of the work environment activities in the organization. However, so far, the systematic work environment management has more focused on social and organizational work conditions and not so much looked at the digital work situation. We thus need to develop and try out new tools focusing on assessing, prioritizing and mending digital work environment problems in a systematic manner.

5.3 The Importance of Standardization

International standards have contributed a lot to the opportunities for systematizing user-centered design work, usability and user experience work and overall ergonomics of the systems, however they are not sufficiently addressed in research. In this project we have had the opportunity to apply and test a forthcoming standard in practical development work and we have done so in collaboration with the editors of the standard, thus contributing to the development and credibility of the standard as such. It has really been a joint venture in which the standards development had an important role in the work at the public authority and the case contributed a lot to the development of the standard.

5.4 Contributions to HCI

This work contributes with an increased understanding of how to systematically apply HCI methods from a work environment perspective, grounded in standards [25, 26, 27] and legislation [13, 14]. It shows how cooperative or participatory approaches [2, 3, 4, 5, 6, 7] may contribute to building deepened insights of the complex relations between digitalization as organizational development [17] and the power of actively involving users [35] addressing issues such as value-based design [36] and the development of the socio technical systems [12, 37]. Through this work a usable digital work environment can be required and developed to meet the overall work environment legislation in a systematic way.

Sweden has a unique situation in having a comprehensive work environment legislation. Up until now this legislation has mostly been used to assess and correct the physical, social and organizational work environment. But the law equally applies to the digital work environment. Providing usable technology for the work place often do not receive enough attention, investment and skills to help improve the situation to an acceptable one, despite the fact that it could make the organization more efficient and effective, improve the situation for the users and thus justify the costs for the investment. So, this is not a paper about another usability inspection method, it is about holistically approaching the root causes to why usability problems at the work place are not sufficiently dealt with and how the legislation can help improve the situation. Using the legislation as a vehicle to drive the development of more usable systems is what this case has explored and successfully shown that it can work.

Sweden has a unique opportunity to do this, due to its past history of participatory design, efficient union collaboration and unique workplace rights, that is a fact. But, many other countries could be able to make use of similar approaches and several countries are also showing an interest in doing so. That is why this is pioneering work in an area previously not researched. And that is why it has a potential interest to be implemented in other countries as well. Even if Sweden has a unique situation, both when it comes to the union-employer collaboration to increase the quality of work and on the prevalent legislation, this case also could serve as an example on how other countries, organizations and employers can make use of the existing work environment legislation

in the country to make sure that actual improvement work to safeguard a risk-free digital work environment actually happens.

6 Conclusion

In this paper we have demonstrated how Digital Work Environment Rounds can be integrated into the Systematic Work Environment Management by a case conducted within a Swedish Court. We have shown the importance of basing the work on the existing work environment legislation, by collaborating closely between union representatives and employers and by also contributing to the recently published Standard; the Usability Round. We conclude that integrating Digital Work Environment Rounds in the systematic work environment routines at the workplace with support from the Work environment legislation has the potential of being a really powerful tool to assess and improve work with digital tools. However, for it to become successful there are several conditions that are necessary on an organizational level. These include, but are not limited to, the following:

- A high skill level and awareness throughout the organization.
- A willingness to make the necessary investments up front that may lead to gains further down the line.
- Strong support throughout the organization from management to the union representatives.

Also, there is a need to further develop the legislation and regulation to also explicitly cover digital work environments, to develop tools to assess and correct digital work environment problems and to make this a strategic goal for the organizations in their development work. Finally, there is a need for much more research to further understand and develop the methods and tools to increase the power and benefit of working with digital work environment rounds.

In this case we have shown how a digital work environment round can be incorporated in the systematic work environment management at a public authority, how this has worked to influence the standardization on the subject and shown as an exemplar that others can take after on how to conduct digital work environment rounds. Although this project is just about to end, several other requests to work towards integrating digital work environment in the systematic work environment management has been requested from several different organizations. This work is just the first step to launch a new standard way of improving our digital tools for work.

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