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The Work Ability and Social Inclusion (WASI) Project

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FOREWORD

We are honored to present the final report of the Work Ability and Social Inclusion (WASI) project. This is the first time that an integrated approach of this nature, bringing together knowledge and a broad expertise from several Nordic and Baltic Countries, with the aim of developing occupational health together with the workforce, has been attempted. The project was funded by the Central Baltic Interreg IV A 2007-2013 programme.

The goals were achieved through extensive cooperation of researchers, experts and other stakeholders. The report outlines the scale of wellbeing at work, including some aspects of individual risks, solutions for versatile working life-related problems and economic facts. It is for this reason that the results of this report can be implemented not only in workplaces but also on a national level in each country.

The project has led to lasting positive changes for workers and working environments. Furthermore, the results have been presented and discussed in workplaces, in theses, at national and international conferences, and in professional as well as scientific articles.

The steering group would like to thank everyone involved in the project: the participating companies and their employees, and the financiers, researchers, experts and other stakeholders for their commitment to the project and its successful outcome.

Helsinki 31.10.2014

On behalf of the steering group
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1 SUMMARY AND CONCLUSIONS OF THE REPORT

Many studies have shown the well-being of employees to be crucial for the productivity of an organization. According to a report from Eurostat in 2010, the most serious and common health problems in the working population across the EU are problems related to the neck, back, hands and arms, and stress and depression.

The purpose of the project was to increase work ability, stress management, good leadership, and thereby social inclusion, in the work force in Finland, Estonia, and Latvia. The primary goals were to improve leadership stress management and improve communication within organizations. Secondary goals were to decrease musculoskeletal disorders, and investigate work environments. We focused on office workers in the field of Information and Communication Technology (ICT). To attain the project's goals the following methods were used:1) a survey (leadership, work ability, stress management, health), simple field measurements, surveying sick-leaves, and early retirements); 2) Metal Age (MA), a work well-being intervention program aimed at creating concrete, practical and tailored solutions for work practices with particular focus on planning how to prioritize development areas already identified by employees and management; 3) implementing the MA program in workplaces jointly with the intervention participants ; 4) maintaining and updating the well-being at work program by means of an internet program; 5) follow-up measurements including a cost-efficacy evaluation; and 6) designing a model for good leadership and stress management.

Occupational well-being survey in Finland, Estonia and Latvia: in Finland, the changes in work ability and in work well-being at follow-up among the MA participants, and in controls who did not participate in the program, were small. According to the Work Ability Index (WAI), work ability stayed on same level on average among the MA participants, and slightly decreased in the control group, resulting a small but statistical significant difference in the mean change in WAI during the follow-up. The only difference in work well-being was in the KIVA question "Have you enjoyed coming to work over the last few weeks?" No changes were observed in employees' experience of leadership based on the leadership questions included in the QPS Nordic questionnaire. In Estonia, according to the KIVA questionnaire, the investigated workers had high coefficients for satisfaction with their work. In addition, the stress measurements did not show high stress levels. In KIVA methodology a team is deployed to find the solutions to specific problems related to the nature of employee's the work that enable the team to find a suitable suitable working arrangements to be developed that can help prevent work-relatedand musculoskeletal disorders. In Latvia in line with the Finnish participants, changes in work ability and in work well-being at follow-up in both the Latvian groups were also rare.

Indoor air in office rooms in Latvia and Estonia: The main focus was on chemical pollutants in offices. The Estonian team did not possess the equipment for determining chemical pollutants chromatographically. The main difference between the Estonian and

Latvian results concerned CO2 concentrations. Whereas the range in Estonia was 500-2000 ppm, in Latvia the contamination of office air with carbon dioxide reached 3 500 ppm, which is a rather high value. The temperature of the air and the humidity were in the same range in the office rooms investigated.

Musculoskeletal disorders in Estonian office workers: Only thirteen employees (20%) were completely free from self-reported muscle and joint complaints. The majority of subjects reported two or more local pains, and neck, back and shoulder pain were especially common. The muscular tensions of computer workers result from the static sitting position, and work-related psycho-emotional stress may further contribute to this. Myotonometrical technology – a non-invasive, quick and easy measurement of superficial skeletal muscles - can be used in occupational health for the prevention and early detection of work-related musculoskeletal disorders.

Interviews in Finland revealed that MA as a method was perceived differently among the informants. The role of the outside facilitator was perceived as important. The outside facilitator was able to raise even difficult issues for discussion, a skill highly valued by the informants. These outsider facilitators "knew what they were doing" and were not afraid to act. The informants also appreciated the opportunity for a social get-together at the beginning of the MA process. Finally, it was concluded that in both organizations rather many "problems" were leadership-related. These issues proved relatively easy to solve, as the leaders modified their behavior. However, the main question raised during the analysis is whether the MA method (actually?) helped the organizations to increase well-being and social inclusion. This question remains unanswered, however, it does not mean that MA as as method does not work. The organizations applied MA in their own way and by so doing they managed to solve several concrete problems.

Leadership in Finland: half of the employees reported positive changes in their immediate superiors´ production- and change-oriented leadership behaviors one year after the MA intervention. Also, half of the managers to the superiors and the superiors themselves reported improvement in production- and change-oriented leadership behaviors. Half or more of the managers to the superiors reported improvement in four of the eight change-oriented leadership behaviors. Also, while half or more of the superiors themselves reported improved leadership behavior in four of the eight production-oriented leadership behaviors, only half reported improved leadership behavior in three of the eight change-oriented leadership behaviors. A trend in personal behaviors was demonstrated in production- and change oriented leadership, while no changes were found in relation oriented leadership. The fact that only a few employees reported any changes in their immediate superiors´ relation-oriented leadership behavior might be due to the fact that the development areas chosen in the MA program was focused more on production- and change-oriented leadership.

Economical evaluation of the WASI project in Finland: the short-term effects of the MA work ability program, such as the MA program and on sick leave days seemed beneficial. However, longer the duration of the program, the benefits disappeared.

The MA as a method for improving well-being at work: Based on the results of seven KIVA questions, work-related wellbeing was on average on a good level at the baseline

in the Finnish, Latvian, and most of the Estonian participants. This fact may partly explain the small effect of the program, which improved well-being at work in just one group, anone Estonian subgroup with low baseline values. Overall, to improve the scientific evidence of the effect of the MA program, high quality randomized controlled trials are needed.

There was a tendency among the Finnish MA participants for work ability to remain (on the same level) (largely unchanged) between baseline and follow-up while among controls it decreased slightly. Although the Finnish control subjects were on average 4 years older than the MA participants, the mean change in the Work Ability Index (WAI) during follow-up remained statistically significant even after adjusting for age. In light of this finding, the MA program may have had a positive effect among the Finnish MA participants, i.e. supporting them to maintain work ability. Such an effect was not observed among the Latvian participants.

Metal Age, Work Ability and stress in Latvia: According to results in Latvian companies and among Latvian employees the **Metal Age** as a method for improving of well-being at work seems to be rather effective as analysis of several answers in the project questionnaire shows improvements after the training and intervention programs. It might also be explained by the fact that initial level of work organization and communication at workplaces were rather low as it was found out also during intervention projects at particular companies. Improvements identified during Metal Age project as most important were dominantly linked to better communication and exchange of information among employees and management.

The changes in **Work Ability index** for Latvian group had some positive improvements after Metal Age training, especially with regards to following factors: possibility to influence the situation at the workplace; work became more autonomous, more attention is paid to the relationships with workmates at the workplace, there is less hurry to finish one's task, or suspend carrying out an ongoing task; decreased the number of employees who consider their job being psychologically strenuous, although the workplace atmosphere became slightly competitive, the workplace still was not supportive of new ideas and employees cannot relax after a working day. In overall there was a weak correlation between stress-causing factors and work ability.

Results of cortisol measurements obtained during the project shows that there were significant number of employees whose cortisol levels showed abnormal diurnal patterns in Latvian group. Examples of the results of the project in Latvia shows an interesting trend – the stress levels decreased after the implementation of Metal Age intervention program in those companies dominantly working with customers (e.g. the "stress" risks were different and probably higher) as opposed to companies where employees mostly worked with documentation. In these companies significant decrease in cortisol level was not observed.

Stress level in Estonia, Finland and Latvia

Project results shows quite few such employees - for example in the Latvian group there were eight individuals that had low concentration difference between morning and evening saliva samples in the first round and three individuals in the second round. In Estonian group there were five individuals in the first round and four in the second and

respectively in Finnish group there were two individuals in the first round and five individuals in the second round that may have a risk of stress and even depression. But, of course, also these results can be affected by so many reasons like age, sex and medicine taken. In general measurements of salivary cortisol could be successfully used to assess the level of occupational stress at the companies and the level to which the employees are coping with it. It is also possible to identify workers with potential to develop more serious health effects in future that shall be specifically addressed.

2 LIST OF PUBLICATIONS RELATED TO THE WASI PROJECT

2.1 Finland

Tuominen R, Surakka J, Piippo J. Work ability program produces short-term productivity improvements. (Manuscript submitted to Healthcare October 2014)

Maciocha A, Surakka J. 2014. Enhancing organisational learning by well-being activities: metal age method. Proceedings of the 6th European conference on intellectual capital. - Trnava, Slovak: Slovak University of technology, 10-11 April 2014. - 2049-0933. - 978-1-909507-20-3. - 8 s.

Maciocha A, Surakka J, Näsman O. 2012. Work Ability and Social Inclusion project-Enhancing collective knowledge by leadership and stress management. Proceedings of the European Conference on Intellectual Capital, Helsinki 23-24.4.2012. Academic Publishing limited, Reading UK www.academi-publishing.org

Maciocha A, Niehoff B, Surakka J. 2012.Knowledge creation and the employee well-being: analysis of the relationship / 13th European conference on knowledge management - EKCM 2012 - Spain: Universidad Politécnica de Cartagena, 6-7 September 2012 - s. 652-662.

Stenbock-Hult B. 2013.Kan arbetsgivarna stöda arbetstagarna att förlänga arbetskarriärerna? : arbetstagarnas röst Gerontologia - Jyväskylä: Kasvun ja vanhenemisen tutkijat. - 0784- 0039 : 3, s. 309-313.

Gustafsson E. 2012. Improving well-being at work with the participatory metal age method. Conference on occupational health and safety: From policies to practice. - Riga : Riga Stradiņš University, 6-7 December 2012. - s. 26

Piippo J. 2012. Trust and mistrust as stress reducing and increasing factors in working life. Conference on occupational health and safety: From policies to practice. - Riga: Riga Stradiņš University, 6-7 December 2012 - s. 46

Gustafsson E. 2012. Utvecklande av välbefinnande I arbetet: en deltagande intervention.Master thesis 2012. Beteendevetenskapliga institutionen. Helsingfors Universitet. 125 s.

Englund E, Huuhtanen, A. 2014.Arbetsrelaterad stress, muskuloskeletala besvär och stresshantering hos kontorsarbetare: En forskningsöversikt (Bachelor thesis, Arcada).

Werner S, Lindroos J. 2014. Metoder för att främja fysisk aktivitet och god ergonomi bland kontors- och informationspersonal på arbetsplatsen : En systematisk litteraturstudie (Bachelor thesis, Arcada).

Piippo J. 2014. "Trust and mistrust as stress reducing and increasing factors in working life". Proceedings of the Latvian Academy of Sciences, Section B. (under review)

2.2 Estonia

Tint P, Meigas K, Tuulik V, Pille V, Oha K, Reinhold K, Karai D, Tuulik V.-R & Lauri, M.-L. 2014. Prevention of physiological and psychological stress at computer-equipped workplaces. De Waard, D, Brookhuis, K, Wiczorek, R, Di Nocera, F, Barham, P, Weikert, C, Kluge, A, Gerbin (Toim.). Human Factors: sustainable life and mobility. Proceedings of the Human Factors and Ergonomics Society Europe Chapter 2013 Annual Conference (12 pp.). Available as open source download http://www.hfes-europe.org/books/sustainablelife.htm: Human Factors and Ergonomics Society Europe Chapter

Tint P, Karai D, Oha K, Koppel T, Tuulik V-R, Tuulik V & Meigas, K. 201). Theworking conditions of office-workers in modern buildings. In: Human Factors: sustainable life and mobility: Europe Chapter Human Factors and Ergonomics Society. (Toim.) Toffetti, A. etc. Torino: Centro Ricerche Fiat, 2013, 1 lk.

Tint P,Tuulik V, Tuulik V-R. 2013. The prevention of physiological and psychological stress at computer-equipped workplaces. In: Human Factors: sustainable life and mobility. Abstract book: Annual Meeting 2013, Europe Chapter Human Factors and Ergonomics Society, 16-18 Oct. Torino. (Toim.) Toffetti, A.; deWaard, D.; Bokkhuis, K. etc.. Torino: Centro Ricerche Fiat, 2013, 1 .* Tint, P.; Tuulik, V.; Karai, D.; Meigas, K. (2014). Health risks to computer workers in various indoor facilities. The Scientific Journal of Riga Technical University: Safety of Technogenic Environment, 5, 47 - 50.

Tint P, Toomeoja K, Tuulik V, Karai D & Meigas, K. (2013). Health risks to computerworkers in various indoor facilities. In: SCEE'2013 proceedings: 54th Int Riga Technical University Conference "Scientific Conference on Economics and Enterpreneurship". (Toim.) Ijevans, I.. Riga: Riga Technical University, 2013, 2.

Tuulik-Leisi V-R, Tuulik V, Pille V, Tamm M, Saarik S, Vare T & Tint, P. 2013. Laser-Doppler Perfusion Monitoring, Myotonometry, and Workplace Risk Evaluation As Assessment Methods Of Musculoskeletal Overuse Syndromes In Industry Workers. Journal of Rehabilitation Medicine, 45(9), 976 - 977.

Tint P, Karai D, Oha K, Koppel T, Tuulik V-R,Tuulik V & Meigas, K. 2013. The computer workers' working conditions influencing the health in modern buildings. Intelligent technologies in logistics and mechatronics systems ITELMS'2013 (247 - 253). Kaunas: Kaunas University of Technology Press

Tint P, Traumann A, Pille V, Tuulik-Leisi V-R &Tuulik V. 2012. Computer users' health risks caused by the influence of inadequate indoor climate and monotonous work. Agronomy Research, 10(S1), 261 - 276.

Traumann A & Tint P. 2011. The quality of indoor climate in offices in atrium-type buildings. Z. Bazaras; V.Kleiza, KTU (Ed.). Proceedings of the ITELMS'2011: 6th International Conference Intelligent Technologies in Logistics and Mechatronics Systems (33 - 38). Kaunas Technical University, by the journal "Mechanika": Kaunas Technology University *

Tint P, Reinhold K & Traumann A. 2011. The improvement of indoor environment in computer-classes. D. Cygas, K. D. Froehner (Ed.). Environmental Engineering. Environmental protection. 8th Int.Conf.May 19-20, Vilnius (382 - 386). Vilnius: VGTU Press "Technika" *

Traumann A, Tint P, Krichevskaya M & Klauson D. 2014. Air quality as an important indicator for ergonomic offices and school premises. Agronomy Research, 12(3), 925 - 934.

Tint P & Tkatsova L. 2012. Ergonomic assessment of workplaces in atrium-type buildings. In: Abstracts of the Conference On occupational Health and Safety: from polocies to practice: Conference on occupational health and safety, Riga, 6.-7 Dec. 2012. (Toim.) Ivars Vanadzins, Inese Martinsone, Linda Skreitule, Maija Treilona. Riga: Riga Stradins University, 2012, 1 p.

2.3 Latvia

Lakisa S, Gravele M, Sprudza D & Vanadzins I. 2013.Microclimate Measurements of Office Work Environment (Biroja darba vides mikroklimata mērījumi) // Thesis of Riga Stradins University Scientific Conference - Rīga, 2013, lpp.171.

Gravele M, Lakisa S, Sprudza D & Vanadzins I. 2013. Carbond Dioxide Concentration in Indoor Air as a Characteristic of Ventilation System (Oglekļa dioksīda koncentrācija iekštelpu gaisā kā ventilācijas sistēmas raksturlielums) // Thesis of Riga Stradins University Scientific Conference - Rīga, 2013, lpp.172.

Martinsone I, Rusakova N, Vizbule L & Bake M-A. 2013. Detection Options of Cortisole – Stress Marker in Saliva // Thesis of Riga Stradins University Scientific Conference - Rīga, 2013, lpp.173.

Sprudza D, Kozlova L, Lakisa S & Bake M-A. 2014. Evaluation of Work Ability and Stress of Office Workers // Thesis of Riga Stradins University Scientific Conference - Rīga, 2014, lpp.82.

Skreitule L & Vanadzins I. 2012. Opportunity to take part in new study on stress (Iespēja uzņēmējiem piedalīties jaunā pētījumā), Darba aizsardzības ziņas nr.25 - Rīga, 2012 February, pp 14-15.

Kozlova L & Vanadzins I. 2013. Darba spējas un sociālā integrācija (Work ablity and social integration), Darba aizsardzības ziņas nr.30 – Rīga, 2013 October, pp 14-15.

Sprudza D, Lakisa S, Erts R, Bake M-A, Vanadzins I, Kozlova & Martinsone I. 2014. Work Ability and Stress factors of Latvian Office Workers. (*submitted and accepted)* RSU Collection of Scientific Papers, 2014 - Riga; RSU, 2014.

Vizbule L, Martinsone I & Vanadzins I. 2014.Determination Method of Salivary Cortisol by High Performance Liquid Chromatography (HPLC). (*submitted and accepted)* Proceedings of the Latvian academy of sciences, Section B: Natural, Exact and applied sciences - Riga; LZA 2014

WASI - Well-Being at Work, Social Inclusion and Participatory Methods: Background, Importance and Theoretical Framework

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Keywords: work ability, stress, ergonomics, indoor air, office workers, leadership

1 THE WORK ABILITY AND SOCIAL INCLUSION PROJECT

The purpose of the project was to increase work ability, stress management, good leadership and thereby social inclusion in the work force in Finland, Estonia, and Latvia. The primary goals were to improve leadership stress management and improve communication within organizations. Secondary goals were to decrease musculoskeletal disorders, and decrease sedentary lifestyle. The Work Ability and Social Inclusion (WASI) project was mainly based on Metal Age (MA), a method developed to increase well-being at work, including measuring the effects of the intervention on the organizational leadership and stress management. WASI was carried out in companies with people who work a lot with ICT technology in Finland, Estonia and Latvia. To attain the project's goals, the following methods were used:

1) a survey (leadership, work ability, stress management, health), simple field measurements, surveying sick-leaves, early retirements),
2) the MA work well-being at work intervention program,
3) implementation of the MA program in workplaces by the intervention participants,
4) maintaining and updating the program by means of an internet program,

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5) follow-up measurements including a cost-efficacy evaluation, and
6) designing a model for good leadership and stress management.

The WASI project also included some country-specific aims, which are presented in the methods section.

2 BACKGROUND

2.1 Well-Being at work in Finland

2.1.1 History from the 1970s onwards

In the 1980s and the 1990s, the structure of work in Finland shifted from an industrial to a service orientation. Hence the nature of the work performed also changed. (Härmä & Nupponen 2002) In the 1990s, information technologies were introduced. This introduced a new task for many workers: managing knowledge. This, also, drastically changed the way work was done in Finland. (Härmä & Nupponen 2002) However, there has been neither any significant change in working conditions nor any significant effort to improve working conditions in general in Finland during the past decade (Syvänen et al. 2012).

The changes related to work today are mainly due to changes in the economy, globalization and the rapid development of information technologies (Härmä & Nupponen 2002). There is constant pressure to improve performance using fewer resources (Syvänen et al. 2012). This has led to a decrease in work satisfaction in workers aged 55 and older (Syvänen et al. 2012). The current situation has also led the younger generation of workers to have a higher likelihood of suffering from depression and other mental disorders (Syvänen et al. 2012). This may be because their workload has increased (Syvänen et al. 2012).

In Finland, work ability is seen as an important component of well-being at work. The importance of work ability is underlined by the fact that it is included in Finnish labor and health legislation. (Hussi 2005) Despite the extensive research conducted on well-being at work, and on ways to improve the situation (Syvänen et al. 2012), the results have not been implemented in practice or any such implementation has been short-lived (Syvänen et al. 2012).

2.1.2 Risks & possibilities

In Finland, ICT workers will face increasing pressure at work. The ageing of the Finnish population also exacerbates the pressure on the workforce. (Syvänen et al. 2012) There is also increased pressure for ICT companies to perform more efficiently and increase productivity. This leads to further pressure on workers in the ICT cluster (Syvänen et al. 2012).

Today, there is an increasing flexibility regarding how work is done. The advance of information technologies means that work is no longer bound to time and place. This entails the risk of a decrease in employee well-being as the amount of work done increases. The pressure to perform better and improve output more at work has also increased. This may lead to a higher level of stress and even burnout. Because work is no longer bound to a specific time and place, the line between personal and work life may become increasingly blurred. Thus, it is vital that attention is paid to the well-being of ICT-workers. (Härmä & Nupponen 2002)

2.2 Well-Being at work in Estonia

2.2.1 History (from the 1970s onwards)

The impact of psychosocial risk factors on well-being at work in Estonia was investigated and analyzed by J. Seppo in "Psühhosotsiaalsete riskide levik Eestis" Indrek Seppo, Janno Järve, Epp Kallaste, Liis Kraut, Maarja Voitka. http://rahvatervis.ut.ee/bitstream/1/1901/1/Seppojt2010.pdf. The Estonian participants in general reported having enough time to finish their work, while 86,5 % reported feeling that their work has been done well done, 77% support from co-workers, 61,5% support and help from their management, 40,6% the possibility to influence important work-related decisions, and 5,6 % having duties that are not acceptable in light of their own values.

2.2.2 Risks & possibilities

The psychosocial character of computer workers' health risks in modern buildings was investigated. The influence of indoor climatic conditions on the development of health impairment in the workplace were also taken into consideration. Computer workers (accountants, secretaries, etc.) often work in a static posture. The most injured regions of the body were the right wrist and the neck. Working conditions (indoor climate, lighting) are closely connected with the development of musculoskeletal disorders (MSDs) in glazed buildings. Low temperatures (<20 C in office) in winter and high temperatures and draughts in summer, insufficient day-light, etc. are supplementary causes for developing MSDs. In addition to the individual and psychosocial factors, the MSDs of computer professionals were also associated also with organizational factors like the length of rest breaks, rotation, and duration of spells of working seated and with factors related to the workplace (the possibility to adjust the office chair and table; placement of screen, keyboard and mouse).

2.3 Well-Being at work in Latvia

2.3.1 History from the 1970s onwards

Well-being as a concept is relatively new in Latvia, as before the 1990s it was seldom operationalized and was not included in legislation or in the training of occupational health and safety experts. The approach applied at that time was more "regulatory", as the former Soviet Union had very strict regulations regarding worker safety and health, even if these were usually ignored (Eglite et al. 2006). Also, the kinds of organizational and psychosocial risks largely responsible for well-being were not typically acknowledged as a significant problem, as shown in part by the morbidity structure of occupational diseases, which were dominated by disorders induced by dust, noise and vibration induced (Eglite et al. 2006). Moreover, the structure of industry was mostly industrial and agricultural, and dominated by large companies that typically ran their own internal occupational health and safety services with specially trained doctors and nurses. However since the 1990s the situation has changed dramatically, with a shift away from large industrial and agricultural companies to an economy dominated by micro and small & medium sized SMEs' companies enterprises working mainly in services sector. This, together with rapid changes in legislation towards a less regulatory approach and changes in the technologies used, has led to a major change in working conditions in Latvia (Sprudza et al. 2010). The information technologies rapidly introduced from the mid-1990s has created a whole new work environment characterized by high stress levels, heavy workloads and various musculoskeletal disorders (Martinsone et al. 2012).

The current situation in the work environment in Latvia is characterized both by the effects of major legislative changes around the year 2002, when the transposition of EU legislation in the area of occupational health and safety took place, and by the effects of changes in the global economic situation (globalization, increase in information technologies, aging, etc.) (Vanadzins et al. 2011). Another significant problem is the challenge of the practical implementation of occupational health and safety (OSH) legislation in micro and small & medium sized companies SMEs' enterprises, where less than one-third of workers are provided with basic OSH services (Vanadzins et al. 2011). Also the increased usage of information technologies have exposed the new generation of workers to high stress levels and risks for musculoskeletal disorders due to intensity of work and workload. This is also reflected in occupational morbidity statistics, where musculoskeletal diseases are now responsible for around two-thirds of all diseases (Martinsone et al. 2012). All this has led to change in the understanding of worker health and safety in which the concept of well-being has become increasingly popular and is now also included in the training of OSH experts and doctors (Eglite et al. 2012).

2.3.2 Risks & possibilities

Several significant risks face Latvian employees and the Latvian work environment in the near future. Among the most important is the practical implementation of OSH legislation, especially in micro companies and among self-employed individuals, often working with information technologies, who are exposed, for example, to high levels of

stress, poor working conditions, overtime working and social insecurity. The ageing of the working population, especially with regards to mental well-being and musculoskeletal disorders also merit attention. The organizational and psychosocial risks related to the wider use of information technologies and changing work patterns (changes in work organization, workload, overtime work, social insecurity etc.) are also significant problems in larger companies linked with loss of work ability and productivity.

3 WORK ABILITY & WELL-BEING AT WORK

3.1 Well-being at work

Many studies have shown the well-being of employees to be crucial for the productivity of an organization. According to a report from Eurostat in 2010, the most serious and frequently reported health problems in the working population across the EU are problems related to the neck, back, hands and arms, and stress and depression

3.1.1 What is well-being at work?

How we feel at work affects how we feel at home and vice versa. Problems at home affect work performance and presenteeism, and if someone is under a lot of stress this can cause sleeping problems and/or irritability at home. It is, therefore, hard to distinguish work health from what is just health in general. Some studies have also shown that people in good shape also seem to enjoy their work more. In sum, not only does one's well-being in general positively affects one's well-being at work, but this also holds the other way round. How to get people to enjoy their work more is therefore what investments in well-being at work are seeking to bring out. It is also hoped that such investments and improvements will also have positive effects on life outside work. In other words, when the aim is to improve well-being at work, the means taken usually focus on what happens in the workplace.

3.1.2 Different components of well-being at work

It is important to take into account all the different components of well-being at work: mental, physical, social and emotional. These different components of well-being at work also affect each other. For example stomach-ache, backache, obesity, etc. can affect mental well-being negatively, but may also be somatic symptoms of, or caused by, depression or other mental problems. The different components of well-being and what they can include are:1) Mental well-being: introduction to work, mentoring, coaching, develop and maintain expertise, development discussions, rotation of work tasks, 2) Physical well-being: exercise, diet, sleep, rest, industrial safety, risk mapping, rescue plan, occupational health services, rehabilitation, 3) Emotional well-being: values, motivation, family, friends, hobbies, associations, 4) Social well-being: social skills, plan how to achieve equality, communication, leadership, paying attention to multiculturalism, parties, recreational activities (Based on Otala & Ahonen 2005).

3.1.3 How improve well-being at work?

First of all, it is important to consider what the most important issues in the target organization or work unit are. This can be done in many different ways. Traditionally, consultants or other experts have been, and often still are, hired to evaluate what issues are the most important issues and suggest solutions. However, in recent years more participatory ways of identifying the main issues and solutions are being applied. Consultants or leaders can, for example, use interviews to find out what employers regard as the main issues and how these could be resolved. In the Metal Age program used in WASI, the issues were first discussed in pairs. All the issues raised were then grouped into bigger units and prioritized by the whole work unit together. After this, the group planned concrete solutions to the most important issues.

Engaging the whole work unit into discussing the issues and finding solution usually decreases resistance to change. If an outside consultant or the managerial group/executives decide what is going to be done, there is always a risk that the employees will not perceive the measures as meaningful. This can then create resistance to change, despite the fact that the plan has been designed to improve everyone's well-being. But resistance to change can also arise and the intervention fail even where a participatory intervention is used. This can happen, for example, if participation is promised, but the employees do not experience that they really are able to influence decision making or that their suggestions are taken seriously.

There is no universal method for improving well-being at work, and therefore it is hard to offer universal advice for how this might best be done. First of all, issues are different across organizations and work units, and second, solutions that work in one work unit or organization might not work in another. And then there are also individual differences. For example, some employees might prefer great autonomy while others would want to have more specific guidelines about how to do a specific task. All of these factors should therefore be considered when planning or implementing actions for improving well-being at work.

3.1.4 A definition of well-being at work

Definitions of well-being are various. Whatever the definition, however, it is important to recognize that well-being at work initiatives need to balance the needs of the employee with those of the organization. We define well-being at work as follows: creating an environment to promote a state of contentment which allows employees to flourish and achieve their full potential for the benefit of themselves and their organization. Well-being is more than the avoidance of physical illness. It represents a broader bio-psycho-social construct that includes physical, mental and social health. Well employees are physically and mentally able, willing to contribute in the workplace and likely to be more engaged at work. Employee engagement influences a range of variables, including employee turnover and absence.

The achievement of personal well-being involves a number of positive decisions regarding lifestyle. This is very different to stress avoidance, with its negative implication of being unable to cope and falling ill prior to any action being taken. In their ideal form,

well-being initiatives are proactive and work to enable employees to achieve their full potential – physical, mental, social, intellectual and spiritual.

Well-being at work, therefore, is not merely about managing a physical and cultural environment with the limited aim of not causing harm to those employed in it. It requires organizations to actively assist people to maximize their physical and mental health. The well-being approach also benefits people at all levels inside and outside the workplace. It makes the workplace a more productive, attractive and corporately responsible place in which to function. Positive well-being can also benefit the local community and, more broadly, the country as a whole, as well people requirie less support from health services.

One of the reasons for the wide diversity in definitions of well-being is that the term has come to mean different things to different people. For some people, the ability to do 50 press-ups may be a sign of well-being, while for others the intellectual challenge of handling a difficult meeting well may provide a positive experience of well-being. The nature and range of the provisions made for enhancing well-being therefore need to be tailored to meet the needs of the individual employees and their organization.

Well-being is a subjective experience. It can involve practical measures such as introducing healthy food or a gym at work, or perhaps less tangible initiatives such as working to match the values and beliefs held by employees with those of their organization. It could be argued that a change in the way employees are engaged in discussions about how their work is organized could have more of an impact on an individual's well-being than the introduction of a corporate gym. Well-being will run the risk of being dismissed as a gimmick, unless those involved in its introduction and promotion demonstrate the positive business benefits that it can bring. To be effective, employee well-being needs to be part of a regular business dialogue and to be deeply embedded in the organizational culture. A well-being dialogue can be beneficial to employees' health by causing them to feel valued and by giving them an opportunity to use their experience to improve their working environment. Many organizations are currently trying to create a balance between maximizing productivity and the risk that their employees may burn out, make costly errors or quit. Adopting a holistic approach to well-being along with the development of initiatives coordinated with other HR policies can offer a means to achieve that balance between productivity and employee health.

3.1.5 Organizational well-being

Organizational well-being is about many things, but among the most important are employees' experience of their work as meaningful and challenging and that they have an opportunity to apply their skills and knowledge in effective working relationships with colleagues and managers in a safe and healthy environment. Well-being-oriented organizations provide the tools to get the job done and the opportunity to achieve personal aspirations, while helping employees to maintain a good work–life balance.

Some of the essential factors leading to organizational and personal well-being are:

- values-based working environment and management style
  - open communication and dialogue
- team working and co-operation
- clarity and unity of purpose
- flexibility, discretion and support for reasonable risk-taking
- a balance between work and personal life
- the ability to negotiate workload and work pace without fear of reprisals or punishment
- being fairly compensated in terms of salary and benefits

The employer also has a duty to ensure that the organizational culture fosters a positive working environment. The need for social justice and human rights has also been addressed. Employers should focus on creating a workplace culture in which everyone feels included, valued and respected. To foster personal responsibility and engagement, a balanced approach is needed to address diverse stakeholder and organizational interests and preferences. Creating a climate of mutual respect and dignity will promote improved working relationships and contribute to productivity and business performance.

3.1.6 Employee well-being

Perhaps the most important factor in employee well-being is the relationships employees have with their immediate supervisor. Where there are strong relationships between managers and staff, levels of well-being are enhanced. A good supervisor will recognize the strengths, likes and dislikes of the team members and will be able to recognize when the volume or complexity of the work is too much for a particular team member. The more capable leaders are in identifying the personal interests and concerns of the individual, the more likely they will be able to create a team where employee well-being becomes an integral part of getting the job done.

Employee well-being involves:

- maintaining a healthy body by making healthy choices about diet, exercise and leisure
- developing an attitude of mind that enables the employee to have self-confidence, self-respect and to be emotionally resilient
- having a sense of purpose, feelings of fulfilment and meaning
- possessing an active mind that is alert, open to new experiences, curious and creative
- having a network of relationships that are supportive

Otala and Ahonen (2005) describe well-being at work as a subjective feeling, a state of mind and the activity level of the work environment. Manka (2011) also pointed out that man should be seen from holistic perspective. According these authors, well-being at work is a balance between physical, psychological, social and mental factors, and which

also includes professional work skills. Well-being at work is also influenced by life situation, family life and external living conditions. These ingredients all affect well-being at work and occupational health. Psychological well-being in the context of occupational well-being cannot be separated from overall psychological well-being (Otala & Ahonen 2005, Ilmarinen, 2009, Kauko-Valli & Koiranen 2010)

The factors that form well-being at work, according Otala and Ahonen (2005 s. 28), are shown, with some modifications, in Figure 1. The model is hierarchic, with physical well-being at the bottom and mental well-being at the top. Several factors have been identified that contribute to the individual's experience of well-being at work (Kauko-Valli & Koiranen 2010). The sense an employee makes of her experience' is always based on her attitude. Other factors contributing on the overall sense of well-being at work include the employee mental capital and her possibilities to influence the work environment, that is, to influence her work tasks and her health (Manka 2011). Irrespective of these influencing factors, employees with a high level of well-being are more effective and more creative than those who do not feel well at work. An employee with high well-being has better tools to handle occupational stress and other disappointments in life, and also take less sick-leave. Mental well-being predicts also longer life and work ability, especially in strenuous working conditions. Mental well-being is essential for being able to experience joy at work. This also holds the other way round: joy at work increases mental well-being. Emotions are also an important factor in occupational well-being, as in all human actions. It is important, therefore, to take emotions into consideration in efforts to spread joy and satisfaction at work.

The importance of maintaining work ability is included in legislation in Finland, and has been well established in the Finnish work environment and occupational culture. Work ability includes the prevention of diseases and also proactive efforts to enhance the work environment. The idea is holistic and includes individual health, occupational competence, a well-functioning work environment and social inclusion (Hussi 2005). Work ability is similar to well-being at work in that it involves achieving a balance between work (environment, leadership, work tasks, social inclusion, organization of work, work demands) and subjective resources (health, skills, competence, education, attitudes, norms). Variations and nuances in work ability exist according to the individual's life situation and environmental conditions. Cooperation between employees and leaders is important, when it seeking to maintain and develop work ability through such means as HR policy, strategical decisions by management, occupational health services and occupational safety (Ilmarinen 2009).

Health promotion is one of the ingredients of work ability and well-being at work. The 1986 WHO declaration on health promotion at work describes it as follows: "Health promotion is the process of enabling people to increase control over, and to improve their health. To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities. Therefore, health promotion is not just the responsibility of the health sector, but goes beyond healthy life-styles to well-being" (WHO 1986)

3.2 Social inclusion

Social inclusion is defined as the participatory, authentic, and accountable manner in which institutions uphold and reinforce the principles of access, equity and, as a result, social inclusion for all.

Social inclusion is the manner in which institutions understand and engage their communities, as well as how they explore, view, and challenge barriers, values, and behaviors. Social inclusion is also defined by how institutions develop, implement, and evaluate policies and procedures, how they provide equitable access to services, and finally, how they demonstrate the level of inclusion through tangible outcomes.

Social inclusion refers to all efforts and policies to promote equality of opportunity to people from all circumstances and from all socially-excluded categories. The circumstances and the categories of people mostly linked to social exclusion are therefore the circumstances and categories to be addressed by efforts to enhance inclusion.

Finally, social inclusion is understood as a multi-dimensional concept that facilitates inclusion from a variety of fronts, including the following: increase in employment; elimination of poverty; enablement of civic engagement; elimination of discrimination; and promotion of access to a variety of public resources and institutions. Based on the concept of social inclusion, projects that engage in social inclusion work should therefore be informed by the perspectives and worldviews of those to be included.

3.3 Stress

Stress can have both negative (distress) and positive (eustress) sides and effects (Selye 1974). Distress, known to have negative outcomes, is the most common type of stress. Eustress, in turn, is a positive cognitive response to stress which can be considered as healthy or giving one a feeling of fulfillment and other positive feelings (Selye 1974). In the context of occupational stress, eustress may be measured on subjective levels, such as of quality of life or working life, job pressures, psychological coping resources, complaints, overall stress level, mental health and challenges connected to work. McGovan, Gardner & Fletcher (2006), conclude that while there is no single definition of stress, occupational stress is often caused by experiences in the working environment. Research on eustress has focused on its presence in the workplace in situations where stress can often be interpreted as a challenge, signifying positive eustress. Stress can also be seen as a hindrance, and in such cases refers to distress that interferes with one's ability to carry out a job or assignment. Whereas negative stress should generally be reduced, it might be that on some occasions positive stress could (actually?) increase wellbeing in working life. Also, according to Lazarus (1966, 1991), eustress can be regarded as a positive and cognitive response to stress that is healthy. It can give a person the experience of succeeding or other positive feelings, depending on how one understands or receives a stressor. A positive response to stressor may be linked to feelings of having control, desirability and basic trust. Eustress also mostly correlates positively with life satisfaction and well-being. The concept of eustress was originally introduced by Selye (1974), and it refers to the entirety of positive adaptive reactions. It is thus the

opposite of distress, which, according to Selye, can be regarded as a specific syndrome triggered by non-specific harmful stimuli or activities. For Selye, eustress represents a pleasant type of stress that does not have the harmful consequences of damaging distress. Selye also regards stressors as healthy when they do not disturb a person's experience of homeostasis or balance in life.

Lazarus (1966) also sees challenges as potential stressors that can manifest themselves in a variety of situations. When the goal of a task or action is experienced as relevant and goal congruence is in place, involvement in its realization has a positive effect not only on the individual's self-esteem but also social esteem. According to Selye's (1983) later research, which has been seen as influenced by the work of Lazarus, eustress and/or the distressful quality of a stressor depends on the individual's interpretation of the context in which it emerges.

3.4 Leadership

Leadership is the process through which people influence other people in order to reach certain organizational and individual goals (Muller & Raich 2005). By permanent motivation of individuals to continuously develop and enhance their work practice, leaders improve employees' work satisfaction and productivity (Muller & Raich 2005). Leadership does affects the well-being of employees in many regards. It is often said that leadership has a wide-ranging influence on the well-being of employees and is an important element of well-being at work. (van Dierendonck et al. 2004) Good leadership, and hence management, are important for well-being at work (Syvänen et al. 2012).

The recent changes in the nature of work and the increased focus on knowledge and competence have also changed the way work is performed. Currently, work can be done very independently. Work is no longer tied to time and place. At the same time, the pressure to perform well and be more productive has increased. This in turn means that the approach to leading workers has also changed, bringing many related challenges. (Syvänen et al. 2012).

Currently, a good leader has to be able to manage both the financial aspects of the organization's activities and take the well-being of its employees into consideration. A balance has to be struck between the requirement of efficiency and allowing employees to be creative and utilize their knowledge and competence. These are the main challenges that face leaders today. According to Skakon et al. (2010), the well-being and stress level of a leader is reflected in the well-being and stress level of the employees. As already stated, the nature of leadership has changed, and leaders are under increasing pressure, especially in the ICT cluster. It follows that leaders are also subject to stress and to a reduced level of well-being. This cycle is one that may affect an entire workplace.

3.5 Trust

Trust is an important factor within working communities and other sites of human interaction. On trust within working communities, three significant factors that increase feel-

ings of trust have been identified: participating and justified leadership, functional working-groups and greater worker independency (Gilson 2003). The phenomenon of trust has also been studied from the social capital point of view (Jokivuori, 2005, Sinervo, Elovainio, Pekkarinen & Heponiemi 2005) as well as from outside working life (Helkama & Seppälä 2004, Piippo & Aaltonen 2008). Based on these studies, we can assume that trust as an independent phenomenon is hard to investigate since its development is connected to and influenced by several factors.

Trust is also considered a basic human need, and its development to a high degree depends on the interaction in the particular human environment (Erikson 1968, Piippo & Aaltonen 2004, 2008). As such, it has been studied from several points of view, e.g., from a psychological viewpoint Erikson (1968), from a sociological viewpoint Giddens (1990, 1991), and from a philosophical viewpoint Lögstrup (1994). All these viewpoints share similarities insofar as all consider that trust is a basic human need and that the development of trust depends on interaction with the social environment. Erikson (1968) argues that if the development of basic trust is disturbed, mistrust emerges. According to Erikson (1968) and Giddens (1991), even experience and the development of safety depend on having basic trust: trust and safety are interdependent. Giddens (1990, 1991) argues that the development of trust is a mutual process between two or more persons, a process which includes disclosure and honesty. When one party discloses something personal about him or herself, he/she invites the other party also to disclose something personal in turn. This kind of process continues, according to Giddens (1990, 1991), and gains strength when the trust developed is not betrayed. In such a process, honesty is important, since all the participants are vulnerable and if the personal issues disclosed are misused, the process stagnates.

4 IMPROVING WELL-BEING AT WORK

4.1 Participatory methods

Participatory methods are based on employee involvement in improving well-being at work. Employees should actively participate in developing this in order to solve issues that negatively affect well-being at work. Research has shown that involving employees in the planning of their work gives better results than consulting experts alone. (Heckscher et al. 2003). The presence of an expert facilitator is almost always required in participatory methods. The facilitator's task is to aid the employees in the discussions and equip them with different tools to facilitate their participation in the process.

A number of participatory methods have been utilized to involve employees in improving well-being at work, including methods in which the employees freely discuss the problems they have identified in their organization. The employees also prioritize and find solutions to these problems. (Mikkelsen, Saksvik & Landsbergis 2000) According to Mikkelsen, Saksvik & Landsbergis (2000), participatory methods of this kind lead to a learning process where the participants feel that they can find and solve their problems themselves and that their proposals are taken seriously by the management.

Additionally, there is a more structured participatory method called the Kaizen program. The Kaizen program is based on cross-functional teams working together for 3-5 days. The teams receive tools for solving their problems and implementing improvements at their workplace. Furthermore, the program entails regular follow-ups that ensure that the measures decided upon are being implemented. (Doolen et al. 2008, Farris, Van Aken, Doolen, & Worley 2008)

Previous studies have shown that participatory methods have a positive effect on the work environment (Mikkelsen & Gundersen 2003, Park et al. 2004). Participatory methods have been shown to have a positive effect both on autonomy at work (Mikkelsen & Gundersen 2003) and productivity (Näsman 2011, Tsutsumi, Nagami, Yoshikawa & Kawakami 2009). Participatory methods counteract decreases in mental health (DeJoy et al. 2010, Tsutsumi et al. 2009) and employee turnover (DeJoy et al. 2010), andreducing absences due to sickness (Näsman, 2011). A study conducted by Rivilis et al. (2006) revealed that participatory methods have a positive effect on feelings both of control at work and of communications within the organization. Furthermore, the study showed that increased feelings of control lead to positive effects such as increased productivity.

According to Baugher (2003), employees have to feel valued and that their opinions are being heard in order to share the goals of the organization. Additionally, Baugher states that it is important for employees that the initial plan is followed. If employees feel that their part in the participatory method is smaller than anticipated, they may become disappointed and turn against the values and goals of the organization. Furthermore, a smaller part than promised during the participatory process may lead to employee resistance to change. It would, therefore, be better to prepare for unexpected events and put the focus on genuine participation by the employees. (Baugher 2003)

It is important that the employees perceive that their voice is heard (Baugher 2003) and that they feel that they are a part of the participatory process (Heckschers et al. 2003). These issues are of importance no matter which participatory method is used.

REFERENCES

Baugher J. 2003. Caught in the middle? Worker identity under new participatory roles. Sociological Forum, 18(3): 417-439.

DeJoy D, Wilson M, Vandeberg R, McGrath-Higgins A & Griffin-Blake S. 2010. Assessing the impact of healthy work organization interventions. Journal of Occupational and Organizational Psychology 83: 139-165. doi: 10.1348/096317908X398773.

Doolen T, Van Aken E, Farris J,Worley J & Huwe J. 2008. Kaizen events and organizational performance: A field study. International Journal of Productivity and Performance Management. 57(8): 637 – 658. doi:10.1108/17410400810916062

Eglīte M, Sprūdža D & Baķe MA. 2006. Arodveselības un darba medicīnas nozarēm Latvijā – 40 gadi // Medicine, Rīga.- 2006, 4, p.9-11.

Erikson EH. 1968. Identity: Youth and crisis. New York: Norton.

Farris J, Van Aken M, Doolen T & Worley J. 2008. Learning From Less Successful Kaizen Events: A Case Study. Engineering Management Journal 3(20). Hämtad från databasen EBSCOhost Academic Search Complete.

Giddens A. 1990. The Consequenses of Modernity. London: Standford University Press

Giddens A. 1991. Modernity and Self-identity. Self and Society in the Late Modern Age. Cambridge: Polity Press

Gilson L. 2003 Trust and the development of health care as a social institution. Social Science & Medicine.

Heckscher C, Maccoby M, Ramírez R & Tixier P-E. 2003. Agents of Change: Crossing the Post-Industrial Divide. Oxford: Oxford University Press.

Hussi T. 2005. Essays on managing knowledge and work related wellbeing (Publications of the Swedish School of Economics and Business Administration nr. 150). Edita Prima Ltd: Helsinki. From https://helda.helsinki.fi/bitstream/handle/10227/122/150-951-555-892-1.pdf?sequence=2

Härmä M & Nupponen T. 2002. Työn muutos ja hyvinvointi tietoyhteiskunnassa. Sitran raportteja 22. Helsinki. ISBN 951-563-419-9 (URL: http://www.sitra.fi/)

Ilmarinen J. 2009. Work ability - a comprehensive concept for occupational health research and prevention. Scand J Work Environ Health 35(1). From www.sjweh.fi.

Jokivuori P. 2005. Fields of social capital. Minerva kustannus, Jyväskylä. (Sosiaalisen pääoman kentät).

Kauko-Valli S & Koiranen M. 2010. Työn ilo ja henkinen hyvinvointi. Teoksessa M. Suutarinen & P.-L. Vesterinen (toim.) Työhyvinvoinnin johtaminen. Helsinki: Otava.

Lazarus RS. 1966. Psychological Stress and the Coping Process. New York, Toronto, London: McGraw-Hill Book Co.

Lazarus RS. 1991. "Psychological stress in the workplace". Journal of Social Behavior and Personality 6 (7).

Lögstrup KE. 1994. The ethical demand. Uddevalla: Mediaprint AB. (Det etiska kravet).

Manka M-L. 2011. Työn ilo (toinen painos). Helsinki: WSOYpro Oy.

McGowan J, Gardner D & Fletcher R. 2006. Positive and Negative Affective Outcome of Occupational Stress. New Zeeland Journal of Psychology. 35:2.

Martinsone Z, Bake MA, Seile A, Zellane M, Sudmalis P, Lakisa S & Sprudza D. 2012.Occupational Risks and Related Health Effects for Office Workers in Latvia

// International Proceedings IFEH 12th World Congress on Environmental Health Vilnius, Lithuania.- 22.-27.05.2012.- ISBN 978-88-7587-664-7.- pp.91-94

Mikkelsen A & Gundersen M. 2003. the effect of a participatory organizational intervention on work environment, job stress and subjective health complaints. International Journal of Stress Management 10(2):91–110. doi: 10.1037/1072-5245.10.2.91

Mikkelsen A,Saksvik P & Landsbergis P. 2000. The impact of a participatory organizational intervention on job stress in community health care institutions. Work & Stress 14(2):156–170. Accesed from Taylor & Francis.

Müller C & Raich M. 2005. The Ambiguous Relationship of Leadership and Intellectual Capital: Understanding how Intellectual Capital is Developed, The Electronic Journal of Knowledge Management 3:1, pp 35-44, available online at www.ejkm.com

Näsman O. 2011. Metal Age och Kiva-enkät. Assisterar vid navigering mot arbetsvälbefinnande. Dalsbruk: Mediona OyAb

Otala L & Ahonen G. 2005. Työhyvinvointi tuloksentekijänä (toinen painos.). Helsingfors: WSOY pro.

Park K-O, Schaffer B, David M, Wilson M & Vandeberg R. 2004. Effectiveness of healthy work organization intervention: Ethnic group differences. JOEM 7(46), 623-634. doi:10.1097/01.jom.0000131793.44014.91.

Piippo J & Aaltonen J. 2004. Mental health: integrated network and family-oriented model for co-operation between mental health patients, adult mental health services and social services. Journal of Clinical Nursing 13: 876-885.

Rivilis I, Cole D, Frazer M, Kerr M, Wells R & Ibrahim S. 2006. Evaluation of a participatory ergonomic intervention aimed at improving musculoskeletal health. American Journal of Industrial Medicine 49 (10):801–810.

Selye H. 1974. Stress without distress. Philadelphia: J.B. Lippincott Company.

Sinervo T, Elovainio M, Pekkarinen L & Heponiemi T. 2005. Equitability of an organization as basis for trust and motivation. Teoksessa P. Jokivuori. Sosiaalisen pääoman kentät. Minerva kustannusosakeyhtiö, Jyväskylä. s. 133–146. (Organisaation toiminnan oikeudenmukaisuus luottamuksen ja motivaation perustana).

Skakon J, Nielsen K, Borg V & Guzman J. 2010. Are Leaders' well-being, behaviours and style associated with the effective well-being of their employees? A systematic review of three decades of research. Work & Stress,24:2, pp 107-139.

Syvänen S, Kasvio A, Loppela K, Lundell S, Tappura S & Tikkamäki K. 2012. Dialoginen johtaminen innovatiivisuuden tekijänä. Työterveyslaitos. Helsinki. ISBN 978-952-261-185-7.

Sprūdža D, Eglīte M, Baķe MĀ, Martinsone Ž, Matisāne L, Mārtiņsone I, Piķe A, Vanadziņš I. 2010. Evaluation of work conditions and occupational health risk factors in enterprises within a 10-year period in Latvia // Proceedings of the Latvian Academy of sciences ISSN 1407-009X / Riga.- Vol.64.- 2010.- N.1/2.- p.10-19.

Tsutsumi A, Nagami M, Yoshikawa T & Kawakami N. 2009. Participatory interventions for workplace improvements on mental health and job performance among blue-collar workers: A cluster randomized controlle trial. JOEM 5(51), 554–563. doi:10.1097/JOM.0b013e3181a24d28.

Vanadzins I, Martinsone Z, Matisane L, Reste J, Bake MA, Sprudza D & Eglite M. 2011.Correspondence of changes in occupational health and safety policy in Latvia with changes in work environment // Proceedings International Forum on Occupational Health and safety: Policies, profiles and Services / Hanasaari Cultural Centre, Finland.- 2011.- p.95-97.

van Dierendonck D, Haynes C, Borrill C & Stride C. 2004. Leadership Behaviour and Subordinate Well-Being. Journal of Occupational Health Psychology, 9:2, pp 165-175.

WHO. Ottawa Charter for Health Promotion 1986. Accessed October the 20th 2012, WHO:s homepage http://www.who.int/healthpromotion/conferences/previous/ottawa/en/

WASI: The Metal Age Method

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1 THE METAL AGE PROGRAM

In the MA program, both employees and leaders are actively involved in a process focused on finding ways to enhance occupational well-being. The goal is to implement a continuous development process in the employee's own work and work environment. One of the goals in participatory innovative work is to be part of the organization's other activities, which in turn promotes a mutual learning process. This participatory innovative activity is based on trust and dialogue within organizations.

The MA program aims to create concrete, practical and tailored solutions. An integral part of the method is planning how to prioritize the development areas that employees and leaders have identified. Prioritization stems from the understanding that not all these development areas can be dealt with at the same time. Thus there is a need for common agreement among the leaders and employees on the development areas to be addressed first. It is important to limit the number of actions and measures at the outset and agree on a certain number of concrete improvements. The prioritization phase requires communication, mutual understanding and consensus within the work unit regarding what is important and what should be done. While prioritization can be seen as

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the most crucial stage of the MA method, the approach comprises four other distinct phases. They are as follows:

1) **Orientation phase.** The matrix shows the situation in the work unit from three different points of view: that of individuals, work units and the organization (Figure 3).
2) **Intervention planning phase.** Here, the aim is to find the development areas for improving well-being at work for the MA planning group. At this stage, the participants should evaluate the development areas freely and list them before grouping them together,
3) **Prioritization phase. T**his phase identifies which challenges are the most important and urgent. A crucial part of the planning process of the MA method is prioritization. Without prioritization, the risk remains that the workplace only lists some but not all the development areas. Alternatively, the list may become so long that there are not enough resources and nothing will be done.
4) **Suggestion phase.** –At this point, suggestions for concrete actions are made. The phase for establishing concrete actions begins after finalisation of the scoring in the prioritisation phase. Concrete actions are agreed on for the development area that obtained the highest score during prioritisation.
5) **Follow-up phase** (KIVA –questionnaire). The MA planning session concludes with the group agreeing on a follow-up meeting to be held after 12 months. In this project we also aim to implement actions and measurements for decreasing work-related stress by first identifying the situations in which work-related stress is increased and on the basis of that knowledge training the employees and leaders involved in stress management. The stress level is measured by stress questionnaires and measuring cortisol in saliva.

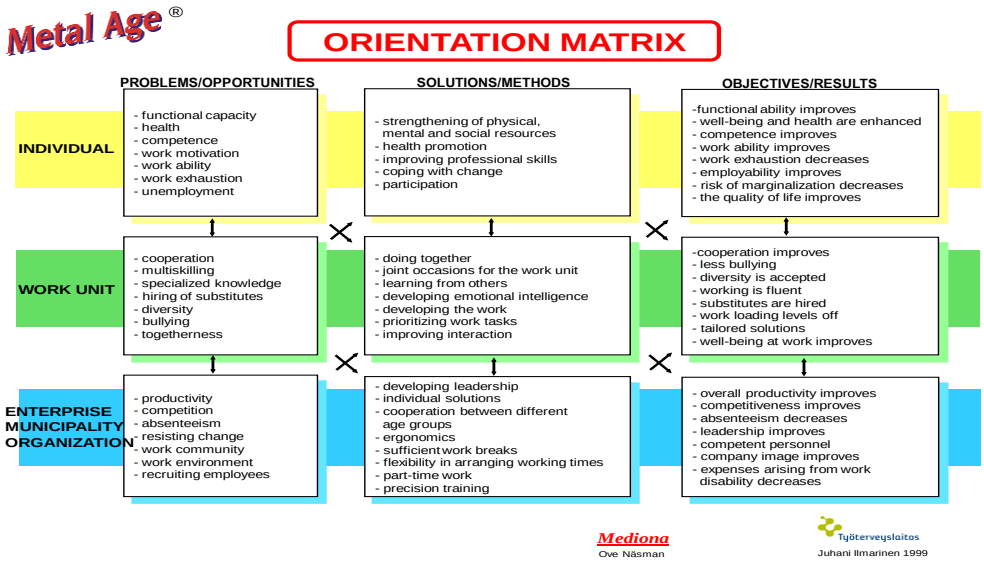

Figure 1. Orientation matrix (Näsman 2011)

1.1 Work ability

Work ability programmes were introduced as an answer to challenges related to the on-going changes in the business environment, the ageing of the workforce and reduced occupational early exit options in the advanced European countries.

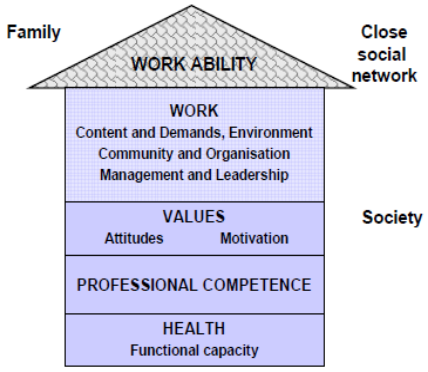

Figure 2. Work ability House

Work ability is a rather complex concept, since it is composed of diverse factors such as professional competence, the demands of the job, the organization of the work, loading of the work, control over the work, physical and psychosocial resources, emotional intelligence, health status, and the work climate (figure 1). As such, projects aiming at enhancing well-being in organisations have significant consequences benefits not only for employees or organisations also working teams, the municipality and/or society at large (Risa 2007).

By assisting employees to cope better at work, through having more energy, work motivation, high-quality working, productivity, and joy in working (Risa 2007), projects like the present one should result in higher employee productivity and thus better performance on the part of the organisation (Tuomi et al. 2001). The activities the project focus on four main areas:

1) employees' health and coping resources,
2) professional competence,
3) work and working conditions, and
4) work community and leadership and management practices.

2 RESEARCH DESIGN

2.1 Surveys in Estonia, Finland, and Latvia

The baseline questionnaire (see appendix 1) was administered to ICT and administrative personnel at the participating organizations between 5/2012 and 8/2013 using the

Digium Enterprise software Questback (www.questback.fi) in Finland (baseline n=112, follow-up n=85)), Estonia (baseline n=295, follow-up =136), and Latvia (baseline n=345, follow-up n=235).

The questionnaire comprised six parts; background, leadership, well-being at work, absenteeism and reduction in work capacity, occupational stress, and work ability. To study personnel's experience of the quality of supervision, the corresponding questions of the General Nordic Questionnaire for Psychological and Social Factors at Work (QPSNordic) were used. The leadership dimension consisted of eight questions each with a five-point response scale from "very seldom or never" to "very often or always". The validation of the instrument has been published in more detail earlier (Dallner et al. 2000).

The KIVA questionnaire (Näsman 2011) was used to examine how personnel experience the climate in their workplaces. The questionnaire comprised seven questions: 1) Have you enjoyed coming to work over the last few weeks? 2) I regard my job as…, 3) I feel in control of my work, 4) I get on with my fellow-workers, 5) My immediate superior performs as a superior, 6) How certain are you that you will keep your job with this employer? and 7) How much influence do you have over factors concerning your job? Each of the questions was evaluated on a ten-point scale from 1 = "not at all" and 10 = "yes, very much".

Stress symptoms were evaluated with Occupational Stress Questionnaire (OSQ) (Elo et al. 1992). The questionnaire included five dimensions with 58 questions. Each question was answered on a fiv- point scale from 1 = "not at all" to 10 = "very much".

Subjects' work ability was investigated with the Work Ability Index (WAI) (Tuomi et al. 1998). Berg and co-workers (2009) stated in their systematic review that the WAI is by far the most widely accepted instrument to measure work ability, as is demonstrated by its availability in 21 languages.

To investigate the effect of the Metal Age (MA) program, a corresponding follow-up questionnaire was sent 12 months after the intervention.

2.2 Interviews in Finland

For the interviews, which were conducted only in Finland, three persons were recruited from each of three organizations: Kårkulla samkommun, the Municipality of Pargas and Turku University of Applied Sciences. The persons in question were recruited by their superior and participation was voluntary. All the interviewees received oral and written information about aim of the interviews and they gave their informed consent. The individual interviews were implemented at their workplaces during working time in April 2012. The issues discussed during the interviews were: Trust, Commitment to work, Occupational health, Leadership and Innovations. The interviews took the form of free flowing discussions on these topics.

Follow-up interviews were conducted one year later in April 2013. Only the persons from the Municipality of Pargas and Turku University of Applied Sciences were inter-

viewed. The personnel from Kårkulla samkommun were either impossible to contact or they did not answer the request for a follow-up interview.

All the interviews were recorded and transcribed for the subsequent analysis, which was performed according to the principles of Grounded Theory, using Atlas ti. 6.2. Grounded Theory and its application have been developed over several decades (Glaser 1992, Strauss & Corbin 1998). According to Strauss & Corbin (1998), Grounded Theory provides the researcher with analytical tools that help the researcher to notice the various meanings of a phenomenon.

The process of applying Grounded Theory is described differently by different researchers. According to Tesch (1990), the main interest in is to seek regularities, to identify and categorise elements, and to study the relations between them. Chenitz and Swanson (1986) consider Grounded Theory to be especially suitable and important for research areas in which there is a need for new points of view. The main principles of Grounded Theory are open coding, axial coding, selective coding and continuous comparison between codes, memos and categories. Open coding incorporates free analysis, mostly of written material such as transcripts of interviews. During this process, the researcher identifies utterances which are interpreted to mean something. As this process continues, it is possible and indeed unavoidable that different utterances will be grouped into the same category because they have the same or a similar meaning. Axial coding involves comparison between the categories and analysis of how they are related to each other. If and when connections are found, it becomes possible for the researcher to identify the core category (selective coding) among the categories initially identified. Selective coding is the process of choosing one category to be the core category, and relating all other categories to that category. Throughout the analytical process, continuous comparison is carried out. The core category of the analysis was trust.

2.3 Economic evaluation in Finland

Work ability programs are widely used to answer the (various?) challenges related to the changing business environment and demands for improved productivity. Work ability is perceived as a rather complex concept (Machioca, Niehoff & Surakka, 2012), and the same program may produce varying outcomes depending on the environment in which it is implemented. Thus, the observed benefits of a program may not be directly generalizable to any other work environment; instead, the expected benefits should be carefully studied in the specific context of implementation. From the point of view of employers, one of the important outcomes of a work ability program is improvement in overall productivity. However, in many workplaces productivity as such is difficult to determine, and measures of sick leave days and presenteeism (feeling sick while at work) have been used as indicators of changes in employee productivity (Prasad et al. 2004). High levels of agreement have been found between self-reported and employer administrative sickness and absenteeism data (Rees & Cooper 1993, Revicki et al. 1994), but self-reported absenteeism has also been shown to underestimate the hours and days missed and overestimate the number of hours worked compared with employer payroll records (Kessler et al. 2003). Older age, lower level of education and, in particular, longer recall time reduce the accuracy of employee self-reported data (Short et al. 2009). Presenteeism estimates are probably even more susceptible to recall bias, and

hence shorter recall periods for these measures have been recommended (Prasad et al. 2004, Sanderson et al. 2007, Beaton et al. 2010).

2.3.1 Objective

The aim of this research was to study the development of sick leaves and presenteeism during a work ability program that has earlier proved to produce improvements in workers' perceived ability to work.

2.3.2 Material and Methods

In 2012-2013, a total of 70 employees from four organizations, and another 42 controls drawn from two of the organizations, were enrolled in a work ability program utilizing the tested concept of the MA method. Application of the MA method is considered simple and fast. In the method, representatives of the employer and employees jointly review the issues that are currently on the table in the target workplace. An integral part of the method is prioritization of the development areas that have been recognized. Not all the issues regarded as important can be handled at the same time. The most important and/or up-to-date issue will be tackled first. After this issue has been satisfactorily solved, the representatives again review the issues that are on the table at that moment and select the most important and/or up to date as the next to be tackled, etc. The aim of the method is to alleviate work-related stress and to improve communication skills, not forgetting the company's productivity and profitability.

Before implementation of the MA program, the enrolled workers filled in a structured questionnaire. Socio-demographic data, detailed information about perceived working conditions and workability, and health status were elicited by means of more than 100 questions. The questionnaire was repeated after one year of from the start of the program. Among other things, the participants estimated their number of sick leave days during the preceding year, selecting from one of five-categories: none, 1-9 days, 10-24 days, 25-99 days and 100 days or more.

From the employers' records we collected the numbers of sick leave days for the three-months period before the program started and for each subsequent three-month period for one year after the initiation of the program. For each three-month period, the number of sick leave days/person/month (SLD) were computed. The overall number of sick leave days during the one year period of program implementation was also computed.

Presenteeism was determined using two questions. First the subjects were asked: How many hours during the preceding 4 weeks have you been at work, despite feeling that because of sickness or for other health-related reasons you should have stayed at home, i.e. you have been sick at work?

After this, the participants were asked to mark on the 10-cm-long Visual Analog Scale (VAS) the point which best describes the level of reduced productivity during the hours of perceived presenteeism. The left-side end point was marked 0 and labeled 'not at all', and the right-side end point 100 with the label 'Extremely'. The overall effect of presen-

teeism on productivity was determined by multiplying the numbers of presenteeism hours by the percentage reduction obtained from the VAS scale.

The gross monthly income of each subject was obtained from the employer and the productivity loss estimates were based on the Human Capital Approach (HCA), where the cost of an hour is the monthly gross income divided by the average number of monthly working hours.

2.4 Ethical approval

The ethical committee of the Hospital District of Helsinki and Uusimaa approved the study protocol.

2.5 Participants in the Metal age programme

2.5.1 Estonia

Six organizations participated in Estonia:

1) ABB AS (Harjumaa, ESTONIA). ABB is a global leader in power and automation technologies that enable customers in the utilities and industrial sectors to improve their performance while lowering their environmental impact. ABB is an international company, with more than 1 100 workers.
2) AS Tallinna Vesi (Tallinn, ESTONIA). AS Tallinna Vesi is the largest water utility in Estonia providing drinking water and wastewater disposal services to over 400 000 people in Tallinn and in several neighbouring municipalities.
3) SA Põhja-Eesti Regionaalhaigla (Tallinn, ESTONIA). The North Estonia Medical Centre is Estonia's foremost hospital. Thev hspital's main buildings are situated in Tallinn (different locations) and Kose. The hospital employs 3 626 people, including 590 doctors, 1 352 nursing staff and 862 caregivers. There are over 100 resident doctors in the hospital at any given time. Medical staff are supported by approx. 714 workers.
4) Haapsalu Linnavalitsus (Haapsalu, Estonia). Haapsalu Town Council comprises 21 elected councillors.
5) PVMP-Ex OÜ ehk Nurme Vabrik (Haapsalu, ESTONIA). OÜ PVMP-Ex / Nurme Factory is a sewing enterprise in Haapsalu, founded in 1992, employing ca 300 people. Since 1994, the factory has held a certified manufacturer's license from W. L. Gore & Associates, Inc. for the production of high-quality waterproof clothing with taped seams. In 2007, W. L. Gore & Associates Inc. granted OÜ PVMP-Ex / Nurme Factory a Gore-Tex® GOLD LEVEL manufacturer's license
6) Tallinn University of Technology (Tallinn, ESTONIA).

These organizations were selected owing to the large numbers of workers employed in them who using a computer for several hours a day and therefore at risk for musculo-skeletal symptoms. Facilitators in these organizations are mostly leaders of the department or representatives of occupational health care.

2.5.2 Latvia

12 organizations from different sectors participated in this project from Latvia:

1) Participant A (Riga, Latvia). One of the top universal banks in Latvia. Field of action: financial and insurance activities.
2) Participant B (Riga, Latvia). A direct management authority, which is subordinated to the Ministry of Welfare. Participant B is the only state institution that implements policy in the field of labor legal relations and occupational safety and health. Field of Action: public administration and defense; compulsory social security.
3) Participant C (Spilve district near Riga, Latvia). A fruit and vegetable processing company, which is the leading producer of food additives in Latvia. Field of Action: manufacture of food products.
4) Participant D (Riga, Latvia). A national radio station, founded in 1925, providing 4 programs with diverse artistic content. Field of action: radio broadcasting.
5) Participant E (Riga, Latvia). International telecommunication organization with one of its branches located in Latvia. Field of action: telecommunications.
6) Participant F (Riga, Latvia). A governmental institution, with its largest and most significant workforce working in 11 headquarters around Latvia performing veterinary supervision and food control. Field of action: public administration and defense; compulsory social security
7) Participant G (Riga, Latvia). The leading pharmaceutical company in the Baltic States, consisting of 4 subsidiary companies in Latvia, Estonia and Russia with representative offices in 13 countries. Field of action: manufacture of basic pharmaceutical products and pharmaceutical preparations.
8) Participant H (Ogre district, Latvia). An international company specialized in manufacturing bakery and sweets with an industrial branch located in Latvia. Field of action: manufacture of food products.
9) Participant I (Riga, Latvia). The leading state administrative institution in the field of education and science, as well as in the fields of sports and official language policy. Field of action: public administration and defense; compulsory social security.
10) Participant J (Riga, Latvia). The company implements state policy in fire safety, fire-fighting, rescue and civil protection, as well as monitors the implementation of statutory fire and civil defense requirements. Field of action: public administration and defense; compulsory social security.
11) Participant K (Marupe district near Riga, Latvia). The largest international aviation company in the Baltic and the main air traffic center in this region. The sole shareholder is the Republic of Latvia. Field of action: air transport.
12) Participant L (Riga, Latvia). A **Riga municipal limited liability company providing** public transport services in Riga. Field of action: urban and suburban passenger land transport.

2.5.3 Finland

Four organizations participated in Finland:

1) Kårkulla Samkommun - administrative and ICT personnelal
2) Turku University of Applied Sciences - project personnelal
3) Municipality of Parainen – administrative and ICT personnel
4) Folkhälsan – administrative and ICT personnel

3 RESULTS OF THE METAL AGE PROGRAM

3.1 Survey in Estonia

To collect the answers given to the different questionnaires in the occupational health field, the IT system developed in TTU by D. Karai et al. was used. 501 workers answered the questionnaires. 295 questionnaires were answered in full and were used for data analysis.

The 295 (98 men and 197 women) office workers (working with computers) with full questionnaire data worked in different institutions. The respondents were divided into two age groups: A) less than 40 years old (N=137, mean age 31.0 years) and B) at least 40 years old (N=152, mean age 54.4 years). Mean time spent in the same occupation was 4.8 years (group A) and 17.4 years (group B). Over 90% of the respondents were engaged in mental work in both groups.

In light of the fact that people begin to work with computers at an ever younger age, more musculoskeletal disorders (MDSs) were reported by younger than by older workers: MSDs were reported by 54% in group A and by 50% in group B. The corresponding proportion of cardiovascular disturbances was 20% and 45%, visual disturbances 16% and 23%, and overweight 20% and 25%, respectively. The focus of the Estonian questionnaire study was mainly on MSDs, the results for which are reported in section 7.1 below.

The results from the questionnaire based on the WAI and Nordic Questionnaire showed that on average the computer workers assessed their health status as rathery good, with WAI index values ranging from 37 to 43.The WAI index was higher in the younger group for WAI 1, WAI 3, WAI 4, and WAI 6. For the KIVA questionnaire, in the younger group, the higher values were observed for the 5th and the 7th questions (on the 0 to 10 point scale) and in the older group the higher values were for the 1st, 2nd, 4th and the 6th questions. All the workers were optimistic that solutions will continue to be found to the problem of monotony in working with computers and that their health status would remain on the same level in the future.

The relationships between the WAI and mean KIVA score, and between all 7 subcomponents of the WAI and all 7 questions of KIVA were investigated using Spearman correlations and determination analysis.

No strong relationship emerged between WAI and KIVA, or between any of their sub-components. Of interest, however, were the relations between the mean scores of KIVA and the WAI: two medium-strength relations were observed for the age-group < 40 years. These relations were between the mean-score of KIVA and the WAI (Spearman correlation coefficient $\rho = 0.41$) and the 3rd question of KIVA and the WAI ($\rho = 0.40$). The determination analysis revealed that in both cases the rate at which alteration in one variable was caused by alteration in the other variable was 16% (using determination analysis). In the age-group < 40 years, an acceptable correlation was found between 12 of the 64 analyzed KIVA questions and the WAI, and in the age-group > 40 years the correlation was acceptable in 5 of the 64 analyzed questions.

The KIVA questionnaire was administered twice: before the of MA intervention program and after it. The number of questionnaires analyzed was 136.

The impact of psychosocial risk factors on well-being at work in Estonia was investigated and analyzed by J. Seppo "Psühhosotsiaalsete riskide levik Eestis" Indrek Seppo, Janno Järve, Epp Kallaste, Liis Kraut, Maarja Voitka. http://rahvatervis.ut.ee/bitstream/1/1901/1/Seppojt2010.pdf.

The investigated workers had high satisfaction with work coefficients, according to the KIVA questionnaire. In addition, the stress indicators did not evaluate their stress levels as high. In the KIVA methodology, a team is deployed to find solutions to specific problems related to the nature of the employee's work that enable suitable working arrangements to be developed that can help prevent work-related musculoskeletal disorders' Data on the answers to the KIVA questionnaire in different offices before and after the MA intervention program are shown in table 1.

Table 1. Mean values of answers to different KIVA questions of participants in different offices before and after the Metal Age intervention program.

Question number	Office 1 B/A*	Office 2 B/A*	Office 3 B/A*	Office 4 B/A*
1	5.0/7.1	6.2/7.3	7.3/7.8	7.1/8.1
2	5.3/8.0	8.4/7.8	8.3/8.7	8.3/8.2
3	8.0/7.7	7.7/7.6	8.3/8.4	8.2/7.9
4	7.8/8.0	8.4/8.9	9.0/9.1	8.5/8.9
5	3.5/7.7	7.3/7.8	8.3/8.5	7.4/8.3
6	5.5/8.0	7.2/8.1	8.8/7.3	8.1/8.2
7	5.8/4.9	7.0/7.6	7.5/7.4	6.7/7.4

B/A*- mean values before / after the Metal Age intervention.

The relations between employer and the employees were usually improved (questions 1, 4, 5). A slight decrease was found for question 3.

3.2 Survey in Finland

In Finland, 112 (84 female, 28 male) subjects participated in the WASI program. Two of them had a lot of missing data, and hence were excluded from the study. Of the remaining 110 persons, 67 (61%) participated in the MA program, and 43 (39%) served as controls. Only 1.8% of the sample reported not having any vocational education. The mean age of the MA participants was lower than that of controls (44.1. years vs. 48.3 years, p=0.017). This difference could be explained by the fact that the MA participants and the controls were drawn from different organizations.

Ninety-one percent (N=61) of the MA participants and 56% (N=24) of the controls answered the follow-up questions. Overall, the changes in work ability and in work well-being at follow-up in both groups were small. According to the WAI, mean work ability remained on the same level among the MA participants, and slightly decreased in the control group (table 2), resulting a small but statistically significant difference in the mean change in the WAI during the follow-up. The only difference in work well-being was observed for the first Kiva question "Have you enjoyed coming to work over the last few weeks" (table 2).

Table 2. Work Ability Index (WAI), and KIVA questions among Finnish WASI (Work ability and social inclusion) participants.

	Metal age participants		Controls		Difference in mean change scores (95% CI)[1]
Outcome	**Before**	**Follow-up**	**Before**	**Follow-up**	
WAI, mean (SD)	41.3 (4.5)	41.9 (4.2)	42.4 (4.2)	39.3 (7.4)	3.7 (1.7 to 5.7)[2]
KIVA summary score, mean (SD)	54.5 (8.0)	54.3 (7.6)	55.4 (6.5)	49.9 (12.5)	3.0 (-0.9 to 6.9)
KIVA, questions 1 to 7, mean (SD)					
Have you enjoyed coming to work in the last weeks?	7.4 (1.6)	7.5 (1.7)	7.4 (1.6)	6.2 (2.7)	1.4 (0.3 to 2.5)[3]
I regard my job as	8.3 (1.7)	8.2 (1.4)	8.1 (1.5)	7.8 (2.5)	0.5 (-0.4 to 1.4)
I feel in control of my work	8.4 (0.9)	8.3 (0.9)	8.4 (0.9)	8.1 (1.6)	0.3 (-0.2 to 0.8)
I get on with my fellow-workers	8.5 (1.6)	8.5 (1.5)	8.8 (1.2)	8.2 (1.8)	0.5 (-0.3 to 1.2)
My immediate superior performs as superior	7.6 (1.8)	7.5 (2.1)	7.3 (1.7)	6.8 (2.8)	0.3 (-0.6 to 1.2)
How certain are you that you will keep your job with this employer?	6.8 (2.4)	6.6 (2.3)	6.4 (2.6)	6.2 (2.5)	0.0 (-1.4 to 1.4)
How much can you influence factors concerning your job?	7.7 (1.8)	7.5 (1.7)	7.6 (1.6)	6.8 (2.7)	0.5 (-0.3 to 1.3)

[1]CI=Confidence interval.

[2]P<0.001

[3]P=0.015

There were any No changes were observed in employees' experience of leadership based on the leadership items included in the QPSNordic questionnaire (table 3).

Table 3. Leadership questions of the General Nordic questionnaire for psychological and social factors at work among Finnish WASI (Work ability and social inclusion) participants.

	Metal age participants[1]		Controls[1]		Difference in mean change scores (95% CI)[2]
Questions	**Before**	**Follow-up**	**Before**	**Follow-up**	
Does your immediate superior encourage you to participate in important decisions?	3.5 (1.1)	3.6 (1.1)	3.5 (1.2)	3.3 (1.4)	0.2 (-0.1 to 0.5)
Does your immediate superior encourage you to speak up, when you have different opinions?	3.2 (1.1)	3.4 (1.2)	3.2 (1.2)	3.2 (1.2)	0.1 (-0.3 to 0.6)
Does your immediate superior help you develop your skills?	3.2 (1.2)	3.2 (1.2)	3.0 (1.3)	2.9 (1.2)	0.0 (-0.4 to 0.5)
Does your immediate superior tackle problems as soon as they surface?	3.4 (1.1)	3.4 (1.2)	3.3 (0.9)	3.3 (1.3)	- 0.1 (-0.6 to 0.5)
Do you trust the ability of the management to look after the future of the company / organization?	3.5 (0.8)	3.6 (0.8)	3.1 (1.0)	3.0 (0.9)	0.2 (-0.2 to 0.5)
Does your immediate superior distribute the work fairly and impartially?	3.6 (1.1)	3.6 (1.0)	3.5 (0.9)	3.5 (1.3)	0.0 (-0.5 to 0.5)
Does your immediate superior treat workers fairy and equally?	4.0 (1.0)	3.9 (1.0)	3.9 (0.8)	3.7 (1.2)	0.1 (-0.4 to 0.5)
Is the realationship between you and your immediate superior a source of stress to you?	1.5 (0.9)	1.7 (1.0)	1.6 (0.8)	1.8 (1.0)	0.0 (-0.4 to 0.4)

[1]Based on the Finnish subjects, who answered the baseline and the follow-up questionnaire.

[2]CI=Confidence interval.

3.3 Survey in Latvia

In Latvia, 345 (223 female, 122 male) subjects participated in the WASI program, of whom 68% (n=235, 203 MA participants, and 32 controls) answered both the baseline and follow-up questions. Only 3.5% of the subjects reported not having any vocational education. The baseline characteristics of the subjects are shown in table 4. In line with the Finnish participants, the changes in work ability and in work well-being at follow-up in both the Latvian groups were also rare. According to the Work ability index, mean work ability remained on same level among both groups (table 4). The only difference in work well-being was observed for the Kiva question "I feel in control of my work" (table 4).

Table x. Work Ability Index (WAI), and KIVA questions among Latvian WASI (Work ability and social inclusion) participants.

	Metal age participants		Controls		Difference in mean change scores (95% CI)[1]
Outcome	**Before**	**Follow-up**	**Before**	**Follow-up**	
WAI, mean (SD)	39.3 (4.9)	38.2 (6.6)	38.3 (4.8)	38.1. (5.6)	0.8 (-1.3 to 2.7)
KIVA summary score, mean (SD)	53.7 (8.7)	52.8 (9.1)	50.7 (8.1)	48.8 (9.4)	-1.0 (-4.0 to 2.0)
KIVA, questions 1 to 7, mean (SD)					
Have you enjoyed coming to work in the last weeks?	7.2 (1.8)	7.0 (2.0)	6.4 (1.8)	6.4 (1.8)	0.17 (-0.5 to 0.8)
I regard my job as	8.2 (1.4)	8.1 (1.5)	8.1 (1.4)	8.2 (1.4)	0.28 (-0.3 to 0.8)
I feel in control of my work	7.6 (1.7)	7.5 (1.6)	7.5 (1.5)	6.7 (2.1)	-0.84 (-1.5 to -0.2)[2]
I get on with my fellow-workers	8.5 (1.2)	8.5 (1.1)	8.1 (1.2)	8.1 (1.2)	0.05 (-0.4 to 0.4)
My immediate superior performs as superior	7.9 (1.7)	7.8 (2.0)	6.8 (2.3)	6.5 (2.3)	-0.07 (-0.7 to 0.6)
How certain are you that you will keep your job with this employer?	8.0 (2.0)	7.6 (2.1)	7.6 (1.8)	7.0 (2.0)	-0.20 (-0.9 to 0.5)
How much can you influence factors concerning your job?	6.4 (2.0)	6.4 (1.9)	6.2 (1.7)	5.8 (2.0)	-0.49 (-1.3 to 0.3)

[1]CI=Confidence interval.

[2]P=0.013

Table 4. Work Ability Index (WAI) and KIVA scores of the Latvian WASI participants

As with the Finnish participants, no changes were observed in employees' experience of leadership based on the leadership items included in the QPSNordic questionnaire (table 5).

Table x. Leadership questions of the General Nordic questionnaire for psychological and social factors at work among Latvian WASI (Work ability and social inclusion) participants.

	Metal age participants[1]		Controls[1]		Difference in mean
Questions	Before	Follow-up	Before	Follow-up	change scores (95% CI)[2]
Does your immediate superior encourage you to participate in important decisions?	3.3 (1.2)	3.3 (1.2)	2.9 (1.1)	3.2 (1.2)	0.28 (-0.2 to 0.7)
Does your immediate superior encourage you to speak up, when you have different opinions?	3.7 (1.1)	3.6 (1.1)	3.3 (1.2)	3.3 (1.2)	0.09 (-0.3 to 0.5)
Does your immediate superior help you develop your skills?	3.6 (1.2)	3.4 (1.1)	3.2 (1.3)	3.2 (1.1)	0.11 (-0.3 to 0.5)
Does your immediate superior tackle problems as soon as they surface?	3.9 (0.9)	3.8 (1.0)	3.6 (1.2)	3.5 (1.1)	-0.02 (-0.4 to 0.3)
Do you trust the ability of the management to look after the future of the company / organization?	3.8 (1.0)	3.6 (1.0)	3.6 (0.9)	3.2 (1.0)	-0.30 (-0.7 to 0.1)
Does your immediate superior distribute the work fairly and impartially?	4.0 (0.9)	3.9 (0.9)	3.5 (1.0)	3.7 (0.9)	0.22 (-0.1 to 0.5)
Does your immediate superior treat workers fairy and equally?	4.2 (0.9)	4.1 (0.9)	3.7 (1.0)	3.7 (1.0)	0.13 (-0.2 to 0.5)
Is the realationship between you and your immediate superior a source of stress to you?	1.8 (1.0)	1.8 (1.0)	2.3 (1.2)	2.1 (1.0)	-0.22 (-0.6 to 0.2)
[1]Based on the Latvian subjects, who answered the baseline and the follow-up questionnaire. Values are mean (SD).					
[2]CI=Confidence interval.					

Table 5. Scores of the Latvian WASI participants for the leadership items included in the General Nordic Questionnaire'

3.4 Interviews in Finland

This chapter is based on findings from follow-up interviews with 5 persons from the city of Pargas and 3 persons from Turku University of Applied Sciences. In both organizations, the process started at Kasnäs Archipelago Spa where an outsider facilitator worked with the different groups. At both organizations some personnel were also educated as a facilitator for continuing MA work.

According to the informants, it is clear that MA has had positive effects, especially in the areas of co-operation among staff members, leadership, interaction between leaders and staff members, and responsibility and community among personnel. According to the informants, the participating personnel worked together in seeking to solve issues or problems identified during the MA process as in need of a solution. For example, in one of the organizations, where two persons undertook responsibility for working with a particular issue, other personnel also became involved in the task in different ways. Much discussion also took place between personnel on the issues they were working with. In fact, some informants reported that there might have even been too much work on some issues and that they have occasionally experienced it as a burden. According to the informants, two of whom were in fact leaders themselves, the leader's behavior had changed. At the beginning of the process, in both organizations the leaders had been subject to more or less harsh criticism which it had not been very easy for them to un-

derstand and accept, as they had considered themselves good leaders. During the process, however, the leaders' behavior had changed, and this was experienced by the personnel as a positive thing. In fact, the change in their behavior by the leaders increased the interaction between leaders and staff members. Most often, the behavior of a leader that the staff members experienced as problematic concerned lack of presence in different ways. It might be a question of the leader's absence, both physically and mentally. However, although a leader was absent physically, this did not mean that he/she had been absent mentally, even if the personnel had experienced it in this way before starting the MA process. During the MA process, it became clear to the personnel that their leader had so much trust in them that he/she did not want to interrupt or act as a controller of their work or way of working. This aspect can be regarded as the "dark side of trust". During the MA process, although the leaders changed their behavior, it cannot be assumed that this change would be permanent. The informants also spoke about community among the personnel and about responsibility. Most personnel seemed to have actively participated and worked with the issues identified during the MA process. These issues have since become a common concern; with no sign form the informants that any of the personnel had stayed outside the process. In fact, although in one organization many new personnel had entered the workplace, they had not been left out but also instead had been taken into groups to work on the identified issues.

The MA process had not continued in accordance with its guiding principles in either organization. The informants often spoke about the difficulty of continuing the process. All agreed that the outsider facilitator role was of importance and they placed a high value on it. However, the outsider facilitator only participated in the process once, at the beginning. After that the groups were left by themselves without any outsider. The facilitators educated in both organizations did not function in the continuation phase as facilitators but as practical organizers. The process in the organizations did not follow the principles of MA either; instead, the personnel, sometimes together with the local facilitator, found their own way of continuing the development process. However, the personnel, together with their leaders, or the leaders by themselves, also clearly created their own way of organizing the continuation. In one organization, the leaders become the persons, trained facilitators, who took the responsibility for continuing with MA, but in their own way. In the other organization some persons were nominated to continue with issues they had taken on as their responsibility. One informant, who also was a leader and facilitator, said that MA was a "wake-up call" to the organization to do something. This informant also said that they could in fact have done everything themselves, if they had only got down to it. The question remains: why did they not do this?

There are also some aspects which cannot be regarded as either purely positive or negative but rather as ambivalent. According to the informants, in both organizations, very concrete issues were worked on during the MA process. Whether this is a good or not so good a thing is difficult to determine, since while the concrete issues the personnel had been working with received a solution, this did not necessarily have any effect on more important problems in the organization. In fact, working with concrete issues might have brought new problems to the surface. Even if it was felt that the sense of community in the organization had increased, several of the informants also reported that the atmosphere in their workplace was not very good. The analysis of the interviews does not reveal the reason for this. It may be that in the process of solving concrete issues other difficulties emerged; the fact that issues that have been smoldering under the sur-

face suddenly appear can be regarded as a normal side effect of MA. However, this was viewed as frightening by some informants, as they were now working without an outside facilitator.

MA as a method was experienced diversely among the informants, with the exception of the outside facilitator, whose role was generally felt to be. The outside facilitator was able to raise even difficult issues for discussion, something the informants valued very highly. The outsider facilitators "knew what they were doing" and were not afraid to act. The informants also viewed the opportunity of a social get-together y at the beginning of the MA process as an important step.

Finally, it can be concluded that in both organizations rather many "problems" were seen as leadership-related. These issues were relatively easily solved, since the leaders adjusted their behavior. However, the main question emerging from the analysis is whether the MA method has helped the two organizations to promote well-being and social inclusion. This question, while it remains unanswered, does not mean that MA as method does not work. The organizations applied MA in their own way, and by so doing managed to solve several concrete grievances, but whether they have managed to identify and reconcile some of the more abstract grievances that continue to worry some personnel in their organizations remains unanswered.

3.5 Economic evaluation of the WASI project in Finland

The average age of those in the Metal Age group was 44 years and among the controls it was 47 years (NS). Average salary levels were also close to parity at 3 155 € per month (NS) in the Metal Age group and 3 066 among the controls. However, the variation in salaries within each group was considerable.

Self-reported estimate of sick leave days during the one year of project implementation was well in line with employer records. Eleven program participants reported 1-9 sick leave days, although their employers' records showed none. One control also reported belonging to the 1-9 sick leave days group, although again no sick leave days were found in the employer's records. Otherwise the match between the datasets was perfect.

Before program initiation, the program participants had slightly (NS) more sick leave days (SLD=0.414) than controls (SLD=0.325). After the first three months of project implementation, the SLD had fallen by 55% to 0.186 among the program participants and increased by 27% to 0.413 among the controls ($p<0.001$). Over the next three months, the numbers of sick leave days further declined to 0.148 among the program participants, and, even more, to 0.016 among the controls ($p<0.001$). However, during the next two measurement periods, 7-9 and 10-12 months after the initiation of the project, the project participants had significantly ($p<0.001$) more sick leave days per person per month (0.803 and 0.884) than before the program started, and also significantly ($p<0.001$) more than the controls: 0.143 and 0.286, respectively. Overall, during the one-year implementation of the program mean SLD increased by 23% among the program participants and decreased by 35% among the controls ($p<0.001$).

During the one month period before program implementation, the MetalAge program participants reported on average 7.1 hours of presenteeism and showed a reduction of 16.3% in productivity during those hours. After the one year of program implementation, these participants reported on average 10.7 hours of presenteeism and showed a reduction in productivity of 15.4%. Among controls, the average monthly hours of presenteeism was 5.1 with 15.8% reduced productivity at the first measurement, and 7.6 and 22.9% after one year. The loss of productivity during the hours of presenteeism was significantly ($p<0.05$) higher among the controls than program participants.

The monthly productivity costs of sick leave days before the program implementation were higher (NS) among the Metal Age group than controls. After the program had been implemented for one year, the average monthly sick leave costs for the last three-month period were highly significantly ($p<0.001$) higher for the Metal Age group than for the controls. Among both the Metal Age program group and the control group, the sick leave costs fluctuated significantly across the observation periods. (Table 6)

Table 6. Average monthly cost (€) of sick leaves using the Human Capital Approach before program implementation and for each three-month period during program implementation among the Metal Age program participants and controls

	Before	1-3 months	4-6 months	7-9 months	10-12 months
Metal Age	60.31	23.90	31.14	144.44	61.31
Controls	25.58	72.00	2.48	28.04	4.96

Presenteeism cost estimates were available only for the one-month periods before the implementation of the program and after the first year of implementation. Before the program implementation, the costs of presenteeism were slightly (NS) higher for the MetalAge group (39.78 €) than for the controls (25.77 €). After the program implementation, the average presenteeism costs remained higher for the program group (82.24 €) (NS) than (63.48 €).

Overall productivity costs, sick leave and presenteeism costs together, were slightly but non-significantly higher for the Metal Age program group than for the controls. For one-third of all employees, no productivity costs were incurred due to sick leaves or presenteeism. Among both groups, overall productivity costs increased, but at a higher rate among the program group.

3.5.1 Discussion

A previous implementation of the Metal Age program has suggested that using it can lead to significant economic savings. However, the study setting in that previous implementation did not include a proper comparison group, and therefore its findings should be viewed with caution. Moreover, it was a pilot study. The present study did not corroborate the previous positive results. On the contrary, the numbers of sick leave days and their costs did not develop in the anticipated direction. The MetalAge program

participants' higher numbers of sick leave days and consequent productivity losses to employers are more likely to be considered discouraging.

During the first months of implementation of the program, positive signals were obtained. In the Metal Age program, the employees' and employer's representatives planned how to prioritize the development areas they had identified, and the topic with highest priority was tackled first (Machioca, Niehoff & Surakka, 2012). It may well be that working on the issue with the highest priority motivates employees and that this is visible in the lower proportion of sick leave days during the beginning of the follow up. When issues of less perceived importance are worked on, employees' interest and motivation may decline.

Participants who know that they belong to certain test group can be expected to behave differently, as they know that their actions are under surveillance. This may also have affected the Metal Age group members' willingness to take sick leave, particularly in the beginning of the program implementation when the issues with the highest priority were being worked on. However, the project participants and controls were not told that their numbers of sick leave days would be collected from the employers' records.

Both the program participants and controls showed the lowest number of sick leave days during the first 4-6 months of project implementation. The program did not start at the beginning of the calendar year, and this three-month period was mainly during the prime holiday season in Finland. At the time of the program implementation short sickness periods, i.e. less than a week, during the annual holidays were not covered by the employer. Thus, the fact that short sickness periods were not counted by those on annual leave is a more likely explanation for this reduction in the number of sick leave days in both groups than any program-related activity. Particularly after the main holiday season, the increase in the rate of sick leave days among the program participants was surprisingly large

The consequences for costs of the sick leaves did not precisely follow the fluctuation in the days of absence from work. This finding is due to the fact that the numbers of sick leave days were relatively small for each three-month period, and that the salary level of those with sickness absence in each measurement period varied considerably. However, the trend in costs and differences between the two groups were similar for both sick leave days and consequent productivity costs.

It is not clear why among both the program participants and controls presenteeism hours were also higher at the second measurement point than one year before. During the study period, Europe in general has been affected by economic recession, and hence Finland has not been in a markedly different situation from the other European countries. When the economic situation is unfavorable and there is a shortage rather than surplus of job openings, employees are probably less willing to change their work places than when the demand for labor is higher. Also, in a poor economic situation employees may feel that their jobs are more threatened, and they do not necessarily want to show many days of absence, if remaining at work is somehow within their control. In such situations, when health status worsens slightly, employees may decide to come to work, whereas during earlier, better economic times they may have decided to stay at home and take a day off. However, the development of sick leave days, particularly

among the program subjects, does not support the idea of a trade-off between less sick leave days of presenteeism.

One major aim of the Metal Age program was to increase the overall productivity of the workplace. The observed 50% average increase in productivity losses among the program participants, compared to the 25% increase among controls, does not encourage direct implementation of the method in other workplaces. The method showed positive effects in one municipality earlier (Revicki et al. 1994, Kessler et al. 2003), and it may be that the method is applicable and economically beneficial in certain workplaces, whereas some other settings do not obtain equally good results. In our study, the numbers of employees and controls in each workplace were too small to make reliable comparisons within workplaces. Before recommending use of the Metal Age method in a larger variety of workplaces, more studies with higher numbers of participating employees and controls are required.

3.5.2 Conclusion

The short-term effects of the implemented work ability program on sick leave days seemed beneficial. However, with longer program duration the benefits disappeared.

4 THE METAL AGE AS A METHOD FOR IMPROVING WELL-BEING AT WORK

According to the KIVA questionnaire, the changes in wellbeing at work were small. This was especially noticeable in the Finnish and Latvian participants. The results for the seven KIVA questions revealed that the baseline wellbeing at work of the Finnish, Latvian, and most of the Estonian participants was on average on a good level. It may, therefore, have been difficult to improve wellbeing among these participants. For one Estonian subgroup, the mean values of the KIVA questions were lower than for the others. It seems that the MA program had positive effect on wellbeing at work among workers whose baseline values were low. However, to improve the scientific evidence of the effect of the MA program, high quality randomized controlled trials are needed.

Among the Finnish MA participants work ability between baseline and follow-up showed a tendency to remain at the same level, while among controls it decreased slightly. The Finnish controls were on average 4 years older than the MA participants; however, even after adjusting for age the mean change in the WAI during the follow-up remained statistically significant. From this point of view, MA program may have had a positive effect among the Finnish MA participants: i.e. it supported the maintenance of work ability. No such effect was observed in the Latvian participants.

REFERENCES

Beaton D, Tang K, Gignac M, Lacaille D, Badley E, Anis A et al. 2010. Reliability, validity, and responsiveness of five at-work productivity measures in patients with rheumatoid arthritis or osteoarthritis. Arthritis Care Res 62:28-37.

Chenitz W & Swanson J. 1986. Qualitative research using grounded theory. In: Chenitz W & Swanson J (Ad.) From practice to grounded theory. Addison-Wesley, Menlo Park, p 3–15.

Dallner M, Lindström K, Elo A-L, Skogstad A et al. 2000. Användarmanual för

QPSNordic Frågeformulär om psykologiska och sociala faktorer i arbetslivet ut provat i Danmark, Finland, Norge och Sverige.

Elo A-L. 1990. Occupational stress questionnaire: User's instructions. Työterveyslaitos.Helsinki.Finlandhttp://ww.norden.org/en/publications/publikationer/2000-603/at_downlod/publicationfile.

Glaser C & Barney G. 1992. *Basics of Grounded Theory Analysis: Emergence vs. Forcing*. Mill Valley (CA): Sociology Press, ISBN 1-884156-00-2

Kessler R, Barber C, Beck A et al. 2003. The World Health Organization Health and Work Performance Questionnaire (HPQ). J Occup Environ Med 45:156-174.

Machioca A, Niehoff B & Surakka J. 2012. Leadership and work ability and their role in knowledge management system support. Proceedings of the 13th European conference on knowledge management - EKCM 2012. Cartagena, Spain pp. 652-662.

Näsman, O. 2011.Metal Age and Kiva-questionnaire. Assist in navigation towards well-being at work. MedionaOyAb. The Archipelago Academy for Well-being at work. Retrieved September, 14, 2013, from http://www.mediona.fi/pdf/KANNSI%20Metal%20Age%20ja%20Kiva-kysely%

Prasad M, Wahlqvist P, Shikiar R & Shih YA 2004. Review of self-reported instruments measuring health-related work productivity. Pharmacoeconomics 22:225-244.

Rees D & Cooper C. 1993. Research note: reliability and self-report sickness absence data in the health service. Health Serv Manage Res 6:140-141.

Revicki D, Irwin D, Reblando J & Simon G. 1994. The accuracy of self-reported disability days. Med Care 32:401-404.

Risa K. 2007. The druvan model:well-being creates productivity. The centre of occupational safety. Helsinki, Finland.
http//www.ttk.fi/files/1166/wellbeingproductivity.pdf. assessed 10.05.11.

Sanderson K, Tilse E, Nicholson J, Oldenburg B & Graves N. 2007. Which presenteeism measures are more sensitive to depression and anxiety? J Affect Disord 101:65-74.

Short M, Goetzel R, Pei X, et al. 2009. How accurate are self-reports? Analysis of self-reported health care utilization and absence when compared with administrative data. J Occup Environ Med 51:786-796.

Strauss A & Corbin J. 1998. Basics of qualitative research: techniques and procedures for developing grounded theory. Thousand Oaks: Sage, ISBN 0-8039-5940-0.

Tesch R. 1990. Qualitative research: Analysis types and software tools. New York: Falmer Press.

Tuomi K, Ilmarinen J, Jaakola A, Katajarinne L & Tulkki A. 1998. Work ability Index. Helsinki: Finnish Institute of Occupational Health.

Tuomi K, Huuhtanen P, Nykyri P & Ilmarinen J. 2001. Promotion of work ability, the quality of work and retirement. Occup Medicine vol. 51, 5, pp.319-324.

WASI – Stress

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1 WHAT IS STRESS

Stress can have both negative (distress) and positive (eustress) sides and effects (Selye 1974). Distress, known to have negative outcomes, is the most common type of stress. Eustress, in turn, is a positive cognitive response to stress which can be considered as healthy or giving one a feeling of fulfillment and other positive feelings (Selye 1974). In the context of occupational stress, eustress may be measured on subjective levels, such as of quality of life or working life, job pressures, psychological coping resources, complaints, overall stress level, mental health and challenges connected to work. McGovan, Gardner & Fletcher (2006), conclude that while there is no single definition of stress, occupational stress is often caused by experiences in the working environment. Research on eustress has focused on its presence in the workplace in situations where stress can often be interpreted as a challenge, signifying positive eustress. Stress can also be seen as a hindrance, and in such cases refers to distress that interferes with one's ability to carry out a job or assignment. Whereas negative stress should generally be reduced, it might be that on some occasions positive stress could actually increase wellbeing in working life. Also, according to Lazarus (1966, 1991), eustress can be regarded as a positive and cognitive response to stress that is healthy. It can give a person the experience of succeeding or other positive feelings, depending on how one understands or receives a stressor. A positive response to stressor may be linked to feelings of having control, desirability and basic trust. Eustress also mostly correlates positively with life satisfaction and well-being. The concept of eustress was originally introduced by Selye (1974), and it refers to the entirety of positive adaptive reactions. It is thus the op-

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posite of distress, which, according to Selye, can be regarded as a specific syndrome triggered by non-specific harmful stimuli or activities. For Selye, eustress represents a pleasant type of stress that does not have the harmful consequences of damaging distress. Selye also regards stressors as healthy when they do not disturb a person's experience of homeostasis or balance in life.

Lazarus (1966) also sees challenges as potential stressors that can manifest themselves in a variety of situations. When the goal of a task or action is experienced as relevant and goal congruence is in place, involvement in its realization has a positive effect not only on the individual's self-esteem but also social esteem. According to Selye's (1983) later research, which has been seen as influenced by the work of Lazarus, eustress and/or the distressful quality of a stressor depends on the individual's interpretation of the context (in which it emerges?).

2 STRESS MEASUREMENTS IN ESTONIA, FINLAND AND LATVIA

Overall saliva from 314 participants from Finland, Estonia and Latvia were analyzed to determine the level of cortisol over the project period. The participants were recruited from several companies in each participating country. The general inclusion criterion was doing "office work" involving a certain level of use of information technologies and exposure to "stress, whatever sector the participant worked in". Control group participants were included on the same criterion, but did not participate in the Metal Age training program. Additional criteria for inclusion of the participant in the final analysis were a filled-in project questionnaire and a full saliva collection (saliva was collected repeatedly over a one-year period. Inclusion also required either two morning and evening or noon and evening cortisol measurements with a sufficient amount of saliva. All these criteria were not easy to meet, which unfortunately resulted in only around 50% of the participants having a full data set.

Collection of saliva for such analyses is a relatively easy and noninvasive process that was done by specially trained researchers from the project team. Saliva samples were collected using special cotton swabs (Salivette systems, Sarstedt, Nümbrecht, Germany). The swab was placed in the mouth, chewed and then transferred back into the plastic tube. Saliva samples were taken 3 times on a single working day (morning, noon and afternoon). After collection, the saliva samples were delivered to the laboratory and stored in a freezer at -20 °C until further analysis.

As the saliva sampling procedure used may influence the quality of the analysis, special guidelines were prepared for the project team on the collection criteria. Most importantly:

1. salivary samples shall be collected using only special sampling tubes (*Salivette systems , Sarsted, Nuembrecht, Germany*) containing a cotton/ polyester swab/tampon;
2. samples shall be collected three times per day:
   i. in the morning (8:00 – 9:00),
   ii. at noon (12:00 – 13:00),
   iii. in the afternoon (16:00 - 17:00);
3. saliva shall be collected according to the following procedure :

i. it is recommended that the first saliva samples be collected in the morning, at the latest within 3 hours after waking,
ii. saliva should be collected 30-60 minutes after eating and brushing of teeth, the mouth rinsed and lipstick, if applied, cleaned off;
iii. the cotton swab shall be chewed gently for 1 minute or until the person is unable to resist swallowing the saliva produced,
iv. the cotton swab shall be returned to the suspended insert and the *Salivette* shall be closed firmly with the stopper,
v. the amount of saliva must not be less than 2ml.

The date of the first saliva sample shall be noted on the Salivette tube along with the time of waking. The saliva samples shall be stored in a refrigerator (at 4-50C) before transportation to the Laboratory of Hygiene and Occupational diseases. According to research data, saliva samples are stable when stored in a refrigerator (no effects on cortisol concentrations were found after storage of saliva at 50C for up to 3 months or at -200c and -800C for up to one year). Research data confirm that repeated freezing and thawing of a sample up to four times before analysis did not affect the measured concentration of cortisol (Garde et al., 2005; Hansen et al., 2008).

Before analysis of salivary cortisol with high performance liquid chromatography (HPLC), the samples were thawed and centrifuged (1000 rpm), ensuring the cleanest analytical sample was used. After centrifugation, each saliva sample was extracted using the solid phase extraction (SPE) technique. For this project SPE Discovery DSC 18 columns (Supelco – Bellefonte, PA, USA) were used. The first step in the extraction process was column equilibration with 3 mL of methanol followed by 3 mL of deionized water. The saliva sample was then applied on a SPE column (1 mL) spiked with 1 mL of internal standard (IS) (53 nmol/l). The next successive steps were washing with 3 mL of water / methanol solution (1:1, v:v) and elution with 3 mL of methanol. Each sample was dried using a vacuum evaporator and then re-suspended with 1 mL of HPLC mobile phase. The level of salivary cortisol was determined by high performance liquid chromatography (HPLC) with UV-detector, as immunoassays can be affected by cross-reactivity from other steroids. Chromatographic separation of the saliva samples was carried out by isocratic elution with 27% acetonitrile and 73% water. The column temperature was 30°C degrees. For each saliva sample, the chromatographic analysis lasted 10 minutes and the mobile phase flow rate was 1 mL/min. The sample injection volume was 100 μL. The absorbance of cortisol was measured at the wavelength of 254 nm.

3 MAIN RESULTS OF STRESS LEVEL MEASUREMENTS IN FINLAND, ESTONIA AND LATVIA

The consequences of stress on the individual level can reduce not only the general quality of life but also well-being of an employee. For some people work-related stress can negatively affect their health. The most typical health problems linked to work-related stress are insomnia, constant tiredness, high blood pressure and nervous twitches (Greiner 2008).

In the normal situation, the level of cortisol fluctuates diurnally, such that it is generally higher in the morning, decreasing during the day if the level of "stress exposure" is not high or if the person is coping with it. A peculiarity of salivary cortisol is that the level taken as the result (numeric value) itself is not so important and can differ widely by age and gender. Other reasons for differences in levels include medications, endocrine disorders, smoking, drinking problems, coffee, etc., but the correct pattern indicating stress-free work is a decreasing trend (thus for persons not working under excessive levels of stress cortisol will tend to be higher in the morning, thereafter decreasing during the course of the day).

All together 121 sets of samples from 314 persons met all necessary criteria for full analysis (e.g. all 6 analyses over 2 sampling periods with a sufficient amount of saliva taken no later than 3 hours after wake up time). However, even if the samples not included were not representative of the pre-intervention and post-intervention levels, they could nevertheless provide reliable information on stress levels in a particular workplace and their potential effects on employees.

The results of the analysis of the cortisol measurements obtained during the project showed that a significant number of employees had abnormal diurnal patterns in their cortisol levels. It was also found that involvement in the Metal Age program could have a beneficial influence on stress levels. Examples of the results of the project are summarized in figure 25, which shows an interesting trend: for the 4 companies that underwent the Metal Age training protocol and participated in the intervention program a decrease in overall cortisol levels was observed for the 2 companies working mostly with customers (Company 2 and Company 3) while the companies working in production or mostly with documentation showed no clear decrease in levels.

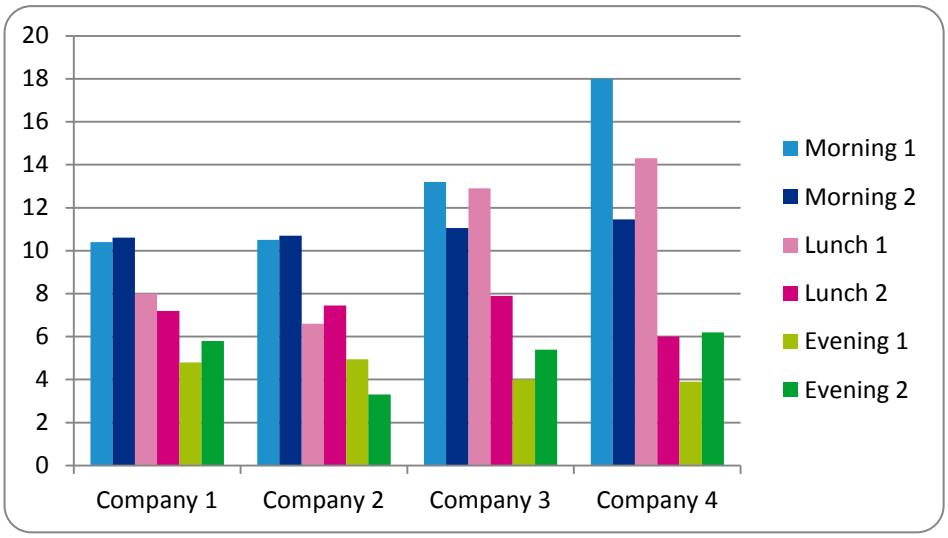

Figure 1. Trends of salivary cortisol level for 1st and 2nd round analysis in 4 companies in Latvia

The other factor that we considered is that a low mean salivary cortisol concentration and a small difference between the morning and evening cortisol concentration (a difference below 1 nmol/L) may be a risk factor for depression (Grynderup et al. 2013).

REFERENCES

Garde AH & Hansen AM. 2005. Long-term stability of salivary cortisol. Scand J Clin Lab Invest. 65(5):433-6.

Greiner A. 2008. An economic model of work-related stress. Journal of Economic Behavior & Organization. 66: 335-346.

Grynderup MB, Kolstad HA, Mikkelsen S et al. 2013. Two-year follow-up study of salivary cortisol concentration and the risk of depression. Psychoneuroendocrinology, 38: 2042-50.

Hansen AM, Garde AH & Persson R. 2008. Sources of biological and methodological variation in salivary cortisol and their impact on measurement among healthy adults: a review. Scand J Clin Lab Invest. 68(6):448-58.

Lazarus RS. 1966. Psychological Stress and the Coping Process. New York, Toronto, London: McGraw-Hill Book Co.

Lazarus RS. 1991. "Psychological stress in the workplace". Journal of Social Behavior and Personality 6 (7).

Selye H. 1974. Stress without distress. Philadelphia: J.B. Lippincott Company.

Selye H. 1983. The stress concept: Past, presence and future. In C.L. Cooper (Ed.) Stress research: Issues for eighties. New York. John Wiley.

WASI - Leadership

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Keywords: leaders, employees, organizational, 360-degree assessment

1 WHAT IS LEADERSHIP

Leadership is the process through which people influence other people in order to reach certain organizational and individual goals (Muller & Raich 2005). By permanent motivation of individuals to continuously develop and enhance their work practice, leaders improve employees' work satisfaction and productivity (Muller & Raich 2005. Leadership has a wide-ranging influence on the well-being of employees and is an important element of well-being at work. (van Dierendonck et al. 2004) Good leadership, and hence management, are important for well-being at work (Syvänen et al. 2012).

The recent changes in the nature of work and the increased focus on knowledge and competence have also changed the way work is performed. Currently, work can be done very independently. Work is no longer tied to time and place. At the same time, the pressure to perform well and be more productive has increased. This in turn means that the approach to leading workers has also changed, bringing many related challenges. (Syvänen et al. 2012)

Currently, a good leader has to be able to manage both the financial aspects of the organization's activities and take the well-being of its employees into consideration. A balance has to be struck between the requirement of efficiency and allowing employees to be creative and utilize their knowledge and competence. These are the main challenges that face leaders today. According to Skakon et al. (2010), the well-being and stress level of a leader is reflected in the well-being and stress level of the employees. As already stated, the nature of leadership has changed, and leaders are under increasing pressure, especially in the ICT cluster. It follows that leaders are also subject to stress and to a reduced level of well-being. This cycle is one that may affect an entire workplace.

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2 ASSESSMENT OF LEADERSHIP IN FINLAND

Large-scale studies indicate a strong correlation between employee ratings of leadership behavior and unit effectiveness, while in many studies employees well-being has also been shown to be crucial for the productivity of an organization (Arvonen 2002, Arvonen & Ekvall 1999,Arvonen & Petterson 1999, 2002, Näsman 2010). The advent of 360- degree multi-rater assessments of leadership behavior has contributed new possibilities for the evaluation and development of leadership. The Farax 360 is a 360-degree multi-rater assessment of leadership behavior. It is based on current leadership theories and empirical studies in large populations and in different European organizations. The Farax 360 assesses change-, production- and relation-employee-oriented leadership (Arvonen 2002, Miller et al. 2009) The Web-based questionnaire comprises 24 questions, eight in each of the three leadership dimensions, rated on a scale of 1-6.

The Farax 360-degree leadership assessment was administrated in the Finnish sample of the study participants. All the Finnish participants were included at baseline. However, due to organizational changes during the study period in two of the six organizations, only 16 employees, four immediate superiors and their managers were available for inclusion in the assessment after the MA intervention. Fortunately, all the participants in the remaining four units completed both assessments.

Superiors´ leadership behavior was assessed by themselves, their managers and the employees. The baseline assessment was performed one week before the MA intervention and the assessment was repeated one year after the intervention.

3 RESULTS

The results indicate improvements in production- and change-oriented leadership, while hardly any improvements were reported in relation-oriented leadership behaviors.

Table 1. The behaviors in production-oriented leadership in which improvements were reported when comparing assessments at baseline and one year after the intervention.

Question	**Employees (n=16)**	**Superiors themselves(n)**	**Managers (n)**
6. Clarifies tasks and roles	9/16	2/4	2/4
9. Rules are being followed	1/16	1/4	1/4
12. Sets clear goals	11/16	2/4	2/4
15. Follows up that tasks are done as planned	9/16	0/4	2/4
17. Controls work	10/16	0/4	1/4
19. Explains the work requirements clearly	9/16	3/4	1/4
21. Plans carefully	10/16	2/4	0/4
22.Gives clear assignments	0/16	1/4	0/4

Table 2. The behaviors in change-oriented leadership in which improvements were reported when comparing assessments at baseline and one year after the intervention

Question	Employees (n)	Superiors (n)	Managers (n)
2. Is a courageous decision maker	13/16	1/4	2/4
5. Encourages thinking along new lines	10/16	2/4	2/4
8. Willing to new ideas	7/16	2/4	1/4
11. Shares visions about the future	1/16	1/4	0/4
14. Pushes for development	12/16	0/4	0/4
16. Starts new change projects	11/16	1/4	3/4
18. Experiments with new ideas	10/16	1/4	2/4
24. Has ideas of change and development	0/16	2/4	1/4

The employees reported positive changes in their immediate superiors´ production-oriented leadership behavior one year after the MA intervention. Improvements in as many as six of the eight measured behaviors were reported by more than half of the employees (9-11 out of 16 employees). Half of the managers to the superiors also reported improved leadership behavior in three of the eight production-oriented leadership behaviors (Table 2).

Positive changes were also reported in change-oriented leadership. More than half of the employees (10-13 of 16 employees) reported improvement in their immediate superiors´ leadership in as many as five of the eight measured behaviors in change-oriented leadership. Half or more of the managers to the superiors reported improvement in four of the eight change-oriented leadership behaviors (Table 2).

Also half or more of the superiors themselves reported improved leadership behavior in four of the eight production-oriented leadership behaviors, while only half of the superiors reported improved leadership behavior in three of the eight change-oriented leadership behaviors (Table 1-2).

The fact that only a few employees reported any changes in their immediate superiors´ relation-oriented leadership behavior might be due to the fact that focus of the development areas chosen for the MA program was more on production- and change-oriented leadership. Also, since the baseline measures were only conducted one week before the intervention started, all the employees had already been informed by their superiors of the coming intervention. This might have had a positive influence on the relation-oriented leadership ratings at baseline.

CONCLUSION

A trend in personal behaviors was demonstrated in production- and change oriented leadership, while no changes were found in relation oriented leadership.

REFERENCES

Arvonen J. 2002. Change, production, and employees - an integrated model of leadership. Department of Psychology, Stockholm University. (Doctoral Dissertation)

Arvonen J & Ekvall G. 1999. Effective leadership style - both universal and contingent? Creativity and Innovation Management, Vol. 8:4: pp. 242-250.

Arvonen J & Pettersson P. 1999. Leadership profiles, moderating factors, and coworker health in the context of downsizing. Reports from the Department of Psychology, Stockholm University, No. 862.

Arvonen J & Pettersson P. 2002. Leadership behaviour as a predictor of cost and change effectiveness. Scandinavian Journal of Management, 18:101-112.

Müller C & Raich M. 2005. The Ambiguous Relationship of Leadership and Intellectual Capital: Understanding how Intellectual Capital is Developed, The Electronic Journal of Knowledge Management Volume 3 Issue 1, pp 35-44, available online at www.ejkm.com

Näsman O. 2011. Metal Age och Kiva-enkät. Assisterar vid navigering mot arbetsvälbefinnande. Dalsbruk: Mediona OyAb

Skakon J, Nielsen K, Borg V & Guzman J. 2010. Are Leaders' well-being, behaviours and style associated with the effective well-being of their employees? A systematic review of three decades of research. Work & Stress, 24:2: pp 107-139.

Syvänen S, Kasvio A, Loppela K, Lundell S, Tappura S & Tikkamäki, K. 2012. Dialoginen johtaminen innovatiivisuuden tekijänä. Työterveyslaitos. Helsinki. ISBN 978-952-261-185-7.

van Dierendonck D, Haynes C, Borrill C & Stride C. 2004. Leadership Behaviour and Subordinate Well-Being. Journal of Occupational Health Psychology, 9:2: pp 165-175.

WASI - Retirement and the Prolonging of Working Careers[i]

Bettina Stenbock-Hult

Keywords: retirement age, work environment, work career

1 RETIREMENT IN FINLAND

One of the major challenges in Finland today is to prolong active working careers by raising the retirement age. For most professions, the legal retirement age is 63-68 years. However, many do not reach the lower limit, becoming prematurely retired at a much younger age. Notwithstanding, the retirement age has risen in recent years, as more and more people are choosing to work after the age of 63. In 2008, the average retirement age was 59.6 years, compared to 60.5 years in 2011. The current goal is to reach an average retirement age of 62.4 years by 2025 (Kauppinen et al. 2013.) One of the key strategies for extending careers is to improve the quality of working life through a variety of health promotion strategies and through taking the health of workers into consideration in all employment-related policies, supporting healthy workplaces, making health services accessible to everyone, and developing innovations for a better working life (Ylikoski et al. 2006). The policy statement issued by the Ministry of Social Affairs and Health (2011) focuses on leadership that supports well-being at work together with occupational health services as an effective partner. In addition it emphasizes the importance of collaboration, knowledge, communication and legislation that support healthy working conditions. Good working conditions described in the policy include fair treatment of workers, compliance with shared values in the workplace, trust in the workplace, genuine cooperation, and equality among workers.

The purpose of this study, within the WASI project, was to describe how the participants viewed their future retirement age and what they thought employers could do to induce them to prolong their working life.

2 RESEARCH DESIGN

In Finland, a questionnaire was sent to 156 individuals. Alongside a large number of other issues, the questionnaire included two open-ended questions about retirement. One question asked the participants to specify the age at which they planned to retire, and the other asked them to indicate what their employer could do to persuade them to prolong

their working career. The answers to the second question were analysed using qualitative and quantitative content analysis.

3 RESULTS

A total of 112 individuals responded to the survey, of whom 108 (80 women and 28 men) replied to both or one of the questions about retirement. The 80 women were 28-62 years old and the men 29-63 years old. The average age of the women who responded was 46. The average age of the men was 45 years old. Most had some kind of professional or higher education qualification and worked in a white-collar job. The women's response to the question on their planned age of retirement ranged between 55 and 70 (mean 64). The most commonly reported retirement age was 65 (n = 38) and the second most common 63 (n = 20).The men's answers ranged between 60 and 70 (mean 64). The men's most frequent responses were fairly evenly distributed between age 65 (n = 10) and age 63 (n = 9). Due to the large age range in the material, it was possible to test the results in relation by age; however, an overview of the distribution of the results did not indicate any association between current age and planned retirement age.

A total of 79 individuals (62 women and 17 men) responded to the open-ended question asking what the employer could do. Collectively, they presented a total of 121 proposals. Inductive content analysis identified five categories: 1) Structural framework (e.g. part-time work, telecommuting, reduced workload, flexibility, extra time off); 2) Concern for the individual and the work environment (such as competence, fairness, occupational health and job satisfaction, work ergonomics, encouragement, and motivation) III. Individual challenges and rewards (e.g. education and training, challenges, more challenging and meaningful work responsibilities, higher pay, benefits) IV. Nothing V. Don't know. The largest proportion of responses focused on structural framework-related factors, and the second-largest on the categories of the individual and the work environment, and individual challenges and rewards. A small percentage of respondents took the position that there was nothing the employer could do, and few did not know. (Table 1.)

Table 1. Employees' proposals for action or measures to be taken by the employer that might persuade them to prolong their working careers

Category	Women N	Men n	Total N	%
I Structural framework	39	3	42	35
II Concern for the individual and the work environment	24	-	24	20
III Individual challenges and rewards	13	11	24	20
IV Nothing	13	5	18	14
V Don't know	9	4	13	11
Total	98	23	121	100

Due to the fact that the sample is small, it is not possible to test for gender differences. On closer scrutiny, however the frequencies would appear to indicate the existence of a difference between the sexes. The structural framework formed the largest category, and it is this category that is especially predominant amongst the women's responses. In order to consider extending their working careers, women desired *"the possibility for flex-time and part-time work"; "reduced workload and the possibility of part-time work"; "flexible working hours, the opportunity to work via telecommuting"; "shorter days"; "part-time work, reduction of work tasks, being able to concentrate on one area"; "more equal distribution of work responsibilities";* and *"a programme with other working tasks for older people."*. The men's answers were similar, but they were fewer in number.

The difference between men's and women's responses was especially pronounced with respect to the second category, Concern for the individual and the work environment. No men suggested any measures in this category that would induce them to prolong their working careers. The women wanted *a "genuine concern for the workers' strength and fairness in decision-making"; "efforts to improve occupational health, especially the ability to do physical work"; "motivate and encourage"; "be sensitive and ask what you are doing, how you feel"; "senior management should understand that they need to encourage those who do the real work"; "improve the employee's opportunities for exercise, ergonomics and job satisfaction"; "my work should be appreciated more"; "resolve the problem of indoor air quality, I have a cough and breathing difficulties in the workplace"; and "employers should take care of their employees [...] a good working environment, then one would certainly desire to work and would be motivated to work past 65 years old"*.

Most men had suggested measures in the category Individual challenges and rewards, such *as "raise salaries, send more often for training, provide an opportunity to visit more trade fairs and the like"; "interesting job responsibilities, benefits"*; and *"Higher Pay!"* as ways of creating new challenging and interesting 'concepts of work'. To induce them prolong their working careers, some women also wanted *"challenges and training within my area"; "two additional paid days off a month, and a salary raise of 5%"*; and *"guidance and development in mental health"* as well as opportunities to influence their work.

Both among women as well as among men, there were those who felt that their employer could not do anything for them that would persuade them to prolong their working careers. Most simply replied "nothing," but some explained their answer by stating that they had worked enough or that younger people should take over: *"Actually, nothing – I've been working for 40 years and think that it is time to step aside and make room for young people."; "While there are many young people who are unemployed, I don't think those who want to retire should be forced to keep working."* Some referred to their particular life situation: *"If the economy is ok, then nothing"; "it depends upon health; if it is bad, then nothing"*.

Those who did not know what the employer could do gave answers such as *"hard to say, I've been here 30 years"; "so far in the future, I can't answer"*; and *"I'll think about it when I get there, don't know in this situation, 15 years left"*. Those who responded in this way were relatively young, but there were also people who were over 50 years old who did not know and had not thought about the issue at all.

4 CONCLUSIONS

The participants in the WASI project planned to work a year longer than the government's target for 2025, i.e. an average of 64 years. One explanation could be that most of the project participants were so called white collar workers and many worked as experts.

The results suggest that men and women may have different expectations regarding what their employer can do to support them in continuing to work after reaching retirement age. The women's expectations included the structural framework and care for the individual and the work environment. The men's expectations focused on individual challenges and rewards. The men had no expectations regarding care for the individual or the work environment. It may also be worth noting that 14% of the participants felt that their employer would not be able to do anything to induce them to prolong the work careers.

REFERENCES

Kauppinen, T, Mattila-Holappa P, Perkiö-Mäkelä M m.fl. (2013) Työ ja terveys Suomessa 2012. Seurantatietoa työoloista ja työhyvinvoinnista. Helsinki: Työterveyslaitos.

Social- och hälsovårdsministeriet. (2011) Policy för arbetsmiljön och välbefinnande i arbetet till år 2020. Social- och hälsovårdsministeriets publikation 13. Helsingfors: Social- och hälsovårdsministeriet.

Ylikoski, M, Lamberg M, Yrjänheikki E et al.(2006) Health in the world of work: workplace health promotion as a tool for improving and extending work life. Reports of the Ministry of Social Affairs and Health 62. Helsinki: Ministry of Social Affairs and Health and Finnish Institute of Occupational Health.

[1] A longer version of the text has been published in Swedish in Gerontologia 2013; 27(3): 309 – 313.

WASI - Musculoskeletal disorders

Viive Pille[i], Viiu Tuulik[i], Kalju Meigas[i], Piia Tint[i], Varje-Riin Tuulik[i]

Keywords: musculoskeletal disorders, office work, ergonomics, computer work

1 MUSCULOSKELETAL DISORDERS FOR COMPUTER WORKERS IN ESTONIA

The number of occupational diseases is a specific indicator of the existence of hazards to the worker in the work environment. Occupational diseases in Estonia are usually diagnosed in the late stage when the worker is already disabled. At this late stage it is difficult to find appropriate rehabilitation methods for total health recovery. The majority of occupational diseases in Estonia are connected with MSDs. There are numerous hazards in the work environment (low temperatures, draught, noise etc.) that can affect office workers, damaging the peripheral and central nervous system (Tint et al, 2012a). Among computer workers, physical complaints are very closely connected with psychological disturbances (Zakerian & Subramaniam, 2009). Stuffy air, noise, temperature and deficient lighting may be supplementary risk factors for developing MSDs and psychosocial stress in the workplace (Tint et al, 2012a).The main physiological and psychological stress factor is a poorly designed workplace (Tint &Traumann 2012b).

Studies on working conditions, physical overload and psychosocial risk factors are complex and have not been conducted in Estonia until now. Therefore, the results of the WASI project are very important, offering ideas for further research to improve the psychosocial work environment. The results could also be implemented in other post-socialist countries, as the work environment in at the baseline was almost the same in all these states. Health complaints according to the WAI are shown in figure 1.

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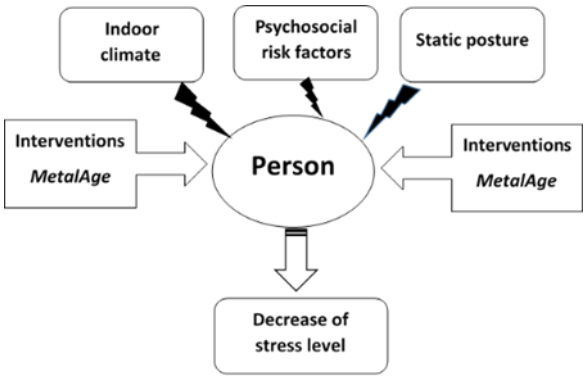

Fig 1. Health complaints according to the Work Ability Index (WAI).

Musculoskeletal disorders were thoroughly investigated in display screen workers. The Nordic Musculoskeletal Questionnaire was used for mapping complaints. The mechanical characteristics of frequency, stiffness and elasticity of the abductor pollicis brevis and the middle part of the trapezius muscle were recorded by means of a Myoton-3 hand-held myotonometer. The subjects estimated the intensity of pain on a 10-point scale.

A myotonometer (MYOTON-3) was used to diagnose the functional state of the skeletal muscles of computer workers. The myotonometer is a hand-held solid-state device developed at the University of Tartu, Estonia by Dr Arved Vain. The myotonometer exerts a local impact on the biological tissue by means of a brief mechanical impulse. The impact force is small enough not to cause any changes in the neurological reaction of the biological tissue. The tissue responds to the mechanical impact with damping or oscillation, which is registered by an acceleration sensor located on the measuring tip of the device.

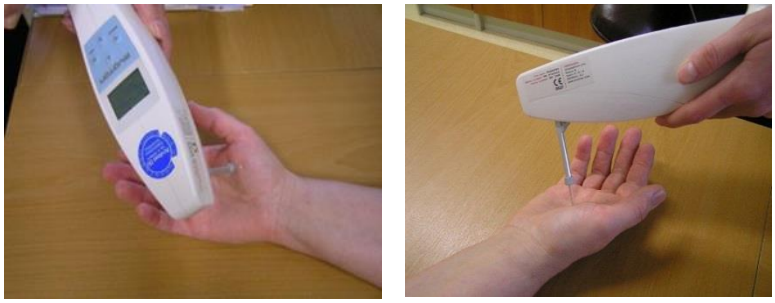

Figure 2. Myotonometer for muscle stiffness measurements

The parameters of the myotonometer consist of 1) Frequency, 2) Decrement, 3) Stiffness

1) Frequency characterises muscle tension. The frequency of the muscle's own oscillation describes muscle tone in the muscle's relaxed state. The value of the parameter is usually 11-16 Hz, depending on the muscle. In a normal muscle, muscle tension at rest is small, but frequency increases when the muscle is energised.
2) Decrement characterises muscle flexibility, i.e. the muscle's ability to recover its original shape after contraction. Decrement values are normally less than 1.0-1.2, depending on the type of muscle. Low flexibility may reduce blood flow to the muscles

when performing working movements. There may be a greater wear and the speed of movement may be limited (Vain).

3) Stiffness characterises the muscle's property of resisting its shape-shifting power. Stiffness values range from 150 to 300 N / m , depending on the type of muscle.

For data processing, the SPSS program and the *t-test* was used to analyse the data.

2 RESULTS

The main conclusion to be drawn from the investigation is that stress situations in the workplace could be prevented if appropriate intervention programs are used. According to two master thesis (Toomeoja 2013, Gridneva 2013), psychosocial reactions to occupational stress factors among computer workers differ both across organizations and by age.

The most interesting finding (based on the study results for workers under age 40 and for those over age 40) is that conditions are either different for younger workers compared to older workers or that the same conditions are experienced differently by the two age groups.

The data analysis used by Tint et al. for this article on "Prevention of physiological and psychological stress at computer-equipped workplaces" has been accepted for publication in the Journal "European Chapter-Annual Proceedings Human Factors Ergonomics Society" (HFES) 2013/2014.

The psychosocial character of the health risks that computer workers are exposed toin modern buildings were investigated. The influence of indoor climatic conditions on the development of health impairment in the workplace were also taken into consideration. Computer workers (accountants, secretaries, etc.) often worked in a static posture. The most injured regions of the body were the right wrist and the neck. Working conditions (indoor climate, lighting) were closely connected with the development of musculoskeletal disorders (MSDs) in glazed buildings. Low temperatures (<20°C in offices) in winter and high temperatures and draughts in summer, and deficiency of daylight, etc. are supplementary risk factors for developing MSDs. In addition to individual and psychosocial factors, MSDs among computer professionals are also associated with organizational factors such as the length of rest breaks and the duration of rotation, printing and sitting, and with factors related to the work station (the possibility to adjust the work chair and table; placement of screen, keyboard and mouse).

3 MUSCULOSKELETAL DISORDERS IN ESTONIAN OFFICE WORKERS

The questionnaire data are presented in "8.1 Survey in Estonia". Sixty-six (37 women and 29 men, mean age 41.7 years) display screen workers participated. The average length of service was 9 years, and the employees reported an average working time with display screens of 7.1 hours each day.

Thirteen employees (20%) were completely free from muscle and joint complaints. The majority of subjects reported local pain in two or more places. Neck pain complaints were reported by 37 workers (56%), and the average intensity of neck pain was 4 on a 0-10 self-assessed pain scale (). Right shoulder pain was present in 22 (33%) workers and left shoulder pain in 18 (27%). Mean intensity of shoulder pain was 4 (0-10). Wrist pain in the right arm was reported in 13 cases (20%), and in the left wrist in just 3 cases (5%). Mean pain intensity was 4.

Twenty-five workers complained of back pain (38%) and the mean intensity of pain was 4 (0-10). The presence of pain was generally short-term, mostly lasting from 1 to 7 days.

Table 1. Health complaints according to the Nordic Musculoskeletal Questionnaire in Estonian display screen workers.

Pain region	Workers N (%)	Severity of pain (0-10); mean
Neck	37 (56)	4.2
Shoulder, right	18 (27)	3.8
Shoulder, left	17 (26)	2.8
Elbow, right	4 (6)	4.7
Elbow, left	4 (6)	2.1
Wrist, right	13 (20)	4.6
Wrist, left	3 (5)	4.0
Back	25 (38)	4.3

The myotonometer measurements revealed a number of significant differences compared to norm values regarding muscle decrement in (mostly) display screen workers:

- M. abductor poll brev left 1.86 vs 1.2; t-test $p<0.001$ differed significantly from the norm.
- M. adbuctor poll brev right 1.96 vs 1.2; t-test $p<0.001$ differed significantly from the norm.
- M. trapetzius med left 1.38 vs 1.2; ; t-test $p<0.001$ differed significantly from the norm.
- M. trapetzius med right 1.38 Vs 1.2; t-test $p<0.001$ differed significantly from the norm.

The muscular tensions of computer workers result from a static working position; work-related psycho-emotional stress may also contribute to these symptoms.

Myotonometrical technology - a non-invasive, quick and easy method for the measurement of superficial skeletal muscles - can be recommended for use in occupational health for the prevention and early detection of work-related musculoskeletal disorders.

4 RECOMMENDATIONS FOR IMPROVEMENT IN COMPUTER WORKPLACE ERGONOMICS IN ESTONIA

The problems reported concerning indoor air, etc. in the same workplace were not experienced in the same way by all the employees. Therefore, an individual approach that takes account of the anthropological and other characteristics of the worker who is to work in a specific workplace needs to be applied.

Info-technology workers often work in under-lit conditions, even where the possibility exists to raise the (artificial) lighting to a normal level (400 - 500 lx).

The ergonomic use of laptops is achieved with a docking station, enabling the worker to also have a big monitor. Some younger workers like to use laptops in the dark (without artificial lighting). This is not correct and can have a detrimental effect on the worker's health years later.

An ergonomically designed workplace can, by decreasing the strain on the body, reduce the possibility of developing MSDs. Musculoskeletal diseases are the most common reason for lowered the employee productivity in the workplace. The chair has to provide lumbar support; otherwise the worker's body is leaning toward the table, imposing strain on the neck, shoulders and back.

The fact that it was not usually possible to rearrange the placement of ceiling lamps to avoid the glare and inconvenience caused to workers by illuminance sources (it was only possible to decrease the number of lamps by switching off) meant that the workstations would need to be re-sited in relation to the existing windows and ceiling lamps. This would increase workers' visual comfort and have a positive ameliorating effect on their muscle- and joint discomfort.

Figures 3 a, b, and c show three different layouts for the same tables and chairs. The workspace shown here is small for 2 persons. The tables and chairs were purchased for the whole four-storey building when the occupants moved in. All the tables and chairs were uniform in size, regardless of the workers' individual anthropological features. Of these three possibilities, b can be considered the best. In b, the light is coming from the left side for both of workers (this is correct, assuming they are right-handed) and it is possible for each to open the window. In the present arrangement of the tables (a), it may not possible to open the window, because the window stop is in the middle of the large window-wall and workers who are small in stature cannot reach the window to open it (the interior has been designed without taking account of the anthropological characteristics of the workers). This conclusion is based on the fact that educational staff are not present at the same time in the room. The simultaneous presence of both occurs 2-3 times a week and not for the whole working day.

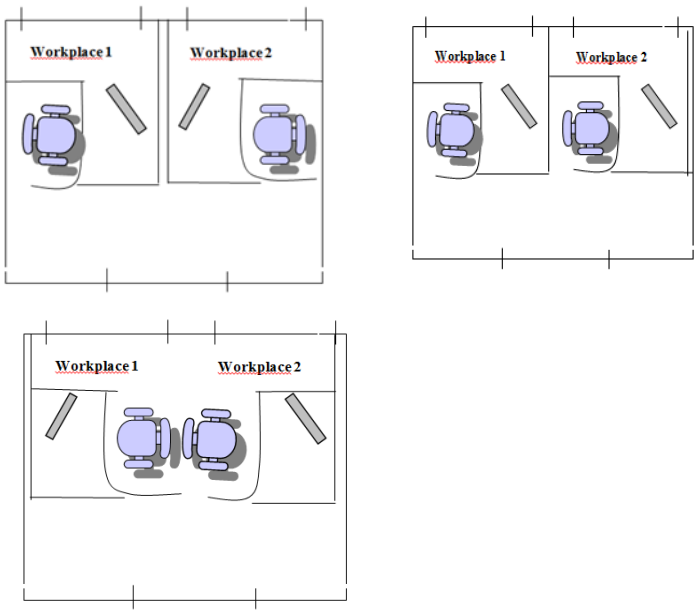

Fig.3. Workroom with 2 workplaces (area 12m^2). Possible ergonomic solutions (a, b or c?)

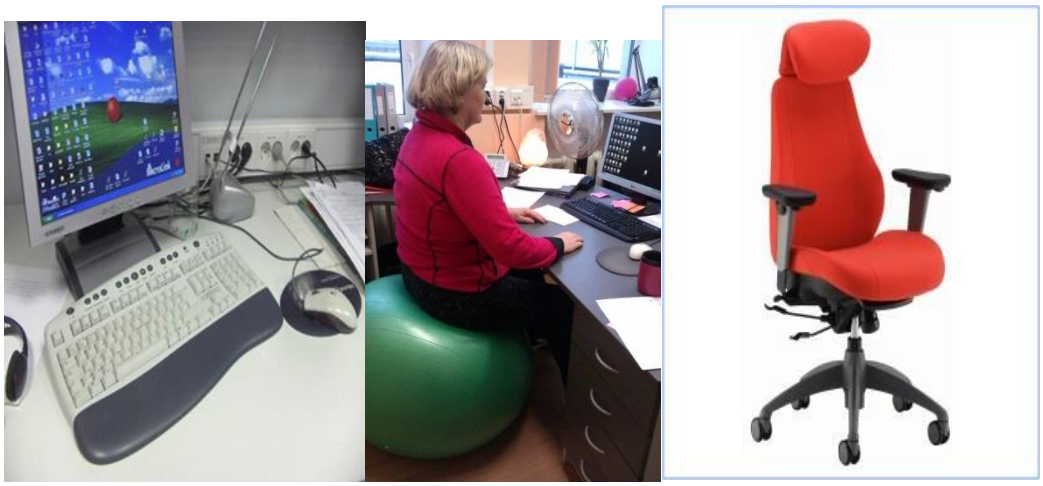

Fig. 3. Ergonomic solutions in the workplace:

A) ergonomic key-board *b) ball as a chair* *c) ergonomic chair*

4.1 Estonian screen display workers; prevention and rehabilitation

Proposals were made for ergonomic improvements in the studied workplaces (new ergonomic chairs, the possibility to change the height of the worktable, change in the siting of a monitor, etc.). Complaints about the air in the work environment and lighting deficiencies were passed on to the employer. The rehabilitation of MSDs is possible using balneological and of physiotherapy methods of treatment (Tuulik et al, 2013, Visnola et al 2010).

By means of a myotonometer the basic indicators of skeletal muscle condition (stiffness, elasticity and decrement) can be determined. These data are valuable for the early

detection of possible health impairments caused by work and for planning rehabilitation treatment in an early stage of overload-induced MSDs.

MSD questionnaires, objective methods and environmental measurements are useful for planning prevention and early rehabilitation before disability onset.

REFERENCES

Gridneva K. 2013. - Influence of psychosocial factors on computer workers job satisfaction. Master thesis.

Tint P et al. 2013/2014. "Prevention of physiological and psychological stress at computer-equipped workplaces" has been accepted for publication in (HFES) 2013/2014.

Tint P & Traumann A. 2012. Health risk assessment in atrium-type buildings. *Inter.J Energy & Environment*, **6**(4):389-396.

Tint P, Traumann A, Pille V, Tuulik-Leisi V-R & Tuulik V. 2012 a. Computer users' health risks caused by the simultaneous influence of inadequate indoor climate and monotonous work. *Agronomy Research*, 10:261-268.

Toomeoja K. 2013. - The computer workers' WAI and satisfaction with work and their relations. Master thesis.

Tuulik V-R, Tuulik V, Pille V, Tamm M, Saarik S, Vare T & Tint P. 2013. Laser-doppler perfusion monitoring, myotonometry, and workplace risk evalution as assessment methods of musculoskeletal overuse syndromes in industry workers.*Journal of Rehabilitation Medicine, 45*:976-977.

Visnola D, Sprudza D, Bake MA & Pike A. 2010. Effects of art therapy on stress and anxiety of employees, Proceedings of the Latvian Academy of Sciences, Section B, 64:85-91.

Zakerian SA & Subramaniam ID. 2009. The relationship between psychosocial work factors, work stress and computer-related musculoskeletal discomforts among computer users in Malaysia. Int J Occup Saf Ergon. 15(4):425-34.

WASI – Indoor Air Quality

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Keywords: indoor air, office room, air temperature, humidity, ventilation, carbon dioxide concentration

1 ESTONIAN AND LATVIAN INDOOR CLIMATE IN OFFICE ROOMS

The number of occupational diseases is a specific indicator of the existence of hazards to the worker in the work environment. In Estonia, occupational diseases are usually diagnosed at a late stage when the worker is already disabled. At this point, it is difficult to find appropriate rehabilitation methods for the total recovery of health. The interaction between the body and the work environment is complicated and four important systems (central nervous, automatic nervous, endocrine and immune) are involved in this network (Raja et al, 1996).

There are many potential hazards in the office work environment (low temperatures, draught, noise etc.) that damage the peripheral and central nervous system (Tint et al. 2011). Among computer workers, the physical complaints are very closely connected with psychological disturbances (Zakerian et al. 2011). Stuffy air, noise, temperature, deficient lighting can all be supplementary risk factors for developing occupational stress in the workplace (Tint et al. 2012).The main physiological and psychological stress factor is a badly designed workplace (Tint & Traumann 2011).Social relationships are important for the physical health of workers (Eisenberg & Cole 2012). Socially connected people live longer than socially isolated people and the first have increased resistance to a variety of somatic diseases, from heart disease to cancer (Miller et al. 2009). The investigation of working conditions, physical overload and psychosocial risk factors is a complex process that has not been carried out in Estonia until now. Consequently, the results of the project “Work ability and social inclusion” are very important

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for Estonian employees and offer ideas for further research aimed at improvement of the psychosocial work environment.

The specific aim of the study was to improve the quality of the indoor climate and design of the workplace to achieve better working conditions and workplace ergonomics (Graves & Tardiff 2006) for office workers. The indoor air quality (concentrating on air purity and temperature) and the possibilities for ergonomic re-design of workplaces in the office-rooms were assessed.

A comparison of the indoor climate of office rooms in Estonia and Latvia is given at the end of the study.

Statistical analyses of the questionnaire data were performed using SPSS statistical software (version 20.0 for Windows; SPSS Inc., Chicago, IL). Descriptive data are shown as means or proportions, and suitable methods, such as repeated sample t-test, were used to analyze the data.

1.1 Indoor climate in office-rooms: material and methods in Estonia

Within the framework of the WASI project, the measurements in Estonia were carried out in five establishments in Tallinn and in two firms in a small West-Estonian town. The requirements regarding indoor climate (IC) quality in Estonian office rooms are laid down in Estonian Standard EVS-EN 15251:2007.. These concern air temperature, humidity, velocity (ventilation), carbon dioxide concentration, noise and lighting. Estonian standard EVS 894:2008 (Daylight in dwellings and offices) is also available. It attends more to the importance of natural lighting and possibilities for compensating for shortages of natural lighting. Establishing the air quality in offices and residential buildings has become increasingly important (Asadi et al. 2011, Dutton et al. 2013, Valancius et al. 2013). Carbon dioxide (CO2) concentrations have increased outdoors and therefore also indoors, with negative effects on indoor workers (Stavova et al. 2007). Mechanical ventilation (Woods et al. 2009) no longer meets the demands of workers. Windows in offices have to be openable.

The 1970s energy crisis led to the design of air-tight buildings. Unopen able windows became a common feature of building design. It is now clear that such airtight buildings create problems. Because of inadequate ventilation to the outside, the air pollutants inside buildings have to be removed. Health disturbances from indoor air pollution can range from nose, eye and throat irritation and aggravation of asthma to increased risk for lung cancer. Biological sources of indoor air pollution include mould, mildew, fungi and bacteria (Schleibinger et al. 2008). Exposure to small amounts of indoor air pollutants can cause minor irritations, such as dry, scratchy eyes and throats, or headaches. However, in large concentrations, pollutants can lead to dizziness, tiredness, and nausea, and rashes. Although anyone can have problems because of indoor air pollution, the most susceptible group is the ageing workforce, people who already have respiratory ailments such as bronchitis, asthma or emphysema. Nowadays, airtight windows are used in the offices in atrium-type buildings close to the atrium (Tint & Traumann, 2012). The physical environment of the work space is important, as it may induce stress

and thereby impair the cognitive endeavors of both scientific and office workers. EVS-EN 15251:2007 distinguishes different (I to IV) categories of comfort.

Numerous studies in both Europe and North America have indicated that non-specific symptoms related to occupancy in office buildings (Bako-Biro et al. 2004, Fang et al. 2004, Saari et al. 2006) and attributed to poor air quality are common among office workers, and that there is considerable variation in the prevalence of symptoms among buildings (Jones 1999, Seppänen et al. 1999, Yunus et al. 2010, Graves et al. 2006). These symptoms are generally referred to as Sick Building Syndrome (SBS) symptoms. SBS has become common due to the construction of buildings designed to be energy-efficient with air conditioning systems and unopen able windows (Berardi et al. 1991). SBS is characterized by the following: eye, nose and throat irritation; a sensation of dry mucous membranes and skin; erythema (skin redness); mental fatigue; headache; a high frequency of airway infections and cough; hoarseness; wheezing, itching and non-specific hypersensitivity; nausea and dizziness. SBS is often also characterized by other non-specific symptoms such as nasal dryness, nasal congestion (stuffy, blocked nose), nasal excretion (runny nose), pharyngeal symptoms, difficulty in concentration, and difficulty in breathing and feelings of tightness in the chest (Seppänen et al. 1999). The term ‘‘SBS’’ is used primarily when the agents causing the symptoms are unidentified and the symptoms do not indicate a specific known disease. SBS symptoms/complaints appear during the workday and improve or disappear at the weekend. Despite several studies aimed at establishing the pathogenetic role of microorganisms, chemical pollutants and the microclimate in such environments, the etiologic factors are usually difficult to identify (Berardi et al. 1991, Lopez et al. 2013, Mergi et al. 2007, Pan et al. 2003, Sadrzadehrafiei et al. 2011).

Natural ventilation in workrooms is as important as natural lighting. Winter, of course, poses problems, as we have to preheat the air (Woods et al. 2009, Voeltzel 2001).

Natural light is associated with lower fatigue and reduced eyestrain. With the natural lighting of rooms, the worker remains in contact with outdoor environment (DeKay 2010). The body uses natural light in a way similar to food and water. The essential biological functions (nervous and endocrine system) are stimulated by natural light (Sharples et al. 2007, Song 2007).

There are a number of factors that can limit the visual functioning of the worker, such as artificial lighting or deficiency of daylight, visual correction, visual angle and distance, flicker, contrast etc. Workers are influenced as psychologically as physiologically by the different spectrums provided by natural and artificial lighting. The profile and structure of the roof of an atrium strongly influences the transmission of natural light: such a roof may let through between 20 and 80% of the outdoor light (Rennie & Parand 1998).

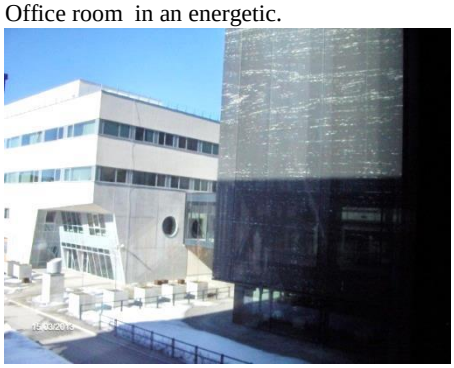
Fig. 1-12 below illustrate the characteristics of the office rooms investigated the

Modern chair

An office- room inside the building(without windows to outdoors)

Office room in an energetic.

Office room in a service enterprise

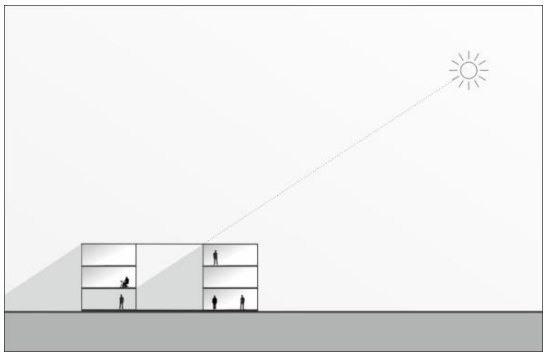


Two new-style university buildings:
A (left)

The spotted material of the library atrium-type building and the library disturbs the students and office-workers (right) building A

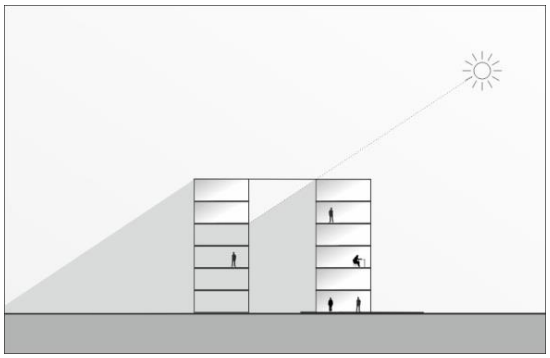
Non-ergonomically designed workroom in building A, closed to the atrium

The ergonomics of the workplaces *a* in the building A



Three-storey building B (built in 2010)

The atrium of the 3-storey building B (with closed roof).



The building B has 6 stories (3 additional

The atrium of the 6-storey building floors were built after 2012).

The work environment measurements were based on ISO, EN DIN, EVS standards: EVS-EN-ISO 7726:2003 "Thermal environments – Instruments and methods for measuring physical quantities"; EVS-EN 15251:2007 "Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics", EVS-EN 12464-1:2002 "Light and lighting- Lighting of work places- Part 1: Indoor work places", EVS 891:2008 "Measurement and evaluation of electrical lighting in working places". The microclimate was measured with a TESTO 435, which also enables the measurement of CO2. Measurements of the lighting of the workplaces and screen were performed using a TES 1332 light-meter (range 1-1500 lx). The lighting was measured on the worktable, on the screen and on the keyboard. Lighting was measured at the local workplaces (normally at a height of 0.80 m above floor level), where a suitable measuring grid was applied. Dust was measured with a HazDust EPAM-5000.

1.2 Indoor climate in office rooms; material and methods in Latvia

The Latvian data have been taken from the PhD thesis of Zanna Martinsone "Non-industrial indoor air quality and development of basic methods for the occupational risk assessment" (Riga 2012).. For the most part, the research emphasis is on chemicals in the indoor air, including dust particles and microclimate measurement methods. The

determined chemicals were: nitrogen dioxide NO2, sulphur dioxide SO2, ozone O3, carbon dioxide CO2; organic compounds (19 different).

Measurements of chemicals were carried out at 5 to 25 measurement points during the workday. The air samples in the breathing zone of employees working in offices throughout the day were gathered with an individual air-sampling device, (Gilian LFS – 113DC), with carbon tubes (ORBO TM-32). The prepared sample analysis was performed by gas chromatography (Varian 3800 with an automatic sample injection system (CP8200), the analytical signal was obtained with a flame ionization detector (FID) and gas chromatography (Agilent 6890N) with a mass spectral analyser (Waters Micromass). Air quality in Latvia is regulated by Regulation Nr.1290 of the Latvian Cabinet of Ministers "Regulation on Air Quality" (11/03/2009).

Indoor air (microclimate) measurements were done hourly at 0.6 m above the floor using Test 400 probe measurements over the work shift, according to BS EN ISO 7726:2004 L and Testo guidelines. The measurement results were compared with the Cabinet of Ministers regulation No.359 "Labour protection in the workplace", according to which in the category of light load job tasks, the microclimate requirements are as follows: 1) for the cold period of the year from +19.0 to +25.00C, 30-70% for relative humidity, 0.05 to 0.15 m/s air velocity; and for the warm period of the year from 20.0 to 28.0C; 30-70%, 0.05-0.15m/s.

2 RESULTS

2.1 Indoor climate in Estonian office-rooms

Health complaints at work are often caused by a badly designed workplace, but these defects are closely connected with indoor climatic conditions (bad microclimate, lighting problems, and the ergonomics of the work-station). Therefore these three components were investigated thoroughly.

The permitted exposure limits for the indoor climate laid down for the 3 comfort categories in standard EVS-EN 15251 are given in Table 1.

The results for the indoor office climate are given in Table 1. The air temperature in offices studied was sometimes (in winter) below the recommended norm (<20-220C). Each of the investigated rooms had mechanical ventilation above the door (5 metres from the window). The mechanical ventilation in the rooms has been monitored for 3 years and the best settings have been identified (cold air is no longer blowing directly on the workers). The relaxation time for heating the indoor air with the existing preheating ventilation systems in low outdoor temperatures is too long, hence it is continuously cold in the rooms. The rooms are equipped with radiators, but in the rooms closed to the atrium they did not switch on until the room temperature fell below 16 degrees. The relative humidity in the winter-time is very low (10-15%), and is a cause of dry skin problems for the workers. Some of the rooms on the first floor closed to the atrium had a bad odor (biological tests were conducted, but no fungi were found). The indoor air was not dusty (below the limits= 0.0050 mg/m3), but neither was it fresh (as report-

ed by the workers). The means that the rooms have to be ventilated naturally by opening the windows at the beginning of the working day and during lunch breaks.

Table 1. Norms for indoor climate in office rooms (EVS-EN 15251:2007)

Category of comfort (I-assessed as the best room)	Indoor air CO_2 concent-ration (measured), ppm	Indoor air CO_2 concentration taking into account a mean outdoor CO_2 level 400 ppm	Air temperature, ^{0}C, summer/ winter	Air humidity, %	Lighting , lx
I	350	750	25.5/21.0	>30	500
II	500	900	26.0/20.0	>25	500
III	800	1200	27.0/19.0	>20	500

Table 2.Results of indoor measurements in office buildings (2012-2013)

Room type	Indoor air temperature, ^{0}C, U = 0.6 ^{0}C		Indoor air humidity, %, U = 2.0%		Lighting, lx, U = 10.4%	Concentration of carbon dioxide	Concentration of dust in the air
	Cold season	Warm season	Cold season	Warm season		CO_2, ppm U= 10%	mg/m^3 U=10%
Office 1	20-22	28-30	22-23	35-65	495-890	537-998	0.030
Office 2	20-22	24-28	15-25	35-75	5-250	500-750	0.020
Office 3	18-22	22-28	20-30	40-75	350-600	350-1200	0.015
Office 4	20-22	20-24	10-21	35-65	25-350	537-998	0.015
Rooms A* close to the atrium	18-20	20-24	10-21	35-65	433-1160	541-897	0.015**
Rooms A* closed to outdoors	17-20	22-28	15-30	40-70	690-1209	478-1152	0.011
Rooms in building B*	18-20	25-26	34-40	35-65	390-765	447-750	0.012

U- uncertainty of measurements;*A, B, atrium-type buildings;** Concentration of dust in the smoking room 0.099 mg/m^3

In summer atrium-facing rooms are not over-heated and are very comfortable in summer when compared to those that are closed to the outside wall. . The measurements of natural lighting in winter yielded values from 50 lx to 100 lx in the rooms closed to the atrium. For workroom a (Fig.13), the opposite windows are very close (other staff are

also working there) and the researchers in the room a often work with the blinds down. This further reduces the penetration natural light into the room.

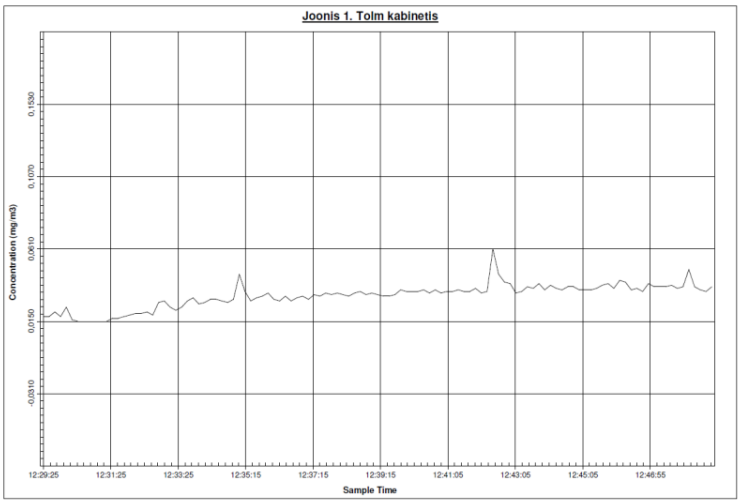


Fig.13. Change on dust concentrations in room a by time (0.0150-0.0151mg/m^3)

The main results of the investigation can be summed up as follows: the indoor air is too dry in the winter season (relative humidity 10-20%); the air temperature in the work-rooms depends on the location of the room in the building; the relaxation time of the temperature is too high (the rooms are not heated or cooled quickly enough in response to sudden changes in the outdoor air temperature); if the room area is smaller than 10 m2 per worker, then the concentration of CO2 is over the recommended norm (>800 ppm); noise is a problem when the ventilation system is working at very high capacity. The concentration of dust is low and moisture in the rooms (causing a bad odour) was observed only on the first floor closed to the atrium. The artificial lighting level was mainly adequate in the investigated organizations.

2.2 Indoor climate in Latvian office rooms

During the project, indoor air measurements in office environments were performed. Ther parameters assessed were: microclimate (air temperature, relative air humidity, and air flow), carbon dioxide and lighting. Laboratory of Hygiene and Occupational diseases has been accredited in the Latvian National Accreditation Bureau (LATAK) since the year 1996. The Measurement methodology met the requirements of Latvian legislation and European standards. The measurement equipment was calibrated and met standard requirements. During the different stages of the project, 171 lighting measurements, 370 microclimate measurements and 420 carbon dioxide measurements were performed in 265 workplaces in 12 organizations (Table 3)

Table.3. Microclimate measurements

Project stage	Number of companies	Number of work places measured	Lighting	Indoor temperature	Relative air humidity	Air flow	Carbon dioxide
WASI 1 (count))	12	170	110	236	236	236	269
Measurements range WASI 1			**83-2044 lx**	**18-27 °C**	**14-62 %**	**0.0-0.16 m/s**	**875-3036 mg/m^3**
WASI 2 (count)	10	95	61	134	134	134	151
Measurements (range) WASI 2			**89-2626 lx**	**21 - 29 °C**	**24 - 62 %**	**0.0 - 0.12 m/s**	**802 - 2491 mg/m^3**

The microclimate measurements were prepared according to LVS EN ISO 7726:2004 (Ergonomics of the thermal environment - Instruments for measuring physical quantities"1 with multifunctional equipment)TESTO 400" microclimate probe. 95% confidence intervals for uncertainty of the measurements were as follows: relative air humidity ± 0.7%, temperature ± 0.2 ^{O}C, air flow ± 0.03 m/s. The measurements were performed in office s, ~1.1 m high, avoiding the probe coming into contact with breath.

The results were compared with reference values laid down by the Latvian Cabinet of Ministers (Nr. 359, 2010 year2). The reference values for office workers (in work category I) are: relative air humidity 30-70 %, temperature 19-25 ^{O}C (cold period) and 20-28 ^{O}C (warm period), air flow 0.05-0.15 m/s, as shown in table 4 below.

Table 4. Microclimate reference values

Nr.	Period of year	Category of work	Air temperature C°	Relative air humidity (%)	Air flow (m/s)
1.	Cold season of year (average air temperature outside the office + 10 °C or lesslower)	I[1]	19,0–25,0	30–70	0,05–0,15
		II[2]	16,0–23,0	30–70	0,1–0,3
		III[3]	13,0–21,0	30–70	0,2–0,4
2.	Warm season of year (average air temperature outside office is more than + 10	I[1]	20,0–28,0	30–70	0,05–0,15
		II[2]	16,0–27,0	30–70	0,1–0,4

	°C or higher)	III[3]	15,0–26,0	30–70	0,2–0,5

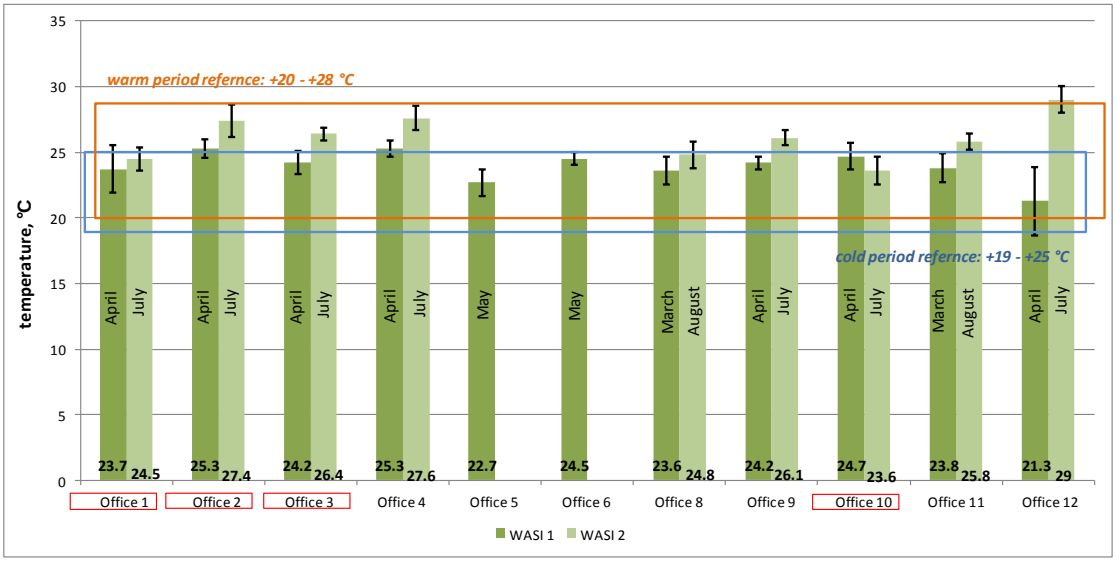
[1] *Category I - work is not related to physical effort or requires a very small or small amount of physical activity (e.g., movement of light objects - up to 1 kg).*

[2] *Category II - work associated with moderate or considerable physical effort (e.g., constant heavy (10 kg) lifting and moving).*

[3] *Category III - strenuous work (for example, constant heavy (more than10 kg) lifting and moving).*

Results of the indoor air temperature measurements results in offices (depending on project stage) are shown below.

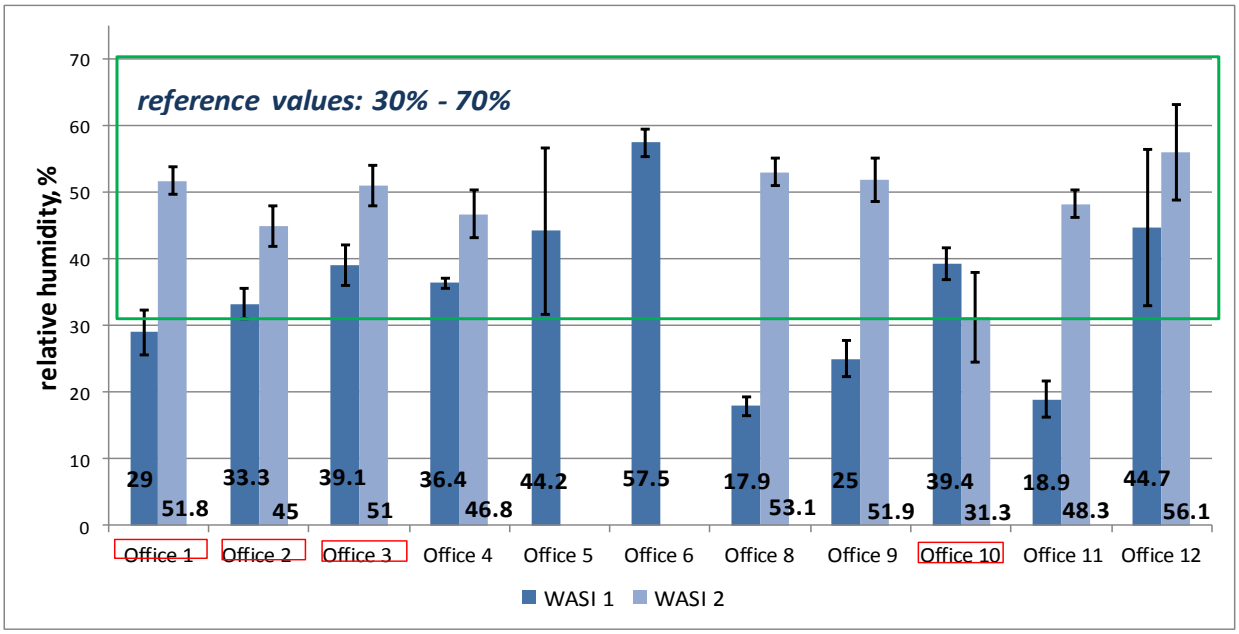
Fig. 14. Microclimate measurements



Microclimate measurements were carried out mostly during the warm season (outdoor temperature +10° C or higher); only 2 offices were assessed during the cold season (in the WASI 1 stage, office nr.8 and nr.11). As the figure shows, even when taking the standard deviation into account, a temperature above the prescribed level (>28° C) was found in only one office (nr.12).

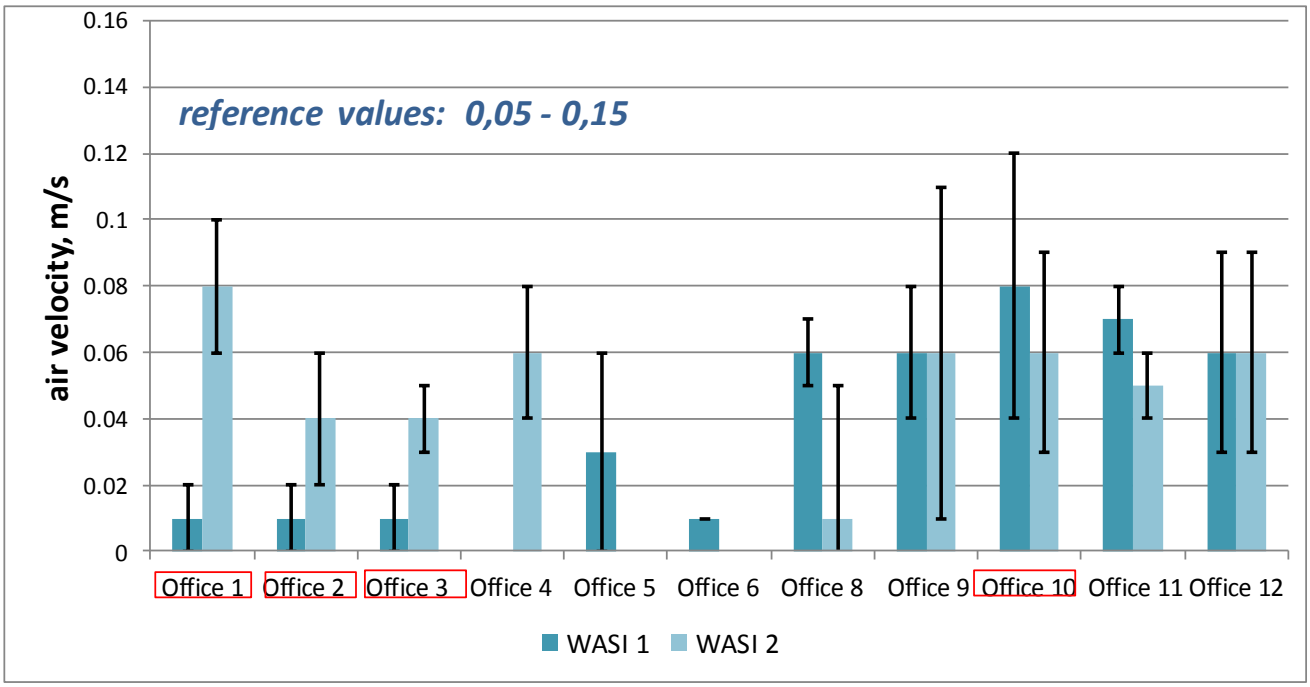
Dry air is a common problem in an office environment. The mean relative air humidity values were below the prescribed value in 4 offices; however, when the SD values were taken into account, dry air was a problem in at least 7 offices in both project stages (Fig. 15).

Fig. 15. Relative air humidity measurements



Low air velocity is one of the indicators of poor ventilation. Poor air velocity was a problem in 11 offices, and in 15 when the SD values were taken into account

Fig. 16. Air velocity measurements



Carbon dioxide pollution in the indoor air was detected when standard ISO 16000-26:2012 (Indoor air - Part 26: Sampling strategy for carbon dioxide3) was applied using multifunctional equipment „TESTO 400" carbon dioxide probe. Measurement uncer-

tainty was set at ± 5%. The measurements were implemented in office workplaces, ~1.1 m high, avoiding the probe coming into contact with breath.

Carbon dioxide is a normal constituent of exhaled breath and is commonly measured as a screening tool to evaluate whether adequate volumes of fresh outdoor air are being introduced into indoor air. The outdoor level of carbon dioxide is usually from 300 parts per million to 400 parts per million (ppm). The carbon dioxide level is usually greater inside a building than outside, even in buildings with few complaints about indoor air quality.

Measurement results were compared with ISO/DIS 16000-26 (Indoor air – Part 26 Measurement strategy for carbon dioxide) for indoor air, reference value 1830 mg/m3 (1000 ppm). Indoor carbon dioxide levels above 1000 ppm indicate the likelihood of inadequate ventilation, and complaints such as headaches, fatigue, and eye and throat irritation may be prevalent. However, a high level of carbon dioxide in a building may indicate the presence of elevated levels of other contaminants that could be responsible for occupants' complaints

Properly ventilated buildings should have carbon dioxide levels between 600 ppm and 1000 ppm, with a floor or building mean of 800 ppm or less4. The maintenance in a building of mean carbon dioxide levels below 800 ppm, together with appropriate temperature and humidity levels, should minimize complaints about indoor air quality should be minimized.

The results are shown in Fig. 17. Carbon dioxide is a simple and effective indicator of ventilation status. As we can see, in 6 offices the carbon dioxide concentration was higher than 1000 ppm.

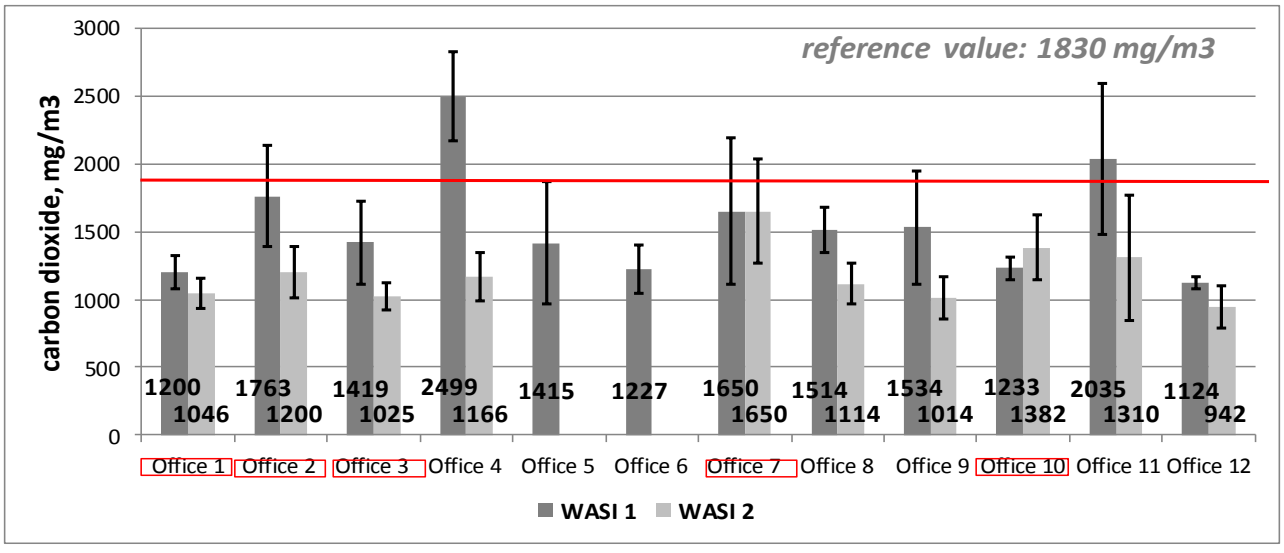


Fig. 17. Carbon dioxide measurements

Lighting was measured according to ГОСТ – 24940 – 96 (Buildings and structures. Methods for measuring the illuminance5) with a TESTO 545. Measurement uncertainty depends on the value measured: at 100 lx uncertainty is ± 7.2 lx, at 300 lx ± 12.5 lx and

at 500 lx ± 21 lx. Artificial lighting is assessed, avoiding natural light (using window blinds); if the measured natural light value divided by measured artificial light value is less than 0.1, then the result is not affected by natural light (in some cases factors were >0.1).

The results were interpreted according to the regulations issued by the Latvian Cabinet of Ministers (Nr. 359, 2010 year2) and LVS EN 12464-1:2011 (Light and lighting - Lighting of work places - Part 1: Indoor work places6). the reference value for office workers is 500 lx.

Average measured values below 500 lx were fairly common in the assessed offices.

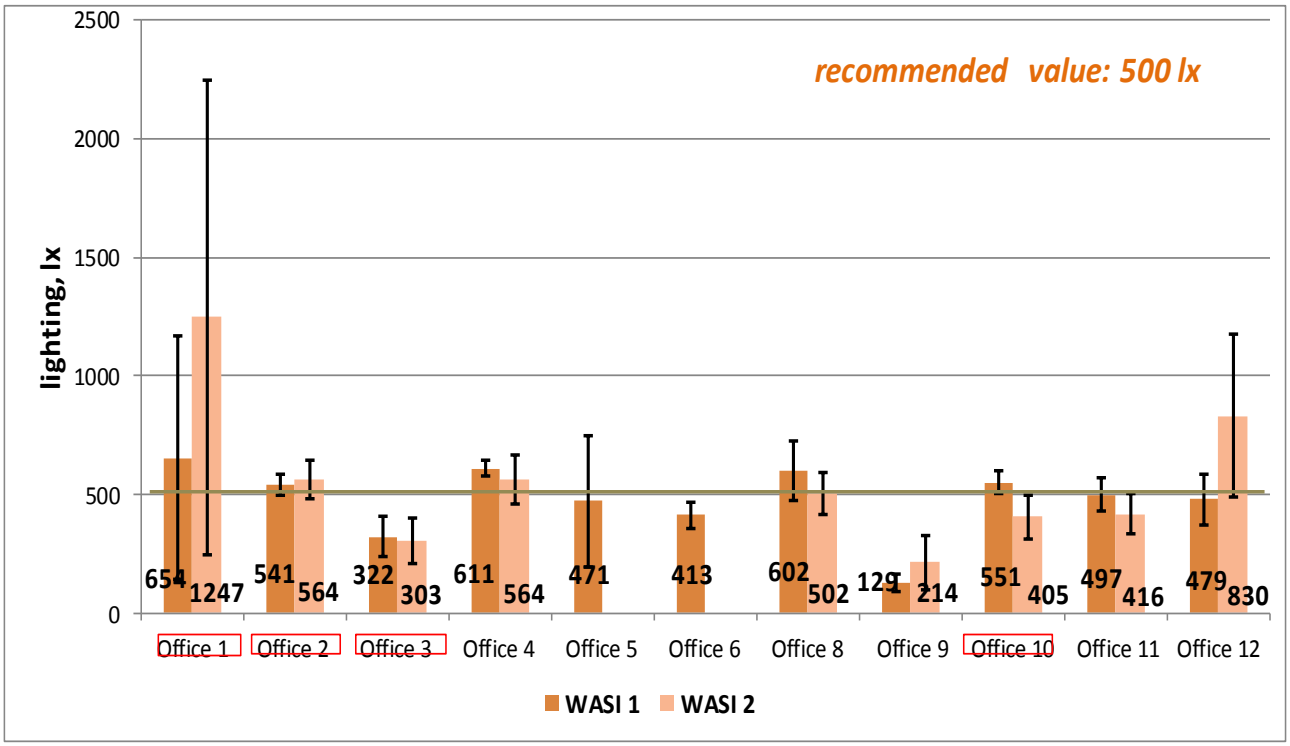


Fig. 18. Lighting measurements

Conclusions. Air temperature measurements and carbon dioxide were mostly in line with the reference values.

Low humidity and lack ventilation are common problems in the office environment.

It is difficult to assess changes in microclimate factors for intervention research purposes, as these factors depend on a number of other factors (ventilation, season, heating system, air conditioning, number of workers, etc.).

Lighting levels were below the recommended values in one-half of cases. In sum, it is difficult to assess the influence of the intervention.

3 COMPARISON INDOOR AIR IN ESTONIAN AND LATVIAN OFFICES

The number of office workers investigated was bigger than in Estonia. The accent was on chemical pollutants in office rooms. The Estonian team did not have the equipment needed for the determination of chemical pollutants chromatographically.

The main difference in the results between Estonia and Latvia concerned CO2 concentrations. Whereas the range in Estonia was 500-2000 ppm, in Latvia the level contamination of office-air with carbon dioxide reached 3 500 ppm, which is rather high for office rooms. Air temperature and humidity were in the same range in the office-rooms investigated.

REFERENCES

Asadi E, Costa JJ & da Silva MG. 2011. Indoor air quality audit implementation in a hotel building in Portugal. Building and Environment, 46:1617-1623.

Bako-Biro Z, Wargocki P, Weschler CJ & Fanger PO. 2004. Effects of pollution from personal computers on perceived air quality, SBS symptoms and productivity in office. Indoor air, 14:178-187.

Berardi BM, Leoni E, Marchesini B, Cascella D & Raffi GB. 1991. Indoor climate and air-quality in new offices - effects of a reduced air-exchange rate. International Archives of Occupational and Environmental Health, 63:233-239.

DeKay M. 2010. Daylighting and urban form: an urban fabric of light. Journal of Architectural and Planning Research, 27(1):33-56.

Dutton SM, Banks D, Brunswick SL & Fisk WJ. 2013. Health and economic implications of natural ventilation in California Office. Building and Environment, 67: 34-35.

EVS 894:2008+A1:2010. Daylight in dwellings and office. Estonian Centre For Standardisation (in Estonian).

EVS-EN 15251:2007. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics. Estonian Centre for Standardisation (in Estonian).

Fang L, Wyon DP, Clausen G & Fanger PO. 2004. Impact of indoor air temperature and humidity in an office on perceived air quality, SBS symptoms and performance. Indoor Air, 14(Suppl 7):74-81.

Graves CG & Tardiff TG. 2006. Office equipment and supplies: a modern occupational health concern? American Journal of Epidemiology, 152:593-594.

ISO 16000-26:2012 “Indoor air - Part 26: Sampling strategy for carbon dioxide”

Jones AP. 1999. Indoor air quality and health. Atmospheric Environment, 33, 4535-4564.

Lopez-Aparicio S & Grasiene R. 2013. Screening indoor air quality in the Lithuanian theatre, music and cinema museum. Journal of Environmental Engineering and Landscape Management, 21 (1):52-58.

LVS EN 12464-1:2011 „Light and lighting - Lighting of work places - Part 1: Indoor work places”

LVS EN ISO 7726:2004 „Ergonomics of the thermal environment - Instruments for measuring physical quantities”

Mergi CA & Al-Dawoud A-S. 2007. Integration of ventilation in the design of commercial buildings- application to atrium buildings in hot/humid climate. Architecture and Environment, 6:14-27.

Pan Y, Li Y & Huang Z. 2009. Study on energy modelling methods of atrium buildings. In: roc. of 11th International IBPSA conference: Building Simulation 2009 (pp.250-257). Glasgow: Simulation Research Group.

Raja A, Tuulik V, Lossmann E & Meister A. 1996. Neural network approach to classify the functional state CNS in case of neurotoxic diseases. Medical and Biological Engineering and Computing, 34(suppl.1): 241-242.

Regulations of Cabinet of Ministers nr. 359 „Occupational Health and Safety requirements in the workplaces"

Rennie D & Parand F. 1998. Environmental design guide for naturally ventilated and daylit offices. Branknell, UK: BSRIA Ldt.

Saari A, Tissari T, Valkama E & Seppänen O. 2006. The effect of a redesigned floor plan, occupant density and the quality of indoor climate on the cost of space, productivity and sick leave in an office building –a case study. Building and Environment, 41:1961-1972.

Sadrzadehrafiei S, Mat KS & Lim C. 2011. Application of advanced glazing to mid-rise office buildings in Malaisia. In: Niola, V., Ng, K.-L. (eds.). Proc. of WSEAS conference EED ’11 (pp.197-201). Montreau: WSEAS press.

Schleibinger H, Laussmann D, Bornehag C-G, Eis D & Rueden H. 2008. Microbial Volatile organic compounds in the air of mouldy and mould-free indoor environment. Indoor Air, 18:113-124.

Seppanen OA, Fisk WJ & Mendell MJ. 1999. Association of ventilation rates and CO_2 concentrations with health and other responses in commercial and institutional buildings. Indoor Air, 9: 226-252.

Sharples S & Lash D. 2007. Daylight in atrium buildings: A Critical Review. Architectural Science Review, 50(4):301-312.

Song KD. 2007. Evaluating daylighting and heating designs of a top-glazed atrium space through physical scale model measurements and CFD analyses. Indoor and Built Environment,16:121-129.

Stavova P, Melikov AK, Sundell J & Naydenov KG. 2007. Air change rate measurement in apartment by CO_2 method. Technika, 4, 166.

Tint P & Traumann A. 2012. Health risk assessment in atrium-type buildings. Inter.J Energy & Environment, 6(4):389-396.

Tint P et al. 2013/2014. "Prevention of physiological and psychological stress at computer-equipped workplaces" have been accepted for publication in the Journal "European Chapter-Annual Proceedings Human Factors Ergonomics Society" (HFES) 2013/2014.

Tint P, Traumann A, Pille V, Tuulik-Leisi V-R & Tuulik V. 2012 a. Computer users' health risks caused by the simultaneous influence of inadequate indoor climate and monotonous work. Agronomy Research, 10:261-268.

Valancius R & Jurelionis A. 2013. Influence of indoor air temperature variation on office work performance. Journal of Environmental Engineering and Landscape Management, 21(1):19-25.

Voeltzel A, Carrie FR & Guarracino G. 2001. Thermal and ventilation modelling of largehighly-glazed spaces. Energy and Buildings, 33:121-132.

Woods AW, Fitzgerald S & Livermore S. 2009. A comparison of inter pre-heating requirements for natural displacement and natural mixing ventilation. Energy and Buildings, 41(12):1306-1312.

Yunus J, Ahmad SS & Zain-Ahmed A. 2010. Analysis of atrium's architectural aspects in office buildings under tropical sky conditions. In: Proc. of International Conference on Science and Social Research (pp.536-541). Kuala Lumpur:IEEE.

ГОСТ – 24940 – 96 „Buildings and structures. Methods for mearsuring the illuminance"

Zakerian S & Subramaniam I. 2011. Examining the Relationship between Psychosocial Work Factors and Musculoskeletal Discomfort among Computer Users in Malaysia. Iran J Public Health.40(1):72-9. Epub 2011 Mar 31.PMID: 23113058.