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in the Faculty of Chemistry
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PREFACE

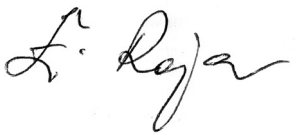
The ergonomics of the 21st Century is actuality in nowadays working environment, process management and relations. Ergonomics tightly associate success in business and employers wellbeing at organizations.

This year Latvian Ergonomics Society (LES) celebrates 5th anniversary. During past five years LES has unified more than 50 members of various professions, published many books, booklets and guidelines in ergonomics field that has stimulated ergonomics scientific and practical development in Latvia as well as understanding in society about ergonomics significance in human quality of life.

LES collaborates with Ergonomics Research Centre (ERC) in the Faculty of Chemistry, University of Latvia, providing consultations and participation in various projects in the field of ergonomics. LES and ERC carry out the scientific research and actively involve students of University of Latvia who attend a higher professional master study program «Work Environment Protection and Expertise». In mentioned master study program the workplace ergonomics is included as a separate discipline. The research work also involves scientists and students from other Latvian universities (Riga Technical University, Latvia University of Agriculture, Rīga Stradiņš University a.o.). LES established essential collaboration with International Ergonomics Association (IEA), Federation of the European Ergonomics Societies (FEES), Nordic Ergonomics Society (NES) and Pennsylvania State University (USA). The importance of this collaboration is a smooth and open dialogue between academia and industry enabling short decision paths and rapid access to reality based data, which can serve as a basis for new theories and applications.

At work and daily life diverse activities human was, remain, and will be the main value of the society despite country economics growth or crisis. Modern companies in Latvia create working conditions that are not only maintaining health and life but are also optimal for the needs and psychosocial capacities of workers. We are delighted that more and more organization managers tightly link business targets and economics indicators with workers wellbeing. Also employers more actively live healthy lifestyle and take part in development of healthy work environment.

The aim of the conference is to introduce with practical and scientifically granted ergonomics solutions in contemporary business environment, about healthy and safe work techniques, as well as promote international exchange of thoughts about human potential improvement at the organizations. Good cooperation between scientists in occupational health and ergonomics, employers and employees will guarantee improvements in health of work forces, as well as the development of business in a changing labor market!



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CONTENT

THE CONCEPT OF ERGONOMICS STUDIES IN THE UNIVERSITY OF LATVIA

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ABSTRACT

Nowadays the University of Latvia pays great attention to the implementation of new subjects and courses in order to promote international identification, to strengthen good reputation and collaboration. But the managers in many cases lack the knowledge of occupational health and safety (OHS), particularly ergonomics. In the University of Latvia has been implemented higher education Program called Work Environment Protection and Expertise. Under this professional master's program it is possible to gain knowledge in modern OHS and ergonomics. Therefore, the students, which are potential new managers of the different enterprises, are educated in these areas. Seeing that healthy, safe and ergonomically designed workplaces relate to workplace health promotion, it is the reason for successful business in the markets. Ergonomics course content modules for key areas and practical realization of the Program are discussed.

KEY WORDS: Ergonomics, Risk Assessment, Expertise, Health and Safety, Teaching Program

OBJECTIVES

The University of Latvia always has been active in international collaboration and nowadays the internationalization processes take place in the following areas:

- Bilateral cooperation agreements (with 104 universities in 37 countries);
- Membership in the international university organizations and networks;
- Participation in international educational and research programs and projects;
- Exchanges of students and teachers;
- International cooperation on the faculty, institute, department and individual levels.

For this purpose, the objective is to focus on implementation of Ergonomics, which is a relatively young discipline in our country, and its importance is undisputable in conformity with the definition: «Ergonomics is a scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance» [1].

Therefore, implementation of ergonomics can be especially attributed to programs based on the prevention and protection of the workers at workplaces. One of those programs is higher professional education program «*Environmental Protection and Expertise*», initiated since September 2002 in the Faculty of Chemistry of the University of Latvia. This internationally accredited program is intended for those who wish to be competent persons in the area of protection of both labour and surrounding environment.

The program has been renewed in 2010 and accredited as Program of Professional Master studies «*Work Environment Protection and Expertise*» for receiving professional master degree in labour protection and qualification of senior specialist of labour protection. The aim of the Program is to prepare qualified specialists capable to ensure – realizing organization, monitoring and expertise of working environment systems according to requirements of laws and regulations of the Republic of Latvia and European Union – protection of working and surrounding environment in different business entities, institutions founded by state or municipality or non-governmental organizations.

The planned results are ensured by the fact that the Program is being realized in close collaboration with other structural units of the University of Latvia and involves generally accepted authorities of natural, technical and environmental sciences.

The Program provides for 2-year studies and its volume is 80 credits (1 credit is 16 class hours). This Program complies with the requirements of Latvian Professional Education Law and of the professional standard PS 0100 «Senior Specialist of Labour Protection».

Working out the Program the following considerations have been taken into account:

1) Commercial companies, public or local government institutions, as well as social institutions henceforth will require a much greater number of specialists-experts in the area of the working environment protection;
2) Cabinet regulations stipulate if there is no possibility for commercial companies to establish the organizational structure for labour protection, the employer shall involve a competent institutions or competent specialists, who will be required to have higher professional education, in setting up and maintaining the labour protection system.

The Program includes:

- Courses providing knowledge of risk factors of working environment, methods to identify and evaluate them;
- Courses allowing to perform analysis of environmental objects and ecosystems;
- Courses providing basics of ergonomics (physical, cognitive, organizational, a.o.);
- Courses providing knowledge of safety of industrial technologies, information technologies, chemical toxicology, radioecology, occupational health, and labor psychology;
- Courses providing knowledge of employment rights, basics of commercial studies, methods of quality management, pedagogy and psychology;
- Practical skills when going into their practice in different business entities, institutions founded by state or municipality or non-governmental organizations, as well as when working at their master's thesis in the field of evaluation of working environment risk factors.

Very important for the Program there is integration of scientific research and educational work, because the courses contain materials taken from:

- Environmental study courses of International Baltic University (*Environment of the Baltic Sea, Well-balanced Environment of the Baltic Sea Region, and Well-balanced Water Management in the Baltic Sea Region* a. o.) [2];
- Materials provided by European Labor Safety and Health Protection Agency established in European Union (*EU Legislation, Good Practice Examples, Branch Risks, Publications* a. o.) [3].

ERGONOMICS TRAINING AREAS AND CONTENT

I. MODULES FOR KEY AREAS

Professional studies course in the ergonomics direction (4 credits) includes various modules for key areas:

1) Ergonomics – science on relationships between a human and his/her work.
2) Importance of work physiology for ergonomics.
3) Importance of anthropometry and biomechanics for ergonomics.
4) Physical ergonomics. Cognitive ergonomics. Organization ergonomics. Computer ergonomics. Participatory ergonomics.
5) Work strain.
6) Violence at work, mobbing and bossing, burn-out syndrome.
7) Preventive measures to eliminate ergonomics risks, work strain and violence at work.
8) Seminar No 1. Ergonomics and human factors.
9) Seminar No 2. Importance of human functional system at the work process.
10) Seminar No 3. Physical load at work.
11) Seminar No 4. Determination of the work ability and workload limit.
12) Seminar No 5. Ergonomics solution at work.
13) Seminar No 6. Work strain situations.
14) Seminar No 7. Communication skills at work.
15) Seminar No 8. Methods of work strain assessment.

II. SHORT CONTENT OF DISCUSSED QUESTIONS IN LECTURES AND SEMINARS

In lectures and seminars students gain experiences how to present their knowledge to others and to take part in discussions.

Work physiology module involve knowledge about human body as a functional unit, how the human systems work, musculoskeletal system, central nervous system, heart and circulatory system, respiratory system, and its role in the process. Physical activities are also discussed: principles of dynamic and static work, the relationship among oxygen consumption, heart rate and the human metabolic energy consumption, a.o.

Anthropometry and biomechanics involve knowledge about human anthropometric characteristics, anthropometric measurements, biomechanical model of the muscle strength, biomechanical load capacity, work postures, biomechanical origin of injuries, a.o.

Load ergonomics involves knowledge about musculoskeletal load risks, muscles fatigue, and its manifestations, vocal and visual load, human postures and movements during work, position and motion analysis of work process, severity of lifting and moving the weight, rest time, the body's physiological response to stressful situations, work ability index, a.o.

Cognitive ergonomics involves knowledge about biological basic of sensory perception, biotechnical systems of man-machine-environment (transmitter and receiver combinations for man-man, man-machine, machine-man, machine-machine), human response on visual indicators and acoustic signals, health damage caused by cognitive ergonomics, equipment design role in various situations.

Organization ergonomics involves knowledge about principles of labour organization, mechanization, automation, functionality, workers' participation in the working process, and communication opportunities during working hours, training of employees, flexible work schedule, shift work, team work, health disorders related to deficiencies in the organization of work and possible solutions.

Computer ergonomics involves knowledge about communication with the computer, seediness effects, visual overload syndrome, carpal tunnel syndrome, spine syndrome, breathing or respiratory syndrome, circulatory congestion syndrome (in head, abdominal organs, and lower extremities), skin problems syndrome (contact dermatitis, eczema, etc.), chronic fatigue syndrome, prevention and ergonomic solutions.

Work strain and violence at work involve knowledge about stressors at work and their identification, physical and mental manifestations of stress, work stress management, recognition of violence at work an preventive measures (organizational, individual interventions, monitoring and evaluation), work stress assessment, work stress index, the stress intensity (Borg scale), burnout syndrome, a.o.

III. ERGONOMIC RISK ASSESMENT METHODS AND TOOLS USED IN STUDENTS PRACTICAL WORK

Ergonomics training (workshops and practical laboratory works – ergonomic risk assessment) is also very important and is a kind of requirement for the students knowledge improvement. The students should give major importance to ergonomic training systems in order to use health and safety aspects with management services effectively in the business in future. Therefore, ergonomics teaching corse content also risk assessment methods and tools, int.al. computer-aided methods in ergonomics (different softwares a.o.).

These methods are discused in relation to International Labour Organization (ILO) conventions (C127 – Maximum weight convention; C148 – Working environment; C155 – Occupational safety and health), European Directives (89/391/EEC, 89/655/EEC, 89/656/EEC, 90/269/EEC, 90/270/EEC, 98/37/EC, 2006/42/EC, a./o.) and Standarts (EN 614 «Safety of machinery – Ergonomic design principles», EN ISO 9241 «Ergonomic requirements for office work with visual display terminals (VDTs)» a.o.).

Different ergonomic risk assesment methods in lectures were discussed and used as training tools in seminars:

- ***Key Item Method*** (Germany) – risk assessment on the screening level in case of manual handling of loads: lifting, holding, carrying, and pulling, pushing;
- ***Manual Handling Assessment Charts*** (United Kingdom);
- ***Ergonomic Workplace Analysis*** (Finland);
- ***Quick Exposure Check*** (USA) – this tool is used to assess exposure to ergonomic hazards.
- ***Ovako Working Posture Analysis System*** – *OWAS* (Finland);
- ***Rapid Upper Limb Assessment*** – *RULA* (United Kingdom);
- ***Rapid Entire Body Assessment*** – *REBA* (United Kingdom);
- ***The Revised NIOSH Lifting Equation*** (USA);
- ***NASA-TLX (Task Load Index)***(USA) – method for assessment of interaction of physical and mental workload;
- ***Softwares:*** WinOwas [4], ErgoEaser [5], ErgoIntelligence (includes RULA, REBA, Strain Index, HumanCad, ErgoImager, ErgoMaster) [6], HSE Fatigue Index [7], WorkPace Personal [8], a.o.

In laboratories experimental/clinical evaluation methods were used to measure the work load (metabolic energy consumption) and muscles fatigue. These methods are:

- Heart rate monitoring and measuring of metabolic energy (kcal/min) to determine the work ability and degree of hardness (carried out using POLAR S810iTM Heart Rate Monitor device);
- Assessment of the functional state of skeletal muscle and fatigue (determine the muscle tonus, contraction frequency and hardness using myotonometric measurements with the MYOTON-3 device).
- Assessment of the stress using CalmLink biofeedback device M-10 and Software (measures galvanic skin electrical resistance and determine the stress levels).
- Digestion of autogenic training and hypnotherapeutic sessions to gain knowledge of muscles and psychoemotional relaxation.

IV. PRACTICAL REALIZATION OF THE ERGONOMICS STUDIES

Teaching methodology: aims, argumentation and analysis. The main aims of the ergonomics studies are:

- To identify and to investigate ergonomics problems and propose, and critically evaluate solutions based on a thorough grounding in research methods and appropriate data analysis techniques;
- To provide a deep understanding of how psychological theory aids our understanding of the relationship between human behaviour and health in an ergonomics context.
- To provide a deep understanding of how human behaviour is influenced by organizations and culture in an ergonomics context.

To reach the aim and to fulfill tasks of the ergonomics studies following teaching methods are used:

- Readings (lectures);
- Seminars and practices, int. al. group work carried out during seminars;
- Individual work – during practice and when working at graduation work.

Lectures and group works are the primary methods for teaching. In the lectures (PowerPoint presentations) the review of key problems of study courses is presented, and it is possible to show videos and sophisticated schemas with added explanations. In seminars and group works students gain experience how to present their knowledge to others and to take part in discussions. Courses include independent work of students, for the efficiency of which everyone can make sure in seminars – presentations with following discussions and public differential assessment. This form of work gives good students the possibility of self-actualization and to get additional motivation to be more serious about their studies.

Practices are organized in branch-specific organizations. Students have to present and defend the result of their practice. The main tasks of the practice there could be mentioned: to acquire skills of working with normative documentation related to working environment protection and ergonomics, to improve their organizing and communication abilities when working in a team, to get practical skills of ergonomics risk analysis, to acquire skills in research work.

Students may use library, in which one can find necessary literature regarding protection of working and surrounding environment. Students may use computer class, if there is a need to process situation tasks using risk assessment software.

Having successfully acquired ergonomics course, students gain an understanding of importance of ergonomics for maintaining of human resources and for improvement of employment life quality. Results student's graduation work are presented in annual scientific conferences of the University of Latvia (in section «Ergonomics and Working Environment») or published in other scientific papers. Information about practical realization of these studies is found also in our publication [9].

V. COMPARISON WITH SIMILAR STUDY PROGRAMS IN OTHER COUNTRIES

The content of the Program has been worked out, basing on education experience and traditions in our country, as well as on experience gained in other European and world universities when carrying out similar programs. As it is known, the course content in different European countries has been designed to satisfy the knowledge requirements specified in the HETPEP (Harmonising European Training Programs for Ergonomics Professionals) document. For example, University of Derby (United Kingdom) has been implemented three MSc programs in Ergonomics area: Health Ergonomics, Human factors, Ergonomics & Organizational Behavior. Course content: Introduction to Ergonomics, Psychology & Human Performance, Ergonomics Methods, Musculoskeletal Disorders & Ergonomics, Investigations & Analysis in Ergonomics, and Systems Ergonomics [10].

University of Limerick (Ireland) prepares masters in ergonomics and their professional competence is to be obtained mainly in the safety area (anatomy and physiology, workplace hazards, human-machine systems, safety analysis and assurance, and occupational hygiene) and ergonomics (human reliability, human performance, workplace design, and work psychology) [11].

In Poland knowledge in ergonomics students gain in the Ergonomics Department of Technical University of Gdansk mastering courses: Occupational ergonomics, Ergonomics of information systems, Decision analysis, Managing web-based company, and Business information visualization [12].

In Nordic countries knowledge in ergonomics students receive in many Universities and education institutions. For example, in Finland MSc programs in ergonomics are at 8 different universities. Full major studies in ergonomics have been provided in the University of Kuopio [13], Faculty of Biomedicine. Example of education programs where ergonomics is included is University of Oulu [14]. In the University of Oulu there is a unit called Work Science for engineering students who will get MSc in engineering. They have several courses varying from physical ergonomics to usability and risk management. Work Science unit belongs to the Department of Industrial Engineering and Management and is responsible for two degree programs: Human Factors and Ergonomics and Safety with the basic courses (Occupational safety, Occupational psychology, Usability and safety in product design, Technology, Society and work, Machine safety and usability, Administration, Chemical and physical hazards in industrial environments, Exercises in work science, Safety in process industry, and Ergonomics). Special courses in ergonomics are also provided by the Finnish Institute of Occupational Health [15]. Denmark has different master programs where ergonomics is only included, e.g. profession Bachelor of Ergonomics, Master in study of Working-environment at Danish Technical University/ Roskilde University [16], but doesn't have special MSc program in Ergonomics. Iceland also does not have MSc in Ergonomics, but courses in Ergonomics are in some cases part of Bachelors education.

In Baltic countries especially ergonomics program is established only in Estonian Agricultural University (Tartu) in 1998 [17]. Implemented was Diploma level study

course in ergonomics and working environment safety with yearly admittance on average 12 students. The study program aims to be rather interdisciplinary within the different fields of engineering, reflecting both similarities and differences in the safety of working environment in industrial, agricultural, building etc. engineering. A professional ergonomist can work for production sector, personnel departments, design departments, training institutions and advisory service. Main courses are: Safety in Working Environment, Risk Analysis of Working Environment, Working Environment in Industry, Agriculture, Forestry and Water Management, Electric Code, Traffic Safety, Transportation and Storing Dangerous Materials, Ergonomics and Safe Workplace Design, Safety in Building, and Pressure and Hoisting Machinery Safety.

It can be concluded that every university has a different number of readings in labor safety, occupational health, environmental chemistry and environmental sciences. Assessing similar programs of other countries, it can be assumed that a considerable place there take working environment risks, putting also an accent on ergonomics. Therefore, it is quite difficult to perform a complete comparison with foreign study programs, because in Latvia, when working out professional programs, one has to follow requirements set by occupational standard.

When comparing programs, it is possible to find identical (or identical according to their content) study blocks. Also the amount of credits is comparable: LU – 60 CP, in other countries it differs from 80 to120 ECTS credits (40 CP = 60 ECTS).

Taking into account the content of the Program, we believe that the total volume of the subjects to acquire and their distribution correspond to foreign study programs and are comparable both regarding the structure and content.

VI. COLLABORATION IN ERGONOMICS FIELD

Collaboration partners within the framework of Program in ergonomics field are:

1) Research Centre for Ergonomics, Faculty of Chemistry, University of Latvia;
2) Faculty of Engineering Economics and Management, Riga Technical University;
3) Forest Faculty, Latvia University of Agriculture;
4) Institute of Occupational Safety and Health, Rīga Stradiņš University;
5) Latvian Ergonomics Society;
6) Department of Public Health, University of Tartu (Estonia);
7) Estonian company OÜ Müomeetria;
8) Department of Industrial and Manufacturing Engineering, The Pennsylvania State University (USA);
9) Complutence University of Madrid (Spain).

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«DFA FF» (DESIGN FOR ALL FAST FORWARD): FROM DESIGN «APPROACH» TO DESIGN «TOOL KITS»

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ABSTRACT

Design for All needs to carry out methods and tools useful to change from a theoretical «approach» to a operational «practice» referred to the project. This paper presents some practical tools that aim to facilitate the designer in the conscious evaluation of that complex system of requirements arising from the multi-use of a «for All» product.

KEY WORDS: Design for All, Limit Target, Design Tools

1. INTRODUCTION: HUMAN DIVERSITY AS A DESIGN RESOURCE

The complexity of contemporary society is also expressed through diversity among individuals. Diversity which is expressed not only in terms of psycho-physical features, but also in relation to the social and cultural ones.

The major developments of globalized markets that have occurred during the last century[1], were not accompanied by a parallel and equally effective cultural evolution, that would had consciously enhanced and protected the «differences»[2]. This weakness has often led to an increase of the discriminatory, distrust and demonization effects against «diversities», pulses that have always been present in human societies, at all levels[3].

Just as a result of globalization, however, our meeting and living places have become places where we can no longer escape from a melting pot of different elements (ethnical, religious, cultural, experiential, etc..), and where, despite the natural resistance that remain even, it spreads the idea that all people, regardless of age, gender, culture, physical and psycho-sensorial abilities, should have the same opportunities to develop a life of dignity and to decide on their own activities, home or lifestyle.

The «Design for All» (DfA), which is the «design of human diversity, social inclusion and equality»[4], has always compared with these issues.

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1 On standardizing effects of globalization on design culture, see also the paper presented at the International Congress of Ergonomics NES 2009 [1]

2 Starting from a reflection asked by a famous sentence by J.J. Rousseau [2], according to which: «Man needs the gaze of others», it can be assumed that the «different» is required to the completeness of humanity itself. In other words, our identity goes hand in hand with that of «otherness» of diversity: We can say «I» only if we also say «other».

3 Although all cultures have always accepted, and often adored, diversity, both that spontaneously present in nature (biodiversity), and the one that refers to man-made artifacts (personalization of things as an element of distinction and therefore of wealth), the same feeling has almost never referred to «diversity» among men, often cause of any kind of persecution and harassment.

4 This definition, taken from the EIDD (European Institute for Design and Disability) «Stockholm Declaration» [3], represents the fundamental principle underlying the design of environments, facilities, everyday objects and services, usable autonomously by individuals with diversified needs and abilities.

In the design for All Approach, therefore, human diversity is an enhanceable «resource» rather than a constraint to be considered during the design phases. In fact, DfA proposes a holistic and innovative approach to the project, which considers the differences between individuals as an important resource for economic and social development, rather than as a «problem» or a «limitation» for the project. That means that Design for All extends the design target to «all» the possible users of a service, product or environment, in order to analyze with awareness their needs and aspirations. In this perspective, also the concept of «users» is extended from the «final» players to all the individuals in the entire product supply chain. This expansion, however, while unables to prefigure new possibilities for innovation, on the other hand, puts some problems for the designer referred to the «management» of the extensive system of needs resulting from it.

This paper proposes a reflection on the importance for DfA to seek methods and tools useful to complete its theoretical «approach with an operational «practice» referred to the project. Some practical tools are presented, developed at the School of Architecture, University «G. D'Annunzio «of Chieti-Pescara (Italy), as part of a Master Degree Laboratory in «Design for All». These are tools that aim to facilitate the designer in the conscious evaluation of the complex system of requirements arising from the use of a multi-project «for All».

2. METHOD: IDENTIFYING AND LEARNING ABOUT THE TARGET IN THE DFA APPROACH

In the Design for All approach, the most important and delicate phase of the entire design process is the definition, sufficiently clear and complete, of the so-called «users-system». In other words, the objective is to understand who comprises the «All», that is who are the users that, at the different phases of design development «desire» enjoying the product and have a «reasonable probability» to do it [4]. For the designer, this implies both to know the psycho-physical characteristics of users interested in the product «independent use» [5], and to understand the reference scenario and the different possible ways in which the product will be used. Assuming that the environment, rather than the physical condition of individuals, is responsible for creating the disability, this implyes that for every activity it is necessary to define a so-called «limit» target, namely the subset of individuals who, in certain contextual conditions and situations of use, represent indeed «the borderline» of the independent use of products and environments. The idea which this design approach is based on is that, by resolving the project in relation to their characteristics, abilities and needs, it is possible to «include», with good approximation, all the others.

Several studies have already highlighted as critical points of the process DfA the identification and knowledge of target users and of limit users. In particular, through the ‹» analysis of All» and the «Nine questions» [6], some analytical tools have still been developed in order to facilitate the identification of the stakeholders of a product and their relative roles during its fruition. The problem is that, compared to the many possible areas of application of Design for All and to the various activities that characterize them, the «limit» group of individuals (with regard to independent use) is particularly and continuously variable and requires redefinition from time to time. The designer, therefore, needs appropriate conceptual and methodological tools with which to identify and define,

[5] Compared to the concept of «self-enjoyment» of the context, please note that the handicap and disability have been defined by the WHO as «a complex interaction between the health of the individual and the influence of the environment surrounding» [5].

every time, the «limit» target, to be then able to describe, with the best possible objectivity and completeness, their needs and, based on these, the project requirements.

DfA, having clarified and defined the theoretical elements and principles that characterize its vision and approach to the project, needs to develop a methodological and instrumental apparatus useful to assist the designer in the complexity of the issues raised from the identification of the target. At the same time it is necessary that these instruments do not have the effect of looking like cages binding the creative steps, which are necessary in the DfA process. Apparatuses, therefore, able above all to organize knowledge and to increase awareness of the difficulties and opportunities for everyone to enjoy environments, products and services in the, potential, different context conditions.

The researches carried out during the last years in the University of Chieti-Pescara aimed to develop tools that are able to identify the «limit» users in an objective and complete way, for each specific activity, task and environmental context. The main idea was that, using these tools, designers could be able to describe each time the specific needs of the limit target and to then transform them, eventually, into design requirements for All. This seems to be fundamental to overcome the apparent abstract nature of the DfA approach.

3. RESULTS: THE A/D TABLE AND THE EWS/EWG MATRICES

Two «devices» of analysis, developed at the University «G. D'Annunzio» of Chieti-Pescara (Italy) as part of a Degree Lab in Industrial Design on the theme of DfA, show that it is possible and desirable that the DfA steps from a theoretical and methodological discussion to the definition of a instrumental apparatus that can be helpful, but without any conditioning and constraint, during the ideational steps of the project activities. They are:

- the «Ability/Difficulty Table», a tool useful for finding the so-called «limit users» for industrial products and systems;
- the «EWS/EWG Matrices», a system of tools used primarily to identify the best design strategies related to environmental signage systems.

These are tools with a «information» value rather than a «determinative» one with respect to the detection of the limit users, to the description of their characteristics and needs, and to the identification of the most appropriate Design for All strategies.

3.1. THE «A/D TABLE»

The «Ability/Difficulty Table» («A/D Table») is an analysis tool, useful during the design brief development for linking the specific tasks to be performed with a given product or in a given environment and the difficulties expressed from time to time by the various possible users. In particular, the «A/D Table» is a rather complex scheme, termed «triple-entry», as it links three groups of variables, which relate to one another two by two. This tool was synthetically constructed through three different steps of development:

- First step: construction of a matrix relating disabilities reported in scientific literature and their objective and generalized «difficulties», with respect to physical/operational and cognitive/cultural aspects;
- Second step: description, through HTA (Hierarchical Task Analysis) methodologies, of a complete and detailed list of tasks related to the specific activity that will be tested and of the physical/operational and cognitive/cultural «abilities» requested of users to do them;
- Third step: definition of the overall pattern of the «A/D Table» by interrelating the results from the previous two steps.

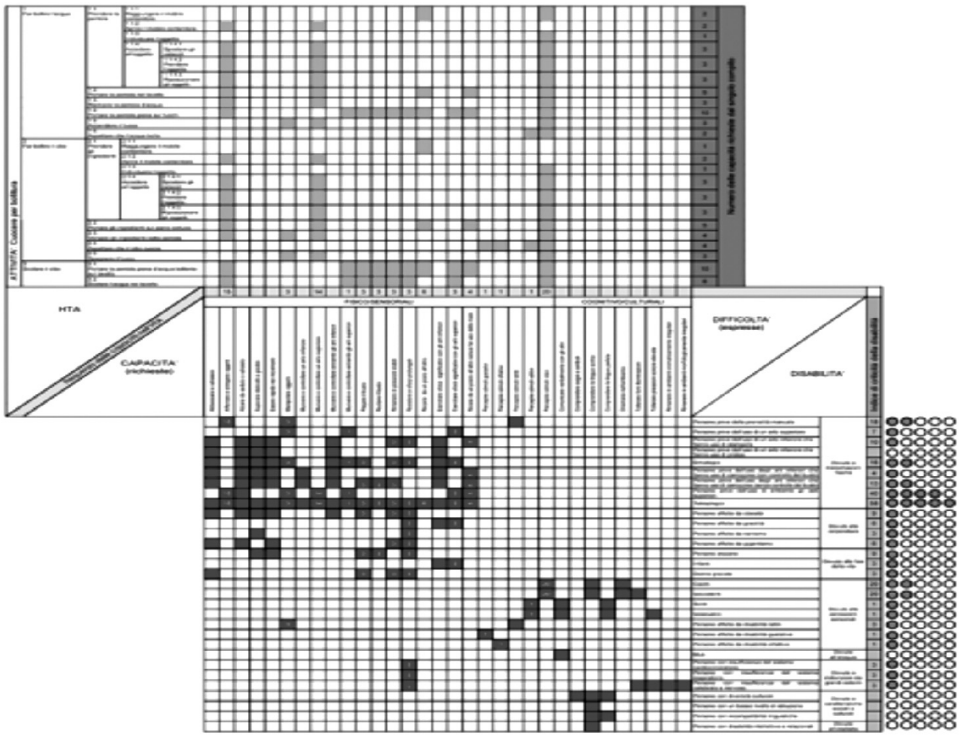

Fig. 1: The A/D Table «in action»: analysis of the specific activity «cooking foods: boiling».

By inserting a detailed description of the analysed activity through a hierarchical decomposition into elementary tasks, the A/D Table returns information related to:

- those tasks that, in the context of the analysed activity, quantitatively require more «skills» to be carried out;
- the frequency with which individual «abilities» are required during the conduct of the entire activity in question;
- a «hierarchy» referred to difficulty among different types of disability with regard to the analyzed activity, which is useful for determining the «limit» users.

These are objective information, mainly quantitative, with respect to which the interpretative action of the designer is still fundamental. The «Table of Abilities/ Difficulties» is therefore a flexible instrument of knowledge: it is a useful operational scheme for the description of the needs framework of the «limit» user in regards to the Design for All approach. Sufficiently detailed and objective, conceptually it is based on the idea of being able to analyze «quantitatively» the ability of critical users with respect to a specific activity.

The potentialities offered by the «A/D Table» must be sought first within its relative ease of use, and then within the accuracy of the results which can be obtained: in fact, it shows within an overall activity, the specific tasks or actions that generate physical/ operational and cognitive/cultural difficulties for some groups of people. The «A/D Table», then, facilitates the construction of an «inclusive» needs framework: this is indispensable to identify the requirements of the system/product according to the Design for All approach.

3.2. THE «EWS/EWG MATRICES»

The EWS (Enabling Wayfinding Strategies) ed EWG (Enabling Wayfinding Guidelines) matrices were developed in order to to know the multi-users difficulties respect to their different orienteering ways (the «EWS Matrix») and to allow the designer to to detect the best design strategies for the development of a enabling communication system of artifacts (the «EWG Matrix»). Overall, it is a «tools kit» that allow both to highlight common problems and resources of environment, and to aware the potential difficulties of the «multi-users» with respect to the various implemented «orienteering strategies».

In particular, the EWS Matrix derives from the need to understand how the well known «nine wayfinding strategies» [7] can really become «for all». Namely, how can they enable all potential users with specific difficulties, allowing them to be able to orient themselves using their own «spare capacities». In fact, the matrix relates in several ways: 46 major disabilities related to «orienteering» and identified through the literature; 17 main capabilities/problems related to «orienteering» activity; 9 Wayfinding strategies; 8 macro-requirements referred to the environmental communication and signage. It is a tool of both «knowledge», that is useful to analyze the specific features of the context, and «project», as it also provides useful and objective information to identify the most effective wayfinding strategies in reference to the same context.

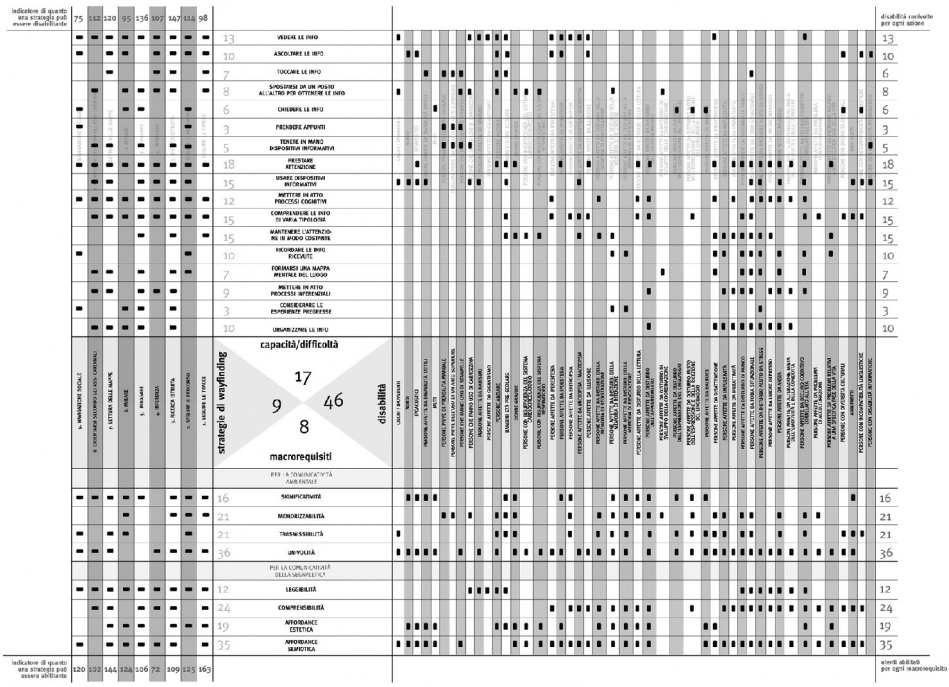

Fig. 2: The «EWS Matrix».

The EWG Matrix, or matrix of the «Guidelines for All», is on the other hand designed to provide the designer with a system of guidelines changing to the changes of the framework conditions (namely, in reference to the place and the multi-users). It can be used starting from the results obtained with the previous matrix, and it eases the selection of strategies for the design of the communication system of artifacts. The designer, therefore, can

understand which could be the best wayshowing inclusive strategies for any specific users and environmental characteristics.

4. CONCLUSIONS: SOME APPLICATIVE CASES

The described «analysis tools» have already be used in some case studies, thus proving their actual utility and flexibility to promote the development of a really inclusive approach to design.

In particular, the A/D Table has been used in two different fields of application of the industrial design: Kitchen designs and Yacht designs. Starting from the analysis of the most critical activities, a methodologically similar path for both application cases allowed to define extremely specific design requirements referring to the independent fruition of the product from the «limit» users. All this, in connection with the so-called Design for All Approach. In these cases the A/D Table allowed for the development of a home kitchen concept, that can make the handling of furnishing and foods easier between the areas that compose it, and of a 10 meters daysailer concept, designed for the facilitation of mobility on board and for sailing navigation.

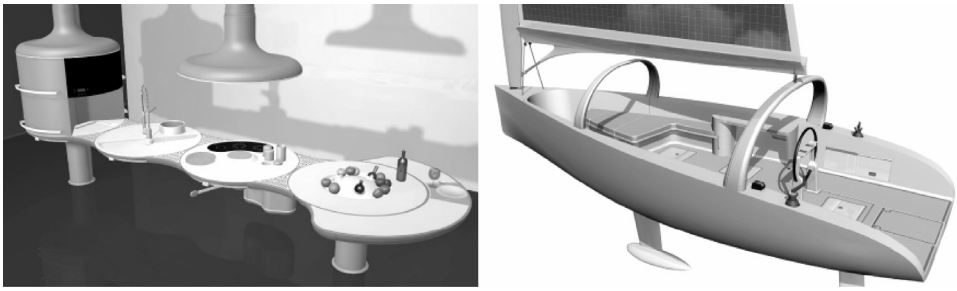

Fig. 3: using the A/D Table. Concepts of a home kitchen «for All» (left) and of a daysailer «for All» (right), designed applying their respective «inclusive» design requirements.

The EWS/EWG Matrices, on the contrary, have been applied to the development of two different concepts referred respectively to the design of an enabling communication system of artifacts for the interiors of a «key Unit» of the hospital clinic of Chieti (Italy), and to the design of a wayshowing system for All for the Campus of the University of Chieti. After a phase of analysis that has highlighted the main problems of the environmental communication of places and of the current signage systems, it was possible to define

Fig. 4: Use of the EWS/EWG matrices for a hospital signage (left) and for a signage device based on the idea of «perspective frame» (right).

both the design concepts, which refers respectively to the idea of a series of entry and exit «portals» for the hospital interior signage and to the idea of a «perspective frame» useful to easily identify the main functions of the University Campus.

5. CREDITS

This paper contains considerations referred to some research experiences developed within the «Interior Design of Sustainable Living» Degree Laboratory, academic year 2008/2009 and 2009/2010, in the School of Architecture of the University of Chieti-Pescara on the main theme: «Design for All». In particular, the reference is to the research carried out with graduants Marco Gregori and Emilio Rossi for the definition of the «A / D Table» and to the research developed with graduands Stefano Picciani and Valeria Vallese for the construction of the EWS / EWG Matrices. The images are taken from the degree thesis of the above: «The home kitchen for All. Enabling solution to facilitate the movement of equipments and foods» (supervisor: Prof. G. Di Bucchianico; candidate: Marco Gregori); «Daysailer of 10 m for All. Sustainable technological solutions for easier navigation» (supervisor: Prof. G. Di Bucchianico; candidate: Emilio Rossi); «The hospital signage for All. Enabling communicative system of artifacts for the interiors of the Hospital Clinic of Chieti» (supervisor Prof. G. Di Bucchianico; candidate: Stefano Picciani); «Orienteering in the Campus. Design of a wayshowing for All system for the «Cittadella of science» in the University Campus of Chieti» (supervisor Prof. G. Di Bucchianico, candidate: Valeria Vallese).

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MODERNIZED LATVIAN ERGONOMIC KEYBOARD

Valdis Vitolins
Odo Ltd, Latvia

ABSTRACT

Increasingly more people use computers and create content using keyboards (even with leading edge touch-screen technology). As in the most part of the world, in Latvia also conventional «Qwerty» keyboard is used. Though for Latvian it is much worse than for English, especially due to enormous load to little fingers. It causes repetitive strain injuries and affects productivity of workers with extensive keyboard usage, especially for data input operators, call centers, inquiry office workers, etc. Improving computer keyboard layout decrease stress to hands and fingers thus minimizing exhaustion and injuries.

With analysis of English and Latvian public domain novels and modern texts, letter appearance and sequence distribution for Latvian language was found. Qualities of alternative layouts for English (Dvorak, Colemak, Hallinstad) were investigated and open source carpalx simulation tool was adjusted according to the findings. Then carpalx was used to check more than 25 million keyboard layouts, measuring finger/hand effort, stroke typing convenience etc., to find the best one. It was proved that existing «Šusildatec» (classic Latvian Ergonomic standard) keyboard is only slightly better than «Qwerty» for Latvian, though it is much worse for English.

After computer simulation, several best layouts were tried practically for more than 6 months and most convenient one was promoted as a new «Latvian Modern» keyboard. Its typing effort is less than for «Šusildatec», load is distributed according to finger strength, and typing strokes are alternating better between hands and fingers. Comparing to «Qwerty» keyboard new layout is better not only for Latvian but for English also. Keyboard drivers are developed for Microsoft Windows and Linux operating systems and are freely available in the web under permissive license.

KEY WORDS: Latvian, Ergonomic, Keyboard, Layout, Typing, Effort, Simulation

INTRODUCTION

Distribution of characters (letters and punctuation marks) is not even and few characters appear much more recently than others. Although precise distribution of characters differs due to author's style, protagonist's names and paper domain, any sample in general conforms to the English language [1]. Fig 1. shows count of characters in «The Adventures of Tom Sawyer» by Mark Twain.

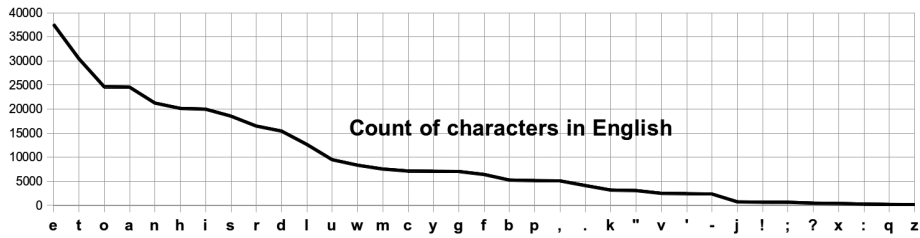

Fig. 1. Count of characters in «The Adventures of Tom Sawyer».

People, whose native language is not English, incorrectly assume that the most popular QWERTY keyboard layout is adapted for English language. Actually it is wrong assumption, because *it was developed considering only marketing and jamming of typewriter hammers* [2]. To avoid jamming, most frequent letters were evenly spread around the keyboard. By looking at worn keyboard one can see picture similar to (Fig. 2), where wearing is shown as a gradual shading of keys, applied in relation to letter appearance in English. Home position for fingers is shown with black rectangle. Positions of top five most common letters are shown with numbers.

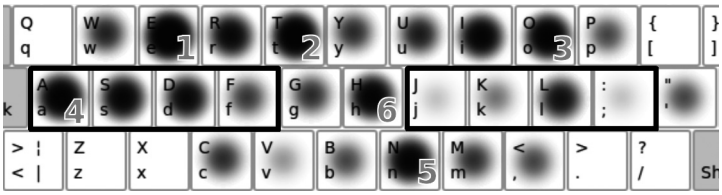

Fig. 2. Qwerty keyboard «wearing" for English language

Inconveniences of QWERTY keyboard are widely analyzed and several layouts are provided: Dvorak, Colemak, etc. [3, 4, 5]. One particular feature of QWERTY keyboard for English language is that although fingers regularly jump to upper keyboard row (three of the most common letters are on the top row), finger effort is distributed quite appropriately – stronger (index, middle) fingers are used more frequently than weaker (ring, little) ones.

Distribution of letters in Latvian differs from English. By summarizing different texts in Latvian, appearance of characters is shown in Fig. 3. Notable difference for Latvian is that accented characters (long vowels: ā, ē, ī, ū, soft consonants: š, ķ, etc.) on QWERTY keyboard are typed using so called «dead key» before plain (i.e. unaccented) letter. Thus *for standard QWERTY keyboard the third most used key in Latvian is not letter but dead key* (usually Apostrophe):

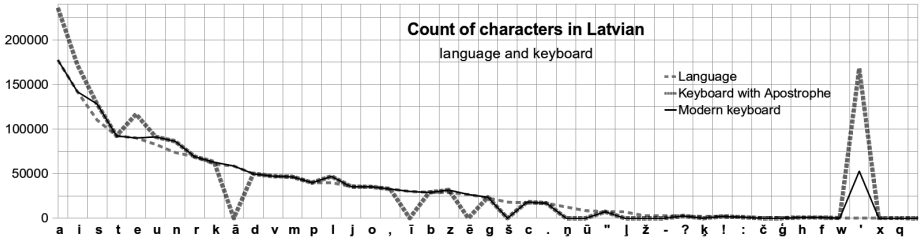

Fig. 3. Appearance of characters in Latvian language and keyboards.

Looking at character distribution on QWERTY keyboard layout (Fig. 4) one can see that too much load is distributed for left hand (letter A) and right hand little fingers (Apostrophe).

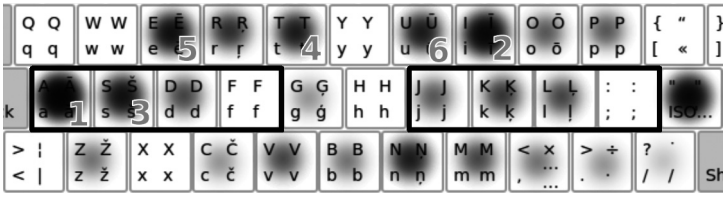

Fig. 4. Qwerty keyboard «wearing» for Latvian language

In typewriter times *Latvian Ergonomic* keyboard (also called Šusildatec or Ūgjrm) was developed for Latvian language. Notable feature of the layout is that most common letters are under index fingers and further letters are distributed to outer fingers. Though 7th and 8th most common letters (N and R) are not placed under little fingers but in index finger's upper row, because for mechanical typewriters little finger was too weak for regular use. This layout has separate key for all Latvian letters sacrificing several Latin letters and special characters (see Fig. 5):

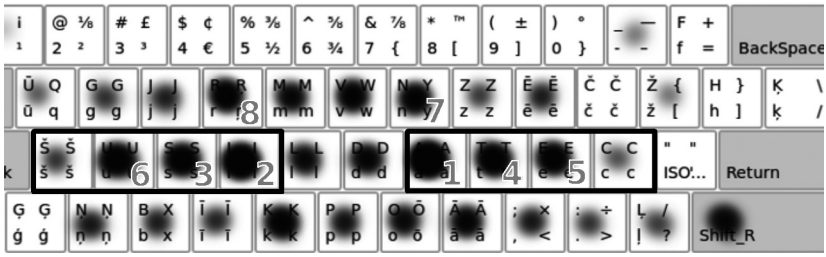

Fig. 5. Latvian ergonomic keyboard «wearing" for Latvian language

Although Latvian ergonomic keyboard is more convenient than QWERTY keyboard for Latvian, it has several drawbacks:

1. Several accented letters (Š, Ģ, Ū, Ž, Ķ, Ņ) are placed at inconvenient positions which are not related to their unaccented letters (S, G, U, Z, K, N). Many accented letters are placed under other hand without any system. That makes typing hard to learn.
2. Even index fingers are the most durable, they are used *too* frequently, because under them are placed most common letters (A and I), and these fingers also press twice as much keys (8, including number row) as other fingers (4). So, most of type speed depends only on agility of index fingers.
3. Several common letters are located in lower row, which is considered less convenient than upper row.
4. Several Latin letters (Y, W, Q, X) can be typed only invoking Alt key. Though due to globalization they deserve more prominent place, e.g.: *www*, *Linux*, *yes* are much more common in every day use than Latvian: *ģeorģīne*, *ļurļaks* or *ņuņņa*. Also special characters (e.g. slash and column) are mandatory part of web address but are hard to type.
5. Commonly used shortcut keys are not considered. E.g. *Ctrl+X* shortcut key needs also Alt key, because X letter can be get only in such way. Commonly used X, C, Z, V letters are not placed nearby to each other.

So, *Latvian ergonomic keyboard was appropriate for typewriters, but it is not convenient enough for contemporary computer usage*. Although formally it was accepted as a National standard [6], it is not widely accepted for computers (in difference with Russian ЙЦУКЕН keyboard which layout is developed by very similar approach).

DEVELOPMENT OF LATVIAN MODERN KEYBOARD

Development of Latvian modern keyboard was long and graduate process, which started with frustration on QWERTY keyboard and (quite surprising) discovery that so called «Latvian ergonomic» keyboard is not much simpler/convenient than QWERTY. From the beginning, investigation had purely practical reasons, but it was advanced to even deeper analysis with more sophisticated and precise methods.

To minimize systematic errors in letter distribution as a language reference were used different publicly available sources: «Mērnieku laiki», «Ceplis», «Purva bridējs», «Ugunszīme» and personal diary (together more than 2 million characters). Distribution of letters and words were got using Linux text processing tools such as: grep, sed, awk and wc. First attempt was to adjust Latvian ergonomic keyboard, but it was abandoned because any small adjustments were not sufficient. Next evolution was achieved using Java application [7], with manual layout adjustment counting total distance what fingers travel over keyboard, relative time of fingers is keyboard rows, load distribution for hands and fingers, typing alternation between hands and fingers. As most effective layout was found wit USIRVPNATEY letters in the home row (see *usirvp* in Fig. 7).

Practically using this layout, it was found that important aspect of usability is convenient layout of commonly used hot keys: X, Z, C, V (invoked together with Ctrl key). They were placed too far away each to other. During investigation of public sources, another tool carpalx [8] was found. This tool does optimization himself by random changes in keyboard layout and checking performance. Performance is based on triads, which are three character substrings formed from the text. The effort model takes into account contributions of following main characteristics:

1. finger travel distance over the keyboard (base effort) if fingers are moved less, then they travel less.
2. uneven hand usage penalty,
3. weaker finger usage and not-home-row usage penalties,
4. typing stroke penalty (e.g. QXE when hand move up and down or H and ‘ for horizontal movement).

Important aspect is that several usability features conflict each to other. E.g. by improving layout for Latvian, in general it becomes worse for English. Decreasing load on little fingers makes worse stroke typing experience, as it increases possibility that the same finger will be used again in different position. Accented and unaccented letters and hot keys sticked together decrease key swapping possibility between hands, etc.

Searching for optimized keyboard layouts was resource consuming task. Three computers were used for several days and were checked more than 25 million layouts. Even this is huge number; it is small comparing to 10^{59} possible combinations. Therefore it can't be granted that the best possible layout is found, though results allow assuming, that it should not be better than 15% for chosen effort parameters.

Although typing effort model in carpalx is quite sophisticated, it doesn't cover all aspects of ergonomics. E.g., carpalx doesn't deal with keyboard «aesthetics» and doesn't check if it is possible to group accented letters together with unaccented ones. It also doesn't

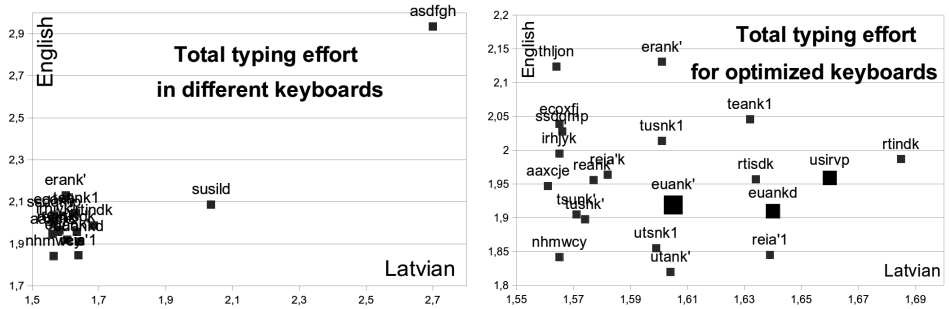

Fig. 6. Total typing effort for different keyboard layouts.

check finger effort, which is not related to writing (e.g. common key sequences and combinations in application usage). Therefore layouts found by carpalx where manually «tweaked» and checked, how much it can be improved considering these constraints without severe decrease in typing effort. Fig 6. shows comparison of QWERTY (asdfg), Latvian ergonomic (susild) and other keyboards for total typing effort (summing all efforts and penalties) for English and Latvian languages. Keyboards which were practically used for longer time are shown with bigger marks (usirvp, euankd and euank') and as final one euank' layout was chosen. It can be seen that in place of smallest effort little bit worse is chosen due to other considerations which can't be checked by carpalx tool.

RESULTS

To ensure that keyboard layouts found by carpalx as most ergonomic were practically usable in real life they were tested practically. Keyboard drivers were prepared for Linux X.org Xwindow system (xkb configuration file) and Microsoft Windows operating systems using MS Keyboard Layout Creator. For Linux operating system are developed typing training lessons in Ktouch tool (can be run also in Windows, using ported KDE version).

In time for more than six months, three keyboard layouts were practically tested for more than three weeks, dosen of layouts were tried for one day. Using practical experience, besides letters in keyboard were added additional symbols (copyright ©, parentheses: «»“”, slashes and pipe: /|\, smilies: ☺, etc.) Fig 7. shows latest version of the keyboard layout in Ubuntu Linux operating system.

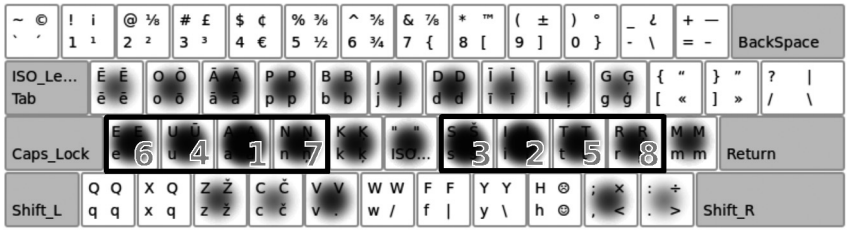

Fig. 7. Latvian modern keyboard «wearing» for Latvian language.

From the web forum it is known that at least *two* other people have started using this keyboard and are very happy with results. Even though it is *not much* it shows that there is interest in this layout. One of these enthusiasts has included this layout in the newest X.org package.

BENEFITS OF THE LATVIA MODERN KEYBOARD

In comparison to QWERTY keyboard

1. 8 most popular letters are located under fingers and can be typed without movement to other key. These letters make more than half of the all amount of letters.
2. With modern layout can be typed at least 15 times more words without moving fingers than with QWERTY keyboard.
3. Introducing dedicated keys for most popular accented letters (Ā, Ē, Ī) number of pressed keys is decreased by 15%.
4. Total path what fingers travel over keyboard is decreased ~1.5 times not only for Latvian, but also for English language.

5. About 95% of letters can be typed by only single key pressing (i.e. one letter is typed by one key), other 5% can be typed by two key stroke, which is more convenient than for QWERTY layout.

In comparison to Latvian ergonomic (Šusildatec) keyboard

1. Even though in modern layout should be pressed 2% more keys (i.e. Alt or Apostrophe as dead key before missing accented letters), in summary fingers travel over keyboard by10% less.
2. By moving most common letter position from index finger to middle finger, probability of typing next letter with the same finger is decreased 3 times.
3. Fingers are located 2 times more in their home position, and are 2 times less moved to the lower row.
4. With modern layout can be written at least 2 times more words without moving fingers than with usildatec keyboard.
5. By eliminating rarely used diacritic letters Ņ, Č, Ģ, Ņ, Ķ, Ļ and Ž, place is cleared for Latin letters and special marks. This greatly improves typing in English and application usage (browsing web, reading and writing e-mail, usage of system utilities, programming etc.).
6. Most frequently used shortcut keys X, Z, C, V are placed together.
7. Diacritic letters Ā, Ē, Ī are located above their «plain» letters, all Latin letters which are not used in Latvian are in lower row, what greatly improves learning.

Drawbacks of the Latvian modern keyboard

1. Several diacritic letters: Ņ, Ū, Ļ, Ķ, Ž, Ģ and Č (and in Latvian standard not used Ŗ and Ō) are typed by two keys using before pressed dead key (Apostrophe) or simultaneously pressed Alt key. Such letters are less than 10% from all.
2. Apostrophe itself can be typed pressing this key twice ore pressing this key and space key (similarly to QWERTY keyboard).
3. Backslash \ less/greater than <> and pipe | is typed by dead key before or with simultaneously pressed Alt key.
4. Keyboard is not fully optimized for Latvian allowing small (<10%) typing effort increase:
   - Common hot keys X, Z, C, V are grouped together to improve application usability,
   - To improve typing for English, a hot key follows as XZCV, only for Latvian XCZV would be better.
   - For English upper row key sequence is ĒOĀPBJDĪLG, only for Latvian ĒPĀDBGJĪLO would be better.
5. In compact keyboards (e.g. on laptops) letter Q doesn't have his own key. Then it can be typed by dead key before or with simultaneously pressed Alt and X key.
6. Apostrophe/double quotes key is between letters, what could look surprisingly/ funny.

CONCLUSION AND FUTURE WORK

Investigations in computer-human interaction with speech-to-text tools is going, though they are not reliable enough for everyday use, and don't seem feasible for busy call center or other open-space office. So, keyboards will be used long time further and it is not too late to implement new standard layout for computer keyboards in Latvia similarly to

Russian ergonomic («ЙЦУКЕН») layout. Although the most improvement the new layout could provide for intensive typists, increasingly more people have personal computers and they are free to use this layout on computers they own.

All investigation is performed by freely available open source tools, process is documented [9] and results are published [10] in the web under permissive (Creative Commons – Attribution) license. This allows anybody to reuse achieved results and perform further investigation. If somebody wander is it worth to find out other keyboard layout, for his language, he can perform simple qualitative analysis, by checking following keyboard features:

1. If two most frequent letters in language (e.g. E and T in English) do not appear under fingers in their home position (e.g. ASDF JKL; for QWERTY keyboard), keyboard is very far from ergonomic.
2. If most frequent two letters appear under index fingers (e.g. A and I in Latvian or A and O for Russian ergonomic keyboards), highly probably index fingers are used too much and layout can be improved by distributing load to other fingers.
3. If most frequent letters appear under middle fingers, (e.g. in E and T for Dvorak, QGMLWY and QFMLWY in English, A and I for Modern keyboard in Latvian), keyboard seems to be appropriate to ergonomics standards.
4. If all 8 most frequent letter appear under fingers in their home position (e.g. Hallingstad for English, Modern keyboard for Latvian), keyboard has smallest finger traveling distance (base effort). Though it makes bigger load to little fingers, or sacrifice stroke typing convenience in comparison to layouts with slightly bigger finger travel effort.

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AUTOGENIC TRAINING BY MIND-BODY RELAXATION FOR EMPLOYEES WITH CHRONIC UPPER BACK PAIN IN TEXTILE ENTERPRISE

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ABSTRACT

3Chronic neck-shoulder pain (NSP), lasting 4 months and any longer is a significant problem for employees in textile enterprises. The aim of this study was to evaluate the effectiveness of using one month autogenic training (AT) for packing operators in textile enterprise who suffer from chronic pain in upper back region. Results show that packing operators with chronic NSP have unpleasant physical and emotional experience caused by stressful unhealthy postures at workplace, psycho traumatic events. Packing operators were under one month AT course evaluation (4 sessions, 60 minutes long one session). AT included suggestions for body-mind relaxation, analgesic suggestions, and detecting depressive mind by positive self-influence. An individualized compact disc with AT suggestions for self-practices at home two times a day between sessions and after treatment course was made and given for each patient. The results indicated decrease in pain intensity, females had it till 1.0 at the end of AT course. Follow-up assessment at 3 and 6 months after AT course indicated lasting reduction in pain intensity for females, which can be explained by benefits of positive self-influence during AT and mind-body relaxation practice at home by compact disc. After hypnotherapy course for all participants in our research (n=10) the life quality increased significantly. Authors conclude that use of AT treatment by mind-body relaxation for packing operators, suffering from chronic neck-shoulder pain is an effective treatment in management of chronic pain patients with psychosomatic complains.

KEY WORDS: Packing Operators, Chronic Pain, Autogenic Training

INTRODUCTION

In Latvia employees with chronic upper back pain are males and females with sensitized nervous system, psychosomatic health problems and chronic pain patient`s behavior. 65% employees admit physical and mental work load influences their pain and pain distribution comprises 19% of total diseases. [1] At the beginning of the 21st century the international epidemic of back pain and disability continues to exact a huge toll in terms of suffering and costs. Many people with psychosomatic back problems have minimal tissue damage yet, suffer terribly. Nowadays, for working age adults patients with chronic back pain is used a new model which includes all the biopsychosocial influences on pain, multidisciplinary treatment of pain`s complex and multidisciplinary biopsychosocial rehabilitation. [2]

Textile industry is one of the oldest industries in Latvia, employing various professions, including packing operators. Packing operators work in forced standing positions all day. Their health problems are caused by ergonomic risks at the workplace. Injuries and muscle pain affect the wrists, shoulders, neck and back are common problems for workers

in the clothing industry. [3; 4] Frequently such problems are caused by psychosocial and individual risk factors at the workplace and it improves workers health in general. [5]

Therefore it is necessary as soon as possible to help workers who suffer from chronic pain. One of the treatment in pain management for such patients is psychotherapeutic method – autogenic training (AT).

The aim of this study was to evaluate the effectiveness of using one month AT course packing operators in the textile industry who suffer from chronic neck-shoulder pain (NSP).

1. METHODS

Packing operators, in total 29, only females with NSP took part in our investigation during period of 2010 – 2011, mean duration of pain was 5.5 ± 1.5 SD months and mean duration of professional experience was 8.2 ± 2.0 SD. The inclusion criteria for investigation were: age; chronic NSP without necessity to use medication treatment; full consent to participate in the study; the exclusion criteria were: acute NSP; having not been to mandatory medical examinations. During testing for AT course with follow-up assessment at 3 and 6 months were selected 10 packing operators – female employees (mean duration of age was 41.5 ± 11.6 SD).

1) *The questionnaire* was done to find out which body parts suffer from pain during work load, to establish unhealthy postures at workplace and maladaptive thoughts.
2) *Numerical Rating Scale.* [6] It is pain intensity instrument (0 – 10 Numeric Rating Scale: 0 = no pain; 1-3 = mild pain; 4–6 = moderate pain; 7-10 = severe pain). Scale was used to determine the intensity of NSP before and after each AT session.
3) *Autogenic Training (AT)* is psychotherapeutic method, focusing on the neuromuscular system, which allows to develope progressive, dynamic relaxed state of the muscles (neck, shoulders, hand, arms, and legs), to feel an inner peace and the stabilizing of mood. [7] The AT was applied in order to learn the technique of self relaxation and self positive control for workers who suffered from chronic pains. After AT session the patient's feeling is assessed with the help of a survey where the effectiveness of the applied positive self relaxation for each particular patient is marked. An individualized compact disc with AT suggestions for self-practices at home two times a day between sessions and after treatment course was made and given for each patient.
4) *Life quality assessment* for packing operators with chronic NSP was realized before and after each AT session by Quality of Life Scale (QLS). [8] QLS considers rather ability to function, than pain alone. It can help people who are suffering from pain, and their health care team, to evaluate and communicate the impact of pain on the basic activities of their daily life. The scale is meant to help individuals by measuring each 10 activity levels (for example, can be active at least five hours a day, take part in limited social activities on weekends, minimal activities at home two days a week, stay in bed at least half of the day, have a social life outside the work, etc). This Scale consists of 0 to 10 variables (0 = «feel hopeless and helpless about the life» and 10 = «normal daily activities, social and family life»).

2. RESULTS AND DISCUSSION

Based on questionnaire dates, it was found that 29 females packing operators in textile enterprise with chronic NSP have unpleasant physical and emotional experience caused by stressful unhealthy postures at workplace, psycho traumatic events.

Results of Numerical Rating Scale show that pain intensity in neck and shoulders for packing operators before AT course was comparatively high (mean points 5.54 ± 1.8 SD in scale 0-10, r > 0.85). After AT results indicated decrease in pain intensity till 1.2 ± 1.6 SD at the end of AT course (see figure 1).

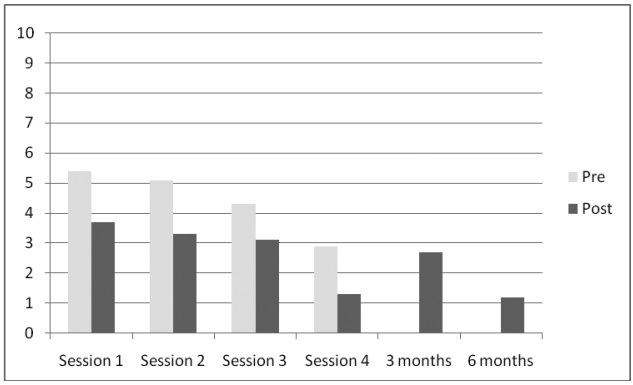

Fig. 1. Pain intensity during one month AT course sessions with follow-up after 3 and 6 months.

Only 10 packing operators individually were under one month AT course evaluation (4 sessions, 60 minutes long one session), but 19 employees were exclusion criterion. Follow-up assessment at 3 and 6 months after AT course indicated lasting reduction in pain intensity for females, which can be explained by benefits of positive self-influence during AT course and mind-body relaxation practice at home using the compact disc. After AT course for all participants in our research (n=10) the life quality (according to Quality Of Life Scale) increased significantly (see Figure 2).

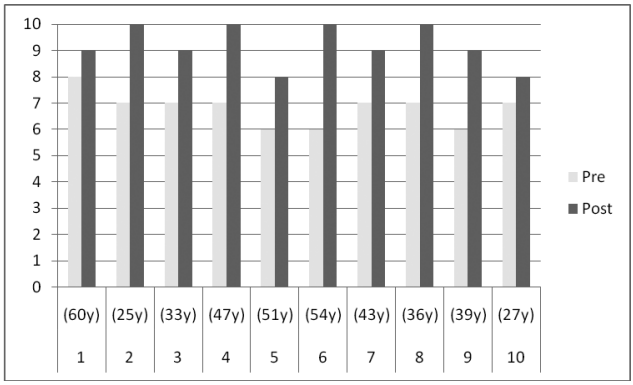

Fig. 2. Quality of Life Scale for females before and after AT course.

The experience of chronic pain that has employees is a complex phenomenon, which includes somatic as well as psychological components. Results of our investigation are in accordance with urgent studies for patients with chronic NSP, in which sensitized nervous system, psychosomatic illness and individual illness behavior experience long-lasting suffering. [9] Relaxation strategies are a common component of multi research modal chronic pain management programs. [10] Nowadays, human experience is understood as having an essentially bodily dimension. The human brain and body (central nervous system and peripheral nervous system) are involved in the production of such dynamic

relaxation in patients, and it is facilitated by feelings of pleasant heaviness in the body and sensations of pleasant warmth in the limbs, recognizing of psycho traumatic events, and emotional comfort.

Affective or emotional experiences at workplace such as compulsory work position during a longer period of work time, excitement, psycho traumatic events have typical bodily aspect. Back pain is an inherent part of some people's response to their work life situation, a state with both irreducibly physical and irreducibly experiential and cognitive dimensions. [11]

Our study demonstrated that one month AT psychotherapeutic treatment for employees with chronic upper back pain is relatively brief and cost effective treatment. Autogenic treatment is focusing on the neuromuscular system, which allows developing progressive and dynamic relaxed state of the muscles (neck, shoulders, back, arms and legs), decrease of work-related pain and the stabilizing of depressive mood [12; 13] and included suggestions for body-mind relaxation, analgesic suggestions, detecting depressive mind by positive self-influence. Our study results confirmed conclusions reported by Evans F.J. and Hawkins R. [14; 15], that during such psychodynamic and psychotherapeutic sessions patients can interpret and make sense of their back pain as part of their experience of the life and reaction to the psycho traumatic events in the workplace, it can effectively reduce emotional distress.

Use of Numerical Rating Scale and Life Quality assessment for employees with chronic pain in neck and shoulders helps such employees to express feelings about their working life, as well as to develop self-management.

CONCLUSIONS

1. Use of AT treatment by mind-body relaxation for packing operators, suffering from chronic neck-shoulder pain is an effective treatment in management of chronic pain patients with psychosomatic complains.
2. During AT treatment employees can develop progressive and dynamic relaxed state of the neck`s and shoulders` muscles and interpret sense of their chronic pain as part of their reaction to the psychosocial stress, and it can stabilize their depressive mood.
3. Body-mind self-practice, between AT sessions and at home using the individualized compact disc with suggestions, is very essential for reducing the intensity and suffering associated with pain.

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REHABILITATION TREATMENT FOR VICTIMS OF BULLYING IN THE WORKPLACE

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ABSTRACT

Work intensification in Latvia is common with other European countries and is connected with stressful working environment and workplace bullying or mobbing, harassment – social phenomena, caused by aggressive micropolitical behavior, organizationally and individually grounded, and poor conflict management. In Latvia are no statistics about mobbing and bossing at work against employees so far, and no research works about rehabilitation treatment for victims of bullying in the workplace. Employees-victims of long-term bullying at work often suffers from post-traumatic stress disorder, mental distress, they are needed to attend a rehabilitation treatment. The rehabilitation treatment by using short-term psychotherapy – cognitively oriented hypnotherapeutic treatment and team learning – helps employees to reduce negative emotions and to build up self-confidence, to acquire self-management strategies.

KEY WORDS: Workplace Bullying, Post-traumatic Stress Disorder, Cognitive Hypnotherapy, Team Learning

INTRODUCTION

Bullying is psychological terror or offensive humiliating behavior carried out by the employer towards an employee or group of employees. Nowadays, the social climate at work may escalate into harsh personalized conflicts and even «office wars» [1, 2]. Bullying continues for at least several months and usually manifests itself as intrigues, psychological war, impinging on others personality.

These are direct and indirect verbal and physical attacks, unified in one hostile system: 1) threatening of the employee's freedom of self-expression – regular interruption of the employer, yelling and swearing, permanent criticism in work play, verbal threat; 2) threatening of one's social relations and social status – being not on speaking terms with employee, threatening the employee as nobody, gossiping, rumor, imitation of one's step, voice, gestures in order to make fun e. c.; 3) threatening the quality of one's work and life situations – assigning of no tasks or tasks far to easy for the employee's skills thus discrediting the employee before others. Victims of regular long-term bullying at work are suffering from the post-traumatic stress disorder (PTSD) – [3]. The PTSD in accordance with ICD-10 [4] includes re-experiencing the psychotrauma, numbing feeling, hyper-arousal. Diagnosis of the PTSD is established, if symptoms persist for longer than 1 month, cause personal distress, and interfere with an individual's ability to function. The experience of sexual harassment at work in males and females also is considered a form of the work-related negative stress with symptoms of the PTSD in employee and frequently effects on drinking outcome [5].

Psychotrauma elicits different physiologic and neurobiological responses in males and females, such as those associated with regulation of the hypothalamic-pituitary-adrenal axis, which coordinates the stress response. Deregulation of this tightly balanced circuit

can occur in people with the PTSD. Disorders of victim's nervous system, destruction of whole health system leading to giving termination notice are indicative of discontinuation of employment relations under compulsion [6, 7].

The PTSD in such victims – patients can be treated effectively with a variety of therapies: the key is recognizing the signs and symptoms, reducing the patient's distress, the impact of the traumatic images and memories, loss of self-esteem. In the treatment of the PTSD all over the world the short-term psychodynamic hypnotherapy, focused on mental and psychosomatic health problems of the patient, recently is being used more and more often. Cognitive hypnotherapy (CHT) is one of the options of such short-term therapy. This method allows changing patient's negative thinking to a healthy, cognitive restructuring, behaviour and emotional reacting, to decrease distress and to improve the quality of patient's life. Rehabilitation treatment program for the victims of bullying with occupational health problems includes short-term psychotherapy: cognitively oriented hypnotherapeutic treatment (CHT) with self-management strategies [8] and team learning (TL) with improvement of workplace relations and organizational culture [9]. Hypnotic susceptibility test before hypnotherapeutic treatment are widely used in clinical and non-clinical research as a screening instrument to select high or low hypnotizable persons, as measure of hypnotic responsiveness [10].

Aim of the study is to approve rehabilitation treatment course – CHT and TL in working female victims of bullying, who suffered from the PTSD.

MATERIAL AND METHODS

During year 2010 – 19 female patients, upper white-collar employees, in the age between 29 and 41 with the PTSD after 6-12 months long workplace bullying were consulted and underwent four weeks CHT and TL course. The inclusion criteria for investigation were: a full psychosocial assessment of employee and health certificate; bullying event was not an isolated event, it occurred with females at least once a week; full consent to participate in the study. There were no exclusion criteria: having not been to mandatory medical examinations.

Traumatic Life Events Questionnaire (TLEQ) [11], a 23-item self-report measure of different types of potentially traumatic events was used in 19 females-victims.

The Social Adaptation Self-evaluation Scale (SASS) [12] – before and after treatment course and during follow-up was applied in females-victims with the PTSD to examine the evaluation of social motivation and behavior (21-item scale, where items explore the areas of the work and leisure, family and extra-family relationships, intellectual interests, satisfaction in roles and patient self perception of his ability to manage and control his environment; each answer is scored from «0» to «3», corresponding to minimal and maximal social adjustment, with a total score range of «0» to «60»; normally the middle number of scores is «35» –«52»). The Posttraumatic Diagnostic Scale (PDS) [13] – before and after treatment course and during follow-up was used with females as self-administered test (49 items-scale, symptoms severity score which ranges from 0 to 51: 0 no rating, 1–10 mild, 11–20 moderate, 21–35 moderate to severe and >36 severe).

Females received CHT twice a week and TL once a week, 60 minutes long one treatment session. Hypnotic Susceptibility Test (HST) [14] before the CHT course helped us to assess the hypnotic susceptibility of our patients (suggestion, imagery responsive, dissociative capacity and cognitive flexibility). Our own practice standards were verified during follow-up throughout three months after treatment course by re-reporting about life quality from females.

RESULTS AND DISCUSSION

It was found, that 19 female patients (mean age – 34.58, SD – 3.83) after regular long-term bullying at work suffered from the PTSD. Fifteen females bullying were psychological aggression: social isolation, verbal aggression, spreading rumors, four females – physical aggression: sexual harassment. Victims of bullying showed such PTSD symptoms as re-experiencing the bullying in nightmares, hyper-arousal, helpless, low self-esteem and bad social well-being. Two females were suicidal ideation and drinking outcome.

Results of the analysis according to TLEQ showed: eleven females bullying were carried out repeatedly and over time, there was presented fear, helplessness and horror; eight females had psychotraumatic event, which caused the most distress, was increasing conflict escalation without de-escalation efforts and individual emotional and practical support in the workplace. Five females reported about bully, who used passive aggression: secrecy and manipulation. All females-victims reported lack of social support from supervisor and colleagues, deficit of anti-bullying policy at work. Nine victims of bullying left the workplace, seeking employment elsewhere.

Results of the analysis according to SASS showed significant health improvement at the conclusion of treatment course and during follow-up with seventeen females (84%), according to PDS – with fifteen females (79%), with level of significance: $p < 0.05$. Division of the females with the PTSD according to the HST, SASS and PDS before the treatment course, at the conclusion of the treatment course and during follow-up is shown in Table 1 and Figure 1. Patient's state during CHT session is shown in Figure 2.

Table 1. Characteristic of females-victims with the PTSD resulted by methods

Methods	*Before treatment course*	*At the conclusion of treatment course and during follow-up*
Hypnotic Susceptibility Test (HST)	10 females – had good suggestion and imagery responsive 9 females – had cognitive flexibility and dissociative ability	–
The Social Adaptation Self-evaluation Scale (SASS)	19 females had resulted low level of well-being (27 points of valuation)	17 females (84%, n=19): 35-45 points; level of significance: $p < 0,05$
The Posttraumatic Diagnostic Scale (PDS)	17 females had valuation scored 21–35 points, 2 females – 38 points	15 females (79%, n=19): 0–9 points; level of significance: $p < 0,05$

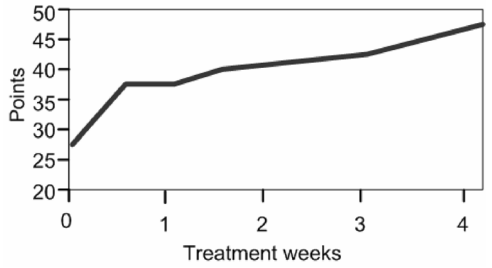

Fig. 1. The Social Adaptation Self-evaluation Scale (SASS), middle number of scores change with 19 females with the PTSD, effected by 4 weeks CHT and TL.

Fig. 2. Patient's state during CHT session

During CHT females were sitting in chairs. For the PTSD management we used such hypnotherapeutic procedures as relaxation induction, distraction, time distortion, processing of psychotraumatic events, metaphorical, imagery techniques, self-hypnosis with ego–strengthening suggestion. An individualized compact disc with suggestions for self-practices at home once a day between sessions and after treatment course was made and given to each patient and was used by 17 females during treatment course and follow-up.

During TL treatment females acquired self-management with improvement of workplace relations and organizational culture, self-help strategies, sexual harassment prevention, employment rights, including compensatory damages. Already during treatment course 10 females did not tend to cope with their problems alone, they demanded their legal rights, consulted trade union representatives and achieved extermination of aggression at the workplace.

Twelve females, after CHT and TL course during 3 months follow-up, reported about increased stress tolerance, growth of self-esteem and communicative competence. Follow-up assessment for such females indicated lasting reduction in hyper-arousal, helpless, low self-esteem, re-experiencing the bullying in nightmares, which can be explained also by benefits of positive self-influence during CHT and mind body relaxation practice at home by compact disc.

The research was worked out with following international human rights and standards of physicians` ethics.

DISCUSSION

In accordance with analysis of the Traumatic Life Events Questionnaire – psychotraumatic event, which caused the most distress, in females-victims was increasing conflict escalation without de-escalation efforts and individual emotional and practical support in the workplace, also reports about lack of social support from supervisor and colleagues, deficit of anti-bullying policy at work. It is in connection with researchers` conclusions about conflict, interpersonal tension continuously escalating situation in the workplace with aggressive interactions among perpetrator, victim and organization and the impact of bullying on psychosocial well-being [15]. Vitally important is fact how an organization coworkers tolerate, react to and manage bullying incident. All employees should receive

basic training on bullying: how to prevent undesirable interaction, report incidents, how to get support from supervisor, confidential counselor or work council, and how to assist any colleagues being bullied [16].

It was proved in our research, the importance during rehabilitation period to reduce the impact of post-traumatic stress symptoms in employees exposed to bullying by such traumatic incident reduction therapies as cognitive hypnotherapy and team learning. It is in accordance with recent research about training/education programs which have positive impact upon sexual harassment in the workplace, it is in accordance with recent research about cognitive-behavioral workshop [17, 18]. Emotionality learning programs by role models and self-management strategies are very urgent and can improve administrative behavior [19, 20].

CONCLUSION

1. Four weeks cognitive hypnotherapy course and team learning for female victims of psychological and physical aggression, workplace bullying is an effective rehabilitation treatment with improving quality of life.
2. To use self-evaluation scales during treatment course and follow-up can help employee to assess own self-esteem and psychosocial well-being.

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SUSTAINABLE BUSINESS DEVELOPMENT BASED ON QUALITY MANAGEMENT AND ERGONOMICS INTERVENTIONS

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ABSTRACT

There is no doubt that process quality is closely related to modern technology development. Work process requires a reasonable request: process adjustment to human needs. It means that process quality management needs to address not only organization outside customers, but also workers. Nowadays, in rapidly changing labour market there is a need for educated workers, as well as comfortable and safe workplaces. This research focuses on the analysis of literature on development of organization process quality management in relation with ergonomics aspects. The aim of research is to discover sustainable business development model of organization process quality management, by analyzing theoretical data about quality and ergonomic interaction effects on the organization's performance. Main results reveal that the process quality management sustainable development model can be based on the continuous process quality management improvement in connection with ergonomics interventions.

KEY WORDS: Business, Ergonomics, Quality Management, Organization

INTRODUCTION

Initially, quality management was used to enhance manufacturing processes through the quality circles and control application. However, nowadays quality aspires to achieve various types of organizations. Contemporary business evolution, dynamic response to the complex challenges, superior customer satisfaction and competition are the potential explanations. Therefore modern managers have to seek for new ways how to achieve sustainable business development. Hence ergonomics interventions in organization's strategy, business and quality management processes have great potential.

Quality management is a tool used to ensure processes of the company and to achieve customer requirements [1]. Therefore organizations provide customer satisfaction, consistent work and improve existing processes by implementing quality management systems. But ergonomic solutions can help to select appropriate workload and optimal working conditions for workers, also improve production technology and have an enormous contribution in human resource development and increase of work abilities [2].

Nowadays every business is subjected to rapid change, for example job content and work organization. Rapid technological changes affect the quality of life of employees, work productivity and product quality. The sustainable development of business is linked to its success in long-term. Success depends from the organization economic and social evaluation, healthy working environment and competitive workers. In today's labor market the human is the main element in active economic environment.

As mentioned, ergonomics and quality management are considered as two separate scientific disciplines, but many authors in their studies emphasized some similarities [3, 4, 5, 6]. In studies, they noted a high and significant correlation between human wellbeing in the organization (technology improvements, an appropriate work organization) and a positive quality results, the human factor and the environmental impact on process management.

AIM OF THE RESEARCH, MATERIALS AND METHODS

The research is aimed to study how quality management and ergonomics interventions can help to achieve sustainable business development based on theoretical analysis.

The monographic research method, graphical and comparison method were used to analyze theoretical data of ergonomics and quality management impact on organization business processes and hence prove the approach to sustainable business development.

RESULTS AND DISCUSSION

Today's changing work environment focuses on work organization and new forms of collaboration (outsourcing, work and resource decentralization, introduction of new technologies [7], etc.). Such dynamic development requires a different approach to solve quality management and ergonomics problems by determining the additional duties to the workers – the core values of the organization [8]. This means that businesses need to focus on ergonomics in order to achieve high productivity and business goals [9, 10]. Accordingly to the definition, ergonomics is the science that deals with interaction of theoretical and practical research on humans and the work environment (technology, machinery, tools a.o.), principles of implementing technological equipment, developing environmental and technology design, thus ensuring the business well-being and economic efficiency [6]. Ergonomics can be linked to organization business strategies in various scopes: business function strategies, cross-functional strategies and corporate strategies [11]. Ergonomics approach improves work processes and has a significant role in reducing the accidents and injuries at work. One of the ways, how to improve process quality is to make it safer and more comfortable. The safety of the processes reduces injuries and saves financial resources of the companies`, increases the satisfaction of process operators and sometimes, introducing only minor changes at workplaces, for example, improving the design of the chair can result in radical changes in workers attitude toward the work.

Historically, the area of quality management constantly tried to find new ways to improve the organization's overall performance. Quality management techniques developed from statistical process control to quality circles [12, 13] and widely used total quality management approach [14]. Researchers from many countries have made an analysis on these issues for several decades. In 1911 the American engineer F. Taylor introduced improvements in task allocation and the payment system for the accomplishment of tasks [15], but the researcher in physics and statistics WA. Shewhart in 1939 set up a scientific approach to the use of statistics in quality management [16]. G. Taguchi in 1986 pointed out how to reduce errors in process management [2], and K. Ishikawa in 1990 proposed quality circles and developed famous seven quality basic tools [17]. Also well-known scientists and practitioners, as WE. Deming [1], JM. Juran, AB. Godfrey [18] contributed significant changes in the process organization, introducing new methodologies for quality management.

Several studies have proved a high and significant correlation between human wellbeing in the business environment (technology improvements, an appropriate labor organization) and a positive quality result [4, 19, 20]. It is also in accordance with W. Karwowski findings, where significant attention has been drawn to the task, tools, equipment and working environment adoption to employees' work abilities and needs, taking into account the overall organization's development strategy [21].

Researchers DB. Harris, FB. Chaney, CG. Drury and JG. Fox emphasizes the process quality and ergonomics close relation in areas of quality and process control [3, 5, 22], indicating that ergonomics can contribute to the business performance. H. Shahnavaz has grouped ergonomic conditions at the organization [23, 24]:

- Workplace adjustment for workers;
- Workers training to improve skills and competencies;
- Changes in work organization, improving employee relationships;
- Technological changes, improvement of human-machine interaction;
- Improving the overall organization system.

This is also in accordance with the International Ergonomics Association definition of ergonomics that states «Ergonomics or human factors is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance» [6]. The coryphaeus of quality management, inventor of continuous quality improvement W.E. Deming compares business system to the network, in which the components are working together in order to achieve a common goal [25]. Thus, ergonomics include social targets (wellbeing) and management targets (system performance). Work productivity, level of quality, cost reduction a.o. are the leading elements of measuring the business performance [11]. Also A. Freivalds states that employee's health and safety are just as essential as company's productivity [26]. It proves the importance of ergonomics in process quality management.

There are studies that verify previously mentioned [27, 28]. J. Eklund and C. Botscha proved rapid improvements in the process quality if organization introduces not only the quality program, but also the ergonomic solutions. The authors indicate that such combination of implementation requires careful planning and investment. Also since 1985 the International Ergonomics Association initiated to develop an area in ergonomics that can be used by business management [19].

Analyzing the theoretical aspects of quality management and ergonomics, author proposes a sustainable development model of process quality management. It combines the essential correlation factors of quality and ergonomics, and it is in a close connection to classical WE. Deming continuous quality improvement cycle (plan-do-check-act) as well as with the European organization of quality guidelines [29] (Figure 1).

This model can be successfully applied for all kinds of organizations, especially, in the manufacturing sector. The sustainable development of the process quality management is affected by the organization's strategy and the cultural context, policy management, customers, employees, and society and socio-economic environment, etc. Application of such model might be problematic in the micro-and small business due to lack of attraction of financial investments. Managers of those companies consider the investments in the production process quality improvements unnecessary, expensive and as a burden, not as an opportunity to improve long-term business operations, hence failing to ensure workers well-being and comfort at work.

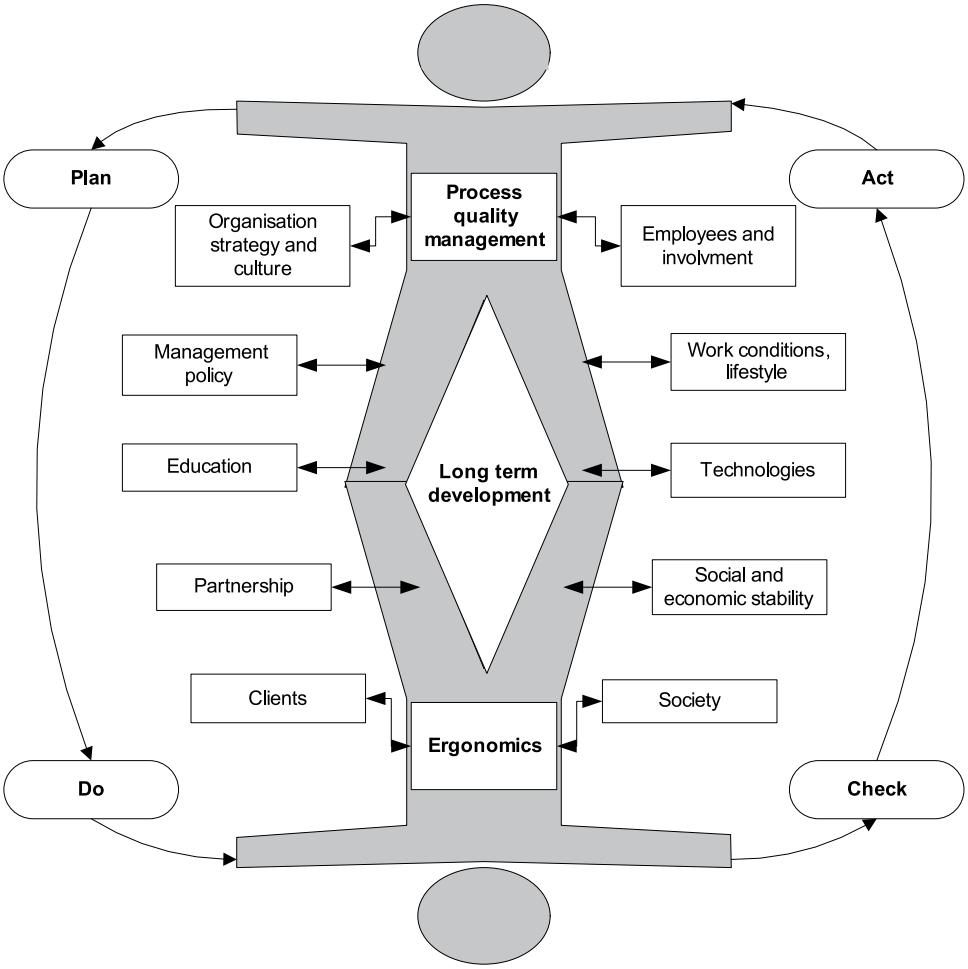

Fig. 1. Process quality management sustainable development model

Successful process quality management begins with the intervention of ergonomic basic principles in the technologies and analysis of the work requirements. The next step is to improve work process. It can be done by introducing advanced technology to adjust human physical and psychical abilities, as well as enhance the safety of work environment. Therefore, the process quality management set the opportunity for innovation, the ability to change and undoubtedly contribute to the sustainable development of the business.

CONCLUSIONS

1. The scientific disciplines of quality management and ergonomics are interconnected based on the theoretical analysis. The theoretical model of sustainable business development can be based on principles of continuous process quality management and ergonomics interventions (considering human factors, social-economic stability, management strategy, culture a.o. factors).
2. Process quality management and ergonomics are closely linked scientific disciplines proved by the literature analysis of various authors.

3. Process quality management's long term development model can be based on continuous operations quality management and ergonomics interaction principles, considering the human factor, socio-economic stability, management policy, strategy and culture environment a.o. factors.
4. The research will continue by carrying out analysis of operations quality management and macroergonomics in particular Latvian business organizations and by studying the effects on long-term development considering also economics efficiency.

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THE EFFICIENCY OF QUALITY MANAGEMENT SYSTEM IN ENTERPRISE LLC «LIEPAJAS UDENS»

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ABSTRACT

Nowadays in a changing economic environment and competitive conditions every enterprise has to find new ways to achieve the highest results with the least possible resources. One of the corner-stones to achieve this goal is quality management system – a tool which enables us to manage the processes of enterprise, to arrange a number of areas in the same time, to optimize processes and continuously improve them.

Thereby in every enterprise where the quality management system (QMS) has been introduced, a question arises: «How to ensure the efficiency of the QMS in enterprise?» Therefore the purpose of the study is to investigate the efficiency of the QMS in enterprise LLC «Liepajas udens» and work out suggestions for improvement of the process quality management, based on theoretical analyses.

The efficiency of the QMS in enterprise has been analyzed by survey of employees, which contains 40 different assertions in 7 different groups of them. Thereby the opinion about the QMS of employees working in enterprise has been collected as well as the main problems of the QMS process realization and improvements have been identified. Defined problems have been analyzed more carefully, thereby it was also possible to identify the level of leadership in which appropriate problem is the most essential.

The QMS in enterprise LLC «Liepajas udens» is effective and ensures continuous improvements of processes. That is proved with the results of survey of employees, where 74% of employees manage and understand the QMS, also they are interested in and motivated to continuously improve it. Though, the results of survey of employees show also several problems of the QMS: employees have a lack of information and knowledge about enterprise and its function and processes of the QMS, also about their work and role in the enterprise and its development. Authors provide conclusions and suggestions for improvement of the QMS working in LLC «Liepajas udens».

KEY WORDS: Quality, Management, System, Efficiency, Improvement

INTRODUCTION

Regardless of company's size, or them being private, state or locally governed, there is a management system that is a core element, which enables us to manage the processes of enterprise. Therefore, more and more companies choose to implement a new process management system, allowing it to arrange a number of areas at the same time, optimize processes of enterprise and continuously improve them; it also helps to see all processes of the enterprise as a whole.

Nowadays, society demands quality, while the quality demands several resources – materials, work, finances, and excellence a.o. However, due to the will of entrepreneurs to survive and develop in competitive environment, the concept of quality has experienced a rapid growth.

Juran J.M. explains that the quality in its core is those product features, which meet consumers` needs and thus ensure customer satisfaction. The quality also means freedom – freedom from mistakes that acquire to make a product repeatedly, creates consumer dissatisfaction, complaints, etc. [1] Because of this, the quality we know today cannot be compared with the quality we knew yesterday. While yesterday's concept of quality was based on experience and subjective conjecture, today's is based on theoretical knowledge and includes all forms of quality display, thus involving even less significant processes of the enterprise. Therefore, the quality already has become one of preconditions for enterprises to survive in today's business world. If one mentioned the quality management system (QMS) five years ago, many people did not know what it meant, nowadays the situation has changed. Not only the managers of enterprise, but also the employees know about the QMS and other management systems. The key purpose of the QMS is to create a framework which would ensure that every time a particular process is carried out using the same information, methods, skills, as well as for the consequent controlling of the process [2]. Thus the system helps to define clear requirements, to inform about the policy of quality and procedures, to monitor work and to improve teamwork. [3] The QMS promotes quality assurance to customers in the enterprise and the ability to compete in global markets. With the help of the QMS several marketing, internal and external customer, supplier partnership advantages are created that provide the competitiveness of the company in both domestic and international markets. [4] Companies have appreciated the benefits of the QMS, thus they have increased emphasis on its efficiency – continuous improvement of companies processes in order to continuously improve them and reduces errors, rejects, etc. [5]

«*The efficiency is how easily, quickly or cheaply with the tool, method or course of action the objective has achieved. From an economic point of view, the efficiency is a maximum return of resources and it use with minimal damage.*» [6] So in essence, the efficiency describes how optimal an enterprise can ensure processes that are necessary for its actions in order to gain maximum benefit by using the least possible resources.

Enterprise LLC «Liepajas udens» has been analyzed in the study. LLC «Liepajas udens» deals with the extraction of drinking water, its preparation, delivery to citizens of Liepaja, to businesses, to institutions and organizations, collection of waste water, its drainage and treatment, as well as urban water supply and sewerage system exploitation. [7]

For LLC «Liepajas udens», like for any other company, it is important that its employees work professionally, creatively and with maximum impact, thus providing customers with qualitative services. LLC «Liepajas udens» finds new solutions to improve the quality of services to its customers every day. Providing the quality of services is an essential result of LLC «Liepajas udens» effective action.

Certified QMS development, implementation and maintenance, in specific, indicates the commitment and ability of LLC «Liepajas udens» to provide appropriate quality standard in all branches and sectors of LLC «Liepajas udens». Thus the authors` states hypothesis of the investigation: the QMS in LLC «Liepajas udens» is effective and ensures a continuous process improvement. Therefore, the aim of the study is to examine the efficiency of the QMS in the enterprise LLC «Liepajas udens» and to work out recommendations for the QMS`s improvement. In order to achieve the aim of this study, several actions have taken place: the efficiency of QMS in LLC «Liepajas udens» has been analyzed, a survey has been created and its results have been collected, this allowed to identify the main problems of the QMS performance and improvement, conclusions and proposals have been made to improve the QMS in the enterprise as well.

1. METHODS

To study the effectiveness of the quality management system (QMS) in LLC «Liepajas udens», the authors decided to use a quantitative method of analyses and conduct a survey of company's employees. The authors modified S.Foster designed questionnaire for evaluating the effectiveness of the QMS. [8] The questionnaire was adjusted to action nature of LLC «Liepajas udens», this was done so the results of the survey could help to identify the major problems of the QMS exactly in LLC «Liepajas udens».

There were 40 different statements in 7 different groups included in the questionnaire:

- Leadership – 7 statements;
- Strategic planning – 3 statements;
- Customer and market focus – 5 statements;
- Measurement, analysis, and knowledge management – 6 statements;
- Human resource focus – 6 statements;
- Process management – 4 statements;
- Business results – 9 statements.

Opposite to each statement a respondent had to mark the most appropriate option: fully disagree, disagree, neither agree/nor disagree, agree, fully agree. At the end of the questionnaire the respondent was required to indicate his position in the company, that way the authors were able to divide the respondents in the company's management levels. LLC «Liepajas udens» organizational structure consists of the chairman of the board, four sectors – water treatment plant, water supply, sewerage and industrial security – and the rest of the business units or departments. Overall there are three levels of management in LLC «Liepajas udens» – 1st management level, 2nd management level and 3rd management level. [9] Despite the fact that respondents were required to indicate their position in LLC «Liepajas udens», their anonymity was guaranteed because the authors were not familiar with the employees. So, the possibility that the respondents would answer falsely was reduced.

Based on 2010 management review data, there are 168 employees in the company LLC «Liepajas udens». [10] In order for the results to be reliable, authors had to find out how many employees had to be involved in questionnaire. This was done by using statistical formula:

$$n = \frac{P \cdot Q \cdot t_{\alpha}{}^{2}}{\Delta_{\alpha}{}^{2} + \frac{P \cdot Q \cdot t_{\alpha}{}^{2}}{N}},$$

where

n – sample size,

N – general group,

P – part of studied characteristics (0,5),

$Q = 1 - P$,

t_{α} – student distribution by categories (1,96),

α – confidence level (0,05 ~ 95%),

Δ_{α} – random level (0,03). [11]

$$n = \frac{0,5 \cdot 0,5 \cdot 1,96^{2}}{0,03^{2} + \frac{0,5 \cdot 0,5 \cdot 1,96^{2}}{168}} = \frac{0,25 \cdot 3,8416}{0,0009 + \frac{0,25 \cdot 3,8416}{168}} = \frac{0,9604}{0,0009 + \frac{0,9604}{168}} = \frac{0,9604}{0,0066} = 146$$

It was calculated that 146 employees had to be questioned, however based on the information provided by LLC «Liepajas udens», on average there were 20 employees who worked in shifts, 5 employees were sick and unable to carry out their duties and 9 employees were on leave. Thus to question 146 employees in limited period of the time was impossible. So, together with the managers of LLC «Liepajas udens» it was decided to interview 120 employees.

120 questionnaires were distributed to all units and departments of LLC «Liepajas udens» during the period from February 28, 2011 till March 18, 2011. At the end of the survey 94 questionnaires or 74% were returned, 26 or 22% were not returned. This means that nearly one-fourth of the respondents rejected the opportunity to provide feedback and recommendations to improve the QMS of the company. The authors give three possible reasons for this fact:

- Working in excessive occupation;
- Disinterest in business promotion;
- Skepticism on the importance of their point of view and possibility to change anything.

Overall, 94 questionnaires were gathered from all units and departments at different management levels of LLC «Liepajas udens».

2. RESULTS AND DISCUSSION

The efficiency of the quality management system (QMS) in LLC «Liepajas udens» is highly dependent on the attitude of the employees towards their work, responsibilities, clients/customers and colleagues and to their company as a whole. Considering, that the statements in the questionnaire were defined positively, it was possible to summarize the overall attitude about the QMS operations in the company without contradiction.

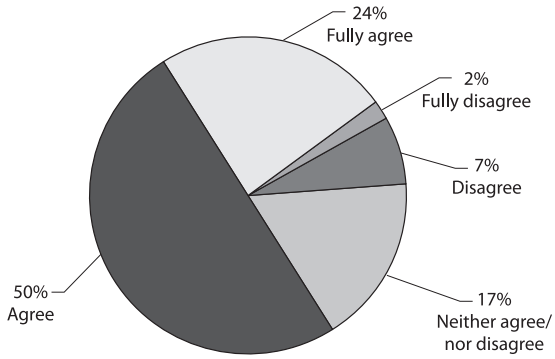

Fig. 1. Attitude of the employees.

Figure 1 shows that 24% of replies were «fully agree», and half or 50% were «agree». So 74% of respondents have a positive attitude regarding the QMS action in company. In authors` opinions, attitude of the employees of the company reflects that the QMS of LLC «Liepajas udens» is effective, so – their hypothesis is confirmed.

Three-quarters of employees in LLC «Liepajas udens» have an understanding and information about the QMS, and why it is necessary in company. So, the employees of the company are aware of the importance of implementing the QMS. Thus, each of these

employees is motivated to give their suggestions and proposals for the development of the QMS, which in its turn ensures the continuous improvement of the QMS.

Based on the survey results, LLC «Liepajas udens» ensures the QMS action. However, in order to enhance the effectiveness of the QMS, continuous improvement is required. For a company to know, how to improve the QMS, it is necessary to identify the main problems.

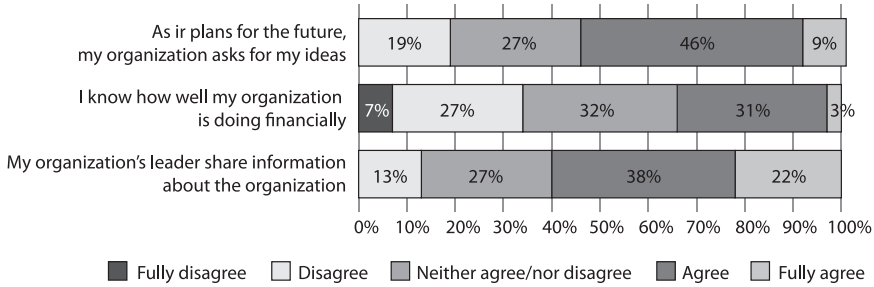

Fig. 2. Replies on statements: «As it plans for the future, my organization asks for my ideas», «I know how well my organization is doing financially», «My organization`s leaders share information about the organization».

Figure 2 shows that one of the most important QMS problems in LLC «Liepajas udens» is associated with the company's management and its employees` mutual communication. Nearly one-fifth or 19% of respondents believe that nobody listens to their suggestions and thoughts when planning the company's activities. 27% of respondents neither agree/nor disagree with this statement. However, more than half or 55% of respondents believe that their proposals are taken into account. This proves that LLC «Liepajas udens» do not sufficiently take into account the proposals and/or recommendations of employees when planning their future operations. It should be noted, this problem exists in all the levels of management. After the authors, this situation might create distrust and lack of confidence in their company and its management. Therefore, the company has to work with their employees, has to listen to their thoughts and opinions for employees to feel important and happy, even if a particular idea is not taken into account when planning the future of the company's action. So, for each of the employees of LLC «Liepajas udens» it is important to be heard, to increase their self-confidence as an employee of the company.

A significant problem of the QMS in LLC «Liepajas udens» is the fact that employees do not know what the financial situation of the company is. 7% of the respondents fully disagree, 27% disagree and 32% of respondents neither agree/nor disagree that they know the financial situation of the company. So the majority of the employees of company are not informed, so it prevents employees to fully understand the current and future direction of the company. The highest unawareness exists in the 3rd management level, which means that with this group the managers have to work the most, because the employees, who are not familiar with the financial situation of the company, may feel insecure about their jobs and business activity as such. Because of this, employees have a new concern on daily bases, which exhausts their minds and affects the level of their stress. So, the achievements of the employees are affected and the company as a whole too.

Figure 2 indicates that the employees of LLC «Liepajas udens» are not adequately informed about the progress of company, its achievements and development perspectives, because 13% of respondents disagree, 27% of respondents neither agree/nor disagree with this statement. This problem is the main concern in the 2nd and 3rd management level, which

means that the managers of the company must think how to make all management levels of the company equally informed. In the authors` point of view, the lack of information about the progress of company, its achievements and perspectives of development interfere with employees feeling as an important part of the company, because the employee is not informed about the activities of the company. So, the employees are not familiar and sure about the direction of the company and its future possibilities. In a way, it can take away the motivation of employees to accomplish their work with integrity and quality, because the employees do not feel and see the overall results of the work.

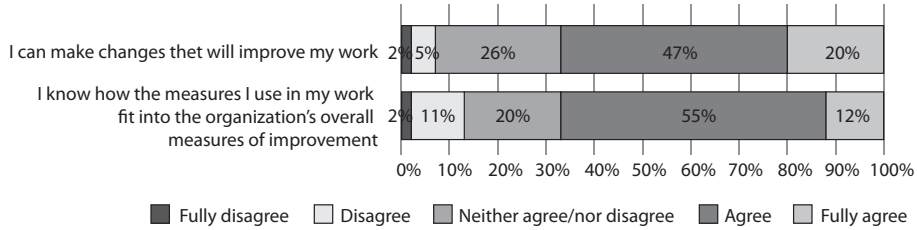

Fig. 3. Replies on statements: «I can make changes that will improve my work», «I know how the measures I use in my work fit into the organization`s overall measures of improvement».

Figure 3 shows that 33% of respondents do not know or are not familiar enough of their duties, tasks, rights and responsibilities; because they are not sure whether they can make the necessary changes to improve their work. In fact, this problem affects only the 3rd management level of LLC «Liepajas udens», thus this group is not aware of their rights. The authors argue that lack of knowledge about their rights reduce productivity in situations, when they need to take operative decisions to improve their work. So, the situation is not improved, and the employee is forced to invest more time and work than she/he should be.

In its turn, 33% of the employees of LLC «Liepajas udens» do not know or are not familiar how the examination (audit) activities are linked with development activities of the company. This problem also is the most in the 3rd management level, but features are also observed in the 2nd management level. Authors believe that this situation is very serious because it shows that the employees do not have an understanding of the importance of the QMS in action of the company. Employees are not sufficiently aware of what the examination (audit) is for and whether they generally have any effect on the overall action of the company. This problem may contribute to the situation that employees are not sufficiently involved in the development and improvement of the QMS.

Due to these identified problems the productivity of the company is delayed. The managers have to work on this problem, so that each employee of LLC «Liepajas udens» is informed about all the activities of the company, and are heard, thus creating the confidence in employees that they are an important part of the company.

For the employees of LLC «Liepajas udens» to be adequately informed about the progress of the company, its achievements, development, perspectives, financial situation, and also to have a good knowledge of examination (audit), the importance of their duties, tasks, rights and responsibilities, the authors suggest to the QMS specialist to create the authors developed informational booklet «Ūdens ziņas» once a month, and to ensure their distribution for all the employees of the company. «Ūdens ziņas» is an informative booklet, which provides information related to the action and employees of LLC «Liepajas udens». It is folded, printed on both sides A3 page, or on four A4 pages: booklet cover, «Achievements, Progress, Estimated», «Up to date Information», «Our People».

To promote the confidence and trust of employees to the company and its managers, the authors offer to the QMS specialist to develop, and the managers of the units and departments to arrange their sections with suggestion mailbox that the QMS specialist inspect and compiles the gathered information on a monthly basis. Suggestions` mailbox is a simple box, which formed in accordance with the principle of the mailbox. It is a place where to put proposals, feedback and reviews.

The authors propose to place the informative booklet «Ūdens ziņas» and the mailbox by a principle of «two in one», as shown in Fig.4.

Fig. 4. Distribution of the informative booklet «Ūdens ziņas» and the suggestion mailbox.

In their opinion, by attaching to the suggestion mailbox a small box for the deployment of informative booklets, there will be a two-fold outcome – constant reminder to the employees about the opportunity to submit their proposals, suggestions and feedback, as well as the opportunity to be informed about the company and its activities, which would be achieved by reading «Ūdens ziņas».

CONCLUSIONS

1. Overall, the attitude of employees in LLC «Liepajas udens» on the QMS in the enterprise is assessed as positive, since only 9% of respondents were negative and 17% neutral. This means that 74% of employees are familiar with and understand the action and importance of the QMS. Those employees are interested and motivated to give their suggestions and proposals for improving the action of the QMS, thus ensuring that the QMS in LLC «Liepajas udens» is continuously improved. Therefore, the authors argue that the QMS of the LLC «Liepajas udens» is effective and provides continuous process improvement.
2. The results of the survey in LLC «Liepajas udens» indicate that the action of the QMS is provided, but the company has to continue uninterrupted development of the QMS, because in each of the statements in the questionnaire were particular problems identified – lack of the employee awareness and understanding of the company, its activities and the QMS processes, as well as on their work and role in the company and its development. Mainly the problems of the QMS exists on the 3rd management

level, because exactly this management level provides the most different and negative replies on statements, so the management should pay the greatest attention to this level of management.

3. The managers of LLC «Liepajas udens» must think about, how to ensure that all employees on all management levels are equally informed and aware of their rights and opportunities to influence the action of the company.

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OCCUPATIONAL NOISE EVALUATION

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ABSTRACT

Authors of this publication worked out the principally new procedure for environment noise measurement and assessment which strongly follows Latvian Standard LVS ISO 9612:2007. All exposure measurement process is divided in eight clearly distinguished goes, beginning from formulation of tasks and aims of measurement, and ending by writing measurement report. New procedure clearly states the locations of measurement microphone taking in account the worker's activities, timetable of tasks of a concrete person – the work schedule of employee and exposures to noise, calculation of uncertainties and assessment of work environment risks.

KEY WORDS: Occupational Noise, Noise Event, Step-by-step Procedure, Equivalent A-weighted Sound Pressure Level, Noise Exposition Level

INTRODUCTION

Since Latvia joined the European Union in 2004 it had been created the legislative act in the field of measurement and assessing the occupational risk factor caused by noise in accordance with the International requirements. This new legislative act brought to Latvia the dissonant opinion in understanding of occupational noise influence to human hearing in comparison with the old-style thinking prevailing in Latvia in the years before. The daily noise exposure level combined with the peak sound pressure appeared instead of normalized A-weighted spectra for each category of workers.

Irreversible hearing impairment is the common risk caused by occupational noise. It is known that an individual having long enough exposure to permanent noise even not exceeding 80 dB(A) can spoil and even lose his hearing. The Cabinet Regulations No 66 [1] prescribes the requirements for the protection of employees from the risk caused by noise of the work environment especially if hearing impairment of an employee can be expected. The indicators causing the risk are defined in these Regulations similarly as in the Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise). These indicators are the exposure limit value, exposure action values and corresponding peak values. There in Regulations also are appointed the actions how to reduce the risk caused by noise and given the guidance (procedure) of measurements as well. Unfortunately, the practice shows that measurement guidance given in Regulations is not very suitable for obtaining straight results and in some cases comes in conflict with the standard measuring methods described in ISO 9612:2007.

We undertook the goal to work out the new procedure of occupational noise indicator measurement to replace the existing procedure in the Regulations. It has been used the International standards translated or corroborated by the Technical Committee of Standardization «Acoustics, mechanical vibration and shock» [2-6].

RESULTS

The new guidance of occupational noise indicator measurement relates to the stationary, semi-stationary and mobile work places. In the stationary workplace the location of an employee is fixed, excluding the time-outs. In the semi-stationary workplace the location of an employee vary repeatedly day-by-day covering some definite number of workplaces. In the mobile workplace the location of an employee is varying in the room or territory during 8 hours of workday and cannot be characterized by very concrete place or location. The accredited laboratory is the only performer of measurements using the calibrated standard sound level meters and data processing equipment.

To avoid any misunderstanding and disaccord among the measurement operators we propose the common terminology:

- Noise event – the separately identified event during the continuous noise in connection with the concrete noise source, location and conditions of operation;
- Series of noise measurements – the overall sequence of separate measurements performed during the workday or workweek;
- The stabilized value of a measurement – the measured value deviates in the range less than ± 0.3 dB during the continuous measurement of a noise. The sound level meter should be switched in «Slow» mode.

1. INSTRUMENTATION

- Sound level meter shall comply with LVS EN 61672 [6] Class 1 or 2. It shall comprise in parallel working peak and squared detectors on every measurement. Sound level meter should indicate, display and register the following environmental noise characteristics: A-weighted sound pressure level or equivalent sound pressure level $L_{Aeq,T}$, dB(A) [3], usually indicated on the display as [LAeq], sound exposition level L_{AE}, dB(A) [2], indicated on the display as [LAE]; the maximum peak level of sound for each separate measurement L_{peak}, dB [7], usually indicated on the display as [LCpkmax]. It is recommended that sound level meter indicates and registers the following auxiliary data: normalized equivalent continuous A-weighted sound pressure level to a nominal 8 h working day, the start time of an each separate measurement and duration.
- Sound level calibrator shall comply with LVS EN 60942 [5]. It is recommended that both calibrator and sound level meter were from one producer.
- Thermometer shall provide the air temperature measurements in the range – 40 °C to + 70 °C with ± 0.5 °C.
- Humidity gauge shall provide the air humidity measurements in the range 10 to 95% RH with ± 5% RH.
- Anemometer shall provide the air flow speed measurements in the range 2 to 10 m/s with the accuracy of ± 5%.
- Barometer shall provide the atmospheric pressure measurements in the range 600 to 1100 hPa with accuracy not less than ± 0.5 hPa.

2. PROCEDURE OF THE MEASUREMENTS

In our opinion the measuring procedure should comprise the following steps described in details below.

Step 1. Set up of the measurement target and purpose. The presentment of the measurement shall comprise:

a) List of employees who fall under determination of the risk factors with their names and activities;

b) Description of the work environment (indoor shop or outdoor conditions, equipment and machinery, work schedule, the idle time included);
c) Purpose of the measurement, even if it does not relate to the determination of the risk factors of employees (e.g. checking the comfort of employee, disturbances in the production process etc);
d) Schedule of the workday of the employee split in noise events and idle times;
e) Schedule of the workweek of the employee split in workdays and noise events and idle times as well. Needed when the measurement operator has to choose what kind of exposure to use;
f) Track of the transmigration of an employee in the semi-stationary workplace.

Step 2. Drawing up the measurement plan. The measurement plan shall comprise all current noise events of a workday, split preferably in hours and minutes. Thus gives the possibility farther on to carry out the calculation of the noise exposition level by means of so called «sampling method» [3].

Step 3. Preparation of a measuring site. In prior to start the noise measurement the operator shall check the ambient temperature, humidity, atmospheric pressure and wind speed, if outdoors. The measurements are allowed when air temperature is within – 10 °C to + 40 °C, air humidity below 80% and wind speed not exceeding 4 m/s. The operator performing the noise measurements is obliged to instruct the assisting persons (the employee, the colleagues of an employee, observers aside) how to behave meanwhile the noise measurements are going on.

Step 4. The noise measurement. The calibration of a sound level meter by means of the sound calibrator shall be made before and after each series of measurement. If during the measurements some shift in calibration occurred, but not exceeded 0.5 dB, this difference should be added/distracted to/from the measuring result as adjustment. The calibration shift more than 0.5 dB shows the fault of instrument.

The sound level meter or its remote microphone or probe should be located at 1.55 m over the ground (floor) at the standing person's workplace or at the height of 0.91 m at the sitting person's workplace as close as possible to the ears of employee. When the measuring noise is in a room the directional pattern of a sound level meter should be «Random» and the microphone directed away from the noise source. Outdoors the directional pattern of a sound level meter should be «Frontal» and the microphone directed to the noise source. In semi-stationary workplaces the sound level meter or its remote microphone or probe should follow the employee under test and at every stop place must be located as per stationary workplace. At mobile workplaces the sound level meter's (noise dose meter's) remote microphone or probe should be permanently attached to the garment of an employee under the test at the distance 0.1 to 0.3 m from his/her ear.

When the noise event lasts considerably long time the measurement can be interrupted before it ends if the stabilized value of a measurement is reached. During the series of measurements when measuring the sound pressure level of the separate noise events there is sometimes necessary to measure the noise level in the loudest pauses. If the noise in a noise event is variable and of a short duration, it is necessary to measure this event repeatedly in the same day or in another day in the same week if this event does not repeat.

Step 5. Processing the measurement results and calculation of the noise exposure level. The performer of measurements in the previously prepared table which covers all 8 hours of a workday or 40 hours of a workweek fills in the measurement results. The table should

encompass data of an each noise event, such as the equivalent sound pressure level $L_{Aeq,Ti}$ or [LAeq], exposition level L_{AE} or [LAE] and the maximum peak level L_{peak} or [LCpkmax]. Variations of the equivalent sound pressure level and sound exposure level also have to be registered, if any, when there is not reached the stabilized value of a measurement in the end of observation interval.

It must be also made remarks in the table about unexpected prevailing noises during the measurement, such as warning signals, explosions, falling constructions, animal noises, loud talks of assisting persons etc. The instrument overloads and underranges also should be registered.

The result of some measurement can be recognized as unrepresentative (abnormal) if during the measuring interval whether the above mentioned unexpected prevailing noises occurred or the energy supply disappeared, unexpected halting of the machines etc – all that can considerably influence the result of measurement.

The recommended method of measuring the A-weighted sound pressure level at workplace is the continuous uninterrupted 8-hour measurement using a noise dose meter.

In case when the workday is split in a number of noise events, the equivalent A-weighted sound pressure level $L_{Aeq,Te}$ can be calculated using equation:

$$L_{Aeq,Te} = 10\lg\left(\frac{1}{T}\sum_{i=1}^{m} T_i 10^{L_{Aeq,Ti}/10}\right); \quad (1)$$

where

$L_{Aeq,Ti}$ is the equivalent continuous A-weighted sound pressure level occurring over the time interval T_i;

T_i is duration of each interval;

m is the number of time intervals.

Noise exposition level $L_{AE,8h}$ can be calculated using the equation:

$$L_{AE,8h} = L_{Aeq,Te} + 10\lg\frac{T_e}{T_0}; \quad (2)$$

where

$L_{Aeq,Te}$ is the measured or calculated equivalent continuous A-weighted sound pressure level in time intervals according to workday schedule of employee;

T_e is the elapsed time of each separate noise measurement or calculated time interval;

T_0 is the normalized workday (8 hours).

Step 6. Calculation of the total uncertainty of the measurement. The values of the peak, equivalent continuous A-weighted sound pressure level and/or noise exposition level should be recorded and presented together with the corresponding uncertainty ± ε in recommended confidence limit 90% [4]. The calculation of the uncertainty of uninterrupted 8 hours measurement (or a stabilized value of a measurement of any duration) of the equivalent continuous A-weighted sound pressure level $L_{A\ eq,Te}$ and/or noise exposure level can be done according the equation:

$$\varepsilon_{L,eq} = u_i = \sqrt{u_{SLM}^{\ 2} + u_{CAL}^{\ 2}}; \quad (3)$$

where

u_i is the uncertainty of the measuring instruments in accordance with [4];

u_{SLM} is the Class uncertainty of a Sound Level Meter, [dB], in accordance with [6];

u_{CAL} is the uncertainty of a Sound Calibrator, [dB], in accordance with [5].

Calculation of the uncertainty of the equivalent continuous A-weighted sound pressure level $L_{A\ eq,Te}$ and/or noise exposure level L_{AE} for one separate noise event in case of a sequence of measurements can be done according the equation:

$$\varepsilon_{L,eq} = \sqrt{u_i^{\,2} + u_S^{\,2}}; \tag{4}$$

where

u_i is the uncertainty of the instruments;

u_S is the component of $\varepsilon_{L,eq}$ which characterize the total uncertainty of the sampling measurements at the standard deviation s [dB], of a measurement series. This component can be found in accordance with table 1 [4].

Table 1. 90% confidence limits of the result, according to the number n of samples and the standard deviation s of their levels

n	s = 1	s = 1,5	s = 2	s = 2,5	s = 3	s = 3,5	s = 4	s = 4,5	s = 5	s = 5,5	s = 6
4	1,2	1,9	2,5	3,2	4,0	4,7	5,6	6,5	7,5	8,6	9,7
5	1,0	1,5	2,0	2,6	3,3	3,9	4,7	5,5	6,4	7,4	8,4
6	0,8	1,3	1,7	2,2	2,8	3,4	4,0	4,7	5,5	6,3	7,2
7	0,7	1,1	1,6	2,0	2,5	3,0	3,6	4,2	4,9	5,6	6,4
8	0,7	1,0	1,5	1,8	2,3	2,7	3,3	3,8	4,4	5,1	5,8
9	0,6	1,0	1,3	1,7	2,1	2,5	3,0	3,5	4,1	4,7	5,3
10	0,6	0,9	1,2	1,6	2,0	2,4	2,8	3,3	3,8	4,4	5,0
12	0,5	0,8	1,1	1,4	1,7	2,1	2,5	2,9	3,4	3,9	4,4
14	0,5	0,7	1,0	1,3	1,6	1,9	2,3	2,7	3,1	3,5	4,0
16	0,4	0,7	0,9	1,2	1,5	1,8	2,1	2,5	2,9	3,3	3,7
18	0,4	0,6	0,9	1,1	1,4	1,7	2,0	2,3	2,7	3,1	3,5
20	0,4	0,6	0,8	1,0	1,3	1,6	1,9	2,2	2,5	2,9	3,3
25	0,3	0,5	0,7	0,9	1,1	1,4	1,6	1,9	2,2	2,5	2,9
30	0,3	0,5	0,7	0,8	1,0	1,3	1,5	1,7	2,0	2,3	2,6

NOTE: u_S values at n = 4 are found by extrapolation.

In prior to use this table such a sampling measurement values should be found:

a) The mean value of sound pressure levels of the measurement series, [dB].

$$\overline{L} = \frac{1}{n}\sum_{i=1}^{n} L_i; \tag{5}$$

where

L_i is each measured sound pressure level of a noise in i separate time intervals;

n is the number of the time intervals.

b) Standard deviation, [dB], of the sound pressure levels:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (L_i - \overline{L})^2}{n-1}}; \quad (6)$$

Step 7. Assessment of a noise as a risk factor. In order to find whether the work environment noise relates to environmental risk factor the measured peak value or/ and the measured or calculated sound exposure level $L_{AE,8h}$ of a noise under interest should be compared to a specified limits given in Clause 15 of the Regulations. It can be distinguished in following cases:

- the noise does not relate to the work environment harmful risk factor and does not even reach the limit of the lower action value, when:

  $L_{AE,8h} \pm \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 80$ dB(A) and $L_{C\,pk\,Max} \pm \boldsymbol{\varepsilon}_{pk} \leq 135$ dB;
- the noise relates to the work environment harmful risk factor and exceeds the lower action value but does not reach the limit of the higher action value, when:

  80 dB(A) $\geq L_{AE,\,8h} \pm \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 85$ dB(A) and 135 dB$\geq L_{C\,pk\,Max} \pm \boldsymbol{\varepsilon}_{pk}$;
- the noise relates to the work environment harmful risk factor, exceeds the higher action value but does not reach the limit level of sound exposure, when:

  85 dB(A) $\geq L_{AE,8h} \pm \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 87$ dB(A) and 135 dB$\geq L_{C\,pk\,Max} \pm \boldsymbol{\varepsilon}_{pk} \leq 140$ dB;
- the noise relates to the work environment harmful risk factor and exceeds the limit level of sound exposure, when:

  $L_{AE,8h} \pm \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \geq 87$ dB(A) and $L_{C\,pk\,Max} \pm \boldsymbol{\varepsilon}_{pk} \geq 140$ dB;
- the noise measurements can not be used for assessment of work environment risk factor and no conclusion can be reached, when:

  $L_{AE,8h} - \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 80$ dB(A) $\leq L_{AE,8h} + \boldsymbol{\varepsilon}_{\mathrm{L,eq}}$,

  $L_{AE,8h} - \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 85$ dB(A) $\leq L_{AE,8h} + \boldsymbol{\varepsilon}_{\mathrm{L,eq}}$,

  $L_{AE,8h} - \boldsymbol{\varepsilon}_{\mathrm{L,eq}} \leq 87$ dB(A) $\leq L_{AE,8h} + \boldsymbol{\varepsilon}_{\mathrm{L,eq}}$;

  or accordingly

  $L_{C\,pk\,Max} - \boldsymbol{\varepsilon}_{pk} \leq 135$ dB $\leq L_{C\,pk\,Max} + \boldsymbol{\varepsilon}_{pk}$ and $L_{C\,pk\,Max} - \boldsymbol{\varepsilon}_{pk} \leq 140$ dB $\leq L_{C\,pk\,Max} + \boldsymbol{\varepsilon}_{pk}$;

In this case the noise measurements should be repeated in order to obtain whether the noise relates to the work environment harmful risk factor:

- Using higher accuracy instruments;
- Performing the continuous all workday long uninterrupted noise exposure measurements.

Step 8. The measurement report. The report should comprise:

- Description of a measurement object and site. List of employees under test;
- Customer data;
- Measurement target and purpose;
- Confirmed by a customer plan of the measurements containing the sketch of measuring site(s) (for stationary and semi-stationary workplaces);
- Instrumentation with calibration history (-ies);
- Noise exposure calculation, the measurement uncertainty calculation and the assessment of a work environment risk factor.

CONCLUSIONS

This new guidance of the occupational noise indicator measurement for replacing the existing procedure in the Regulations has been elaborated to offer it to the Health Ministry of Latvia to include it in the Regulations. This guidance is devoted for easier adaptation the requirements of International standard ISO 9612. Step-by-step procedure makes it easy to measure the equivalent continuous A-weighted sound level, the noise exposure level and the sound peak measurements as well. The assessment of obtained results is much more detailed than it is given in the standard. At present there are already some laboratories following this procedure in Latvia.

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THE ROLE OF ERGONOMICS IN THE EDUCATION

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ABSTRACT

Modern ergonomics as a theoretical and practical approach had been historically restricted to industrial and military fields. It is becoming widely involved into other fields, such as office, household, leisure time etc. Education, from the kindergarten to the university levels, is not an exception. Besides the classical application of ergonomics (the adjustment of the working environment for the worker) a new practical application and scientific research field is appearing in education – educational or pedagogical ergonomics.

The main problem areas for ergonomics in education are: the adjustment of the working environment both for students and teachers; the study of different micro – and macro-ergonomic factors; the influence on teaching and learning processes; as well as the education of students as future employees for a healthy and safe working life.

KEY WORDS: Education, Ergonomics, Pedagogy, School

INTRODUCTION

Ergonomics as a science, studying individuals or groups at work, is steadily entering such fields as the office, household and school. The fundamental issue is- how well the working environment is adjusted to the needs of the worker's – also student's and teacher's – physiological, mental and other needs, in order to retain their health ensure, their welfare, and better life quality in the long term, as those factors are crucial to maximum creativity and efficiency in working/learning processes.

However, the applications of ergonomics to education considerably differ from the classical approach – adjusting the working environment to *the worker*. Firstly, according to Latvian (and many other countries') legislation only the teacher is a worker, where as from the point of ergonomics – that is each individual doing work, including the work of learning. Secondly, if only school authorities are made responsible for adjusting working places to the needs of those working, a considerable part of those working in school (e.g. students, teachers, etc.) are actually deprived of their responsibilities regarding their working environment, which is unacceptable in modern society. Thirdly, one of the tasks a school has to complete, and the very essence of educational process, is to socialize the future member of society (the student, i.e. the one being educated), which includes also preparing the student for working life thus developing his/her understanding about a healthy and safe working environment.

The goal of the research is to summarize the latest information regarding the position of modern ergonomics in the education system both from the aspect of classical ergonomics and pedagogical processes.

METHODS

In this research the methodological principles of meta-analysis were used, based both on different publications and research projects, carried out between 2000 and 2010 in several educational institutions, among students as well as teachers.

RESULTS

A school ergonomics expert T.J. Smith (USA) indicates that a student in school environment is affected by such factors as study contents and curricula, resources (textbooks, audio-visual aids, media), educational technologies, classroom and school-building ergonomics, the macroergonomics of the education system, as well as teaching/learning factors, individual (personal) factors, social and family factors [1]. These are certainly not only the ergonomic kind of aspects. Although the situation with ergonomics being regarded as an interdisciplinary science, whose object is practically anything related to the working person in working the environment, has objectively broadened the scope of classical ergonomics that mainly focused on physical environment and individuals working in it.

The analysis of publications has revealed that introducing ergonomics into school environment in accordance with contemporary tendencies is a complex ergonomic, economic and social problem [2]. First of all, this problem concerns students and teachers as *persons working* in a common environment. Moreover during the last two or three decades the information and communication technologies (ICT) have entered schools worldwide and have brought along cardinal changes regarding the technical learning aids. Besides the ICT are not only a means to process information but also a means to create new information. Meanwhile the computer as such, and the computer at school, has become one of the most important factors endangering one's health; and for those working with computer it is also important how well furniture is adjusted to their anthropometric parameters [3; 4]. It is not enough to simply instruct users on working safety or teach the basics of working methods – it is essential to considerately and carefully arrange the working environment/place in accordance with ergonomic demands, as well as to explain seemingly simple things regarding working safety and proper working methods. Furthermore students have to realize that those demands are not teacher's whims but are essential to ensure the students' health and life quality.

In recent years another component of the ICT use has emerged – safe Internet use in the personal context, which, though being of no ergonomic origin, due to the Internet addiction, has grown into a problem related to cognitive ergonomics [5]. In such context, along with ergonomic aspects, the role of pedagogy increases.

All above mentioned is complemented by the factor, that EU normative provide the issues of working safety and occupational health in school curricula, not only in respect of safety at a particular working (i.e. learning) place, but also with the purpose of developing school graduates' – future employees' – understanding of fundamental working safety and occupational health principles, and awareness of their own responsibility for their working place [6; 7]. EU pays particular interest to the safety while working with the ICT, as proven by the latest report [8].

We have to note that teachers in their everyday work have only recently (during the last 10-12 years) started using modern technologies more widely, on the one hand intensifying the teaching/learning process, and on the other hand encountering stricter safety regulations (voltage in the equipment, higher levels of psychological stress, etc.).

The latest tendency in the world is to view the issue from two aspects: ergonomics **in** school, and ergonomics **for** school [9]. The first concept – *ergonomics in school* – basically means ergonomics in the physical school environment, so called microergonomics (students' anthropometric parameters versus school furniture, schoolbags, etc.) The second concept – *ergonomics for school* – first of all concerns classroom environment (as interpreted by S. Legg and K. Jacobs, [9]), However we would rather view it as learning

environment, including learning contents, structure, organization, etc. which could also be defined as macroergonomics. The most important problem within *ergonomics for school* is how to integrate ergonomics into curricula, including teacher training curricula [9]. So we can talk of a new field for scientific research – pedagogical ergonomics.

PEDAGOGICAL ERGONOMICS

The term *pedagogical ergonomics* is brand new and synonymous to the parallelly used *ergonomics for school*. V. Kučinskas, one of the pioneers who in 1970s and 80s in the Soviet Union begun analyzing teaching/learning processes at higher (universities) level from the perspective of ergonomics, has written that *pedagogical ergonomics is a branch of pedagogy devoted to investigating teachers and students' physiological and psychological working capacities in order to determine the best conditions for retaining their health and intensifying their work with minimum consumption of their biological resources, nervous and psychic energy, as well as time and material resources, which would ensure that each participant of the teaching/learning process have adequate circumstances for their professional, mental and physical growth* [10]. So, pedagogical ergonomics concentrates on ensuring qualitative teaching/learning in ergonomically proper working environment, i.e. on fully adapting teaching/learning environment to the needs and demands of those working in it – both teachers and students, although their requirements to working environment are mostly very various due age differences, work tasks peculiarities, as well as other factors.

J.Voronina offers a slightly different interpretation: *Pedagogical ergonomics is an applied branch of pedagogic, focused on the pedagogical process as the following system – «teacher-, as pointed above student – teaching/learning aids – environment»* [11]. This version in some way broadens the classical definition of ergonomics, according to which this science focuses on the system «man – machine», where the «machine» means any technical appliance used while working. However, in any teaching/learning situation there are two main persons (workers) involved – the student and the teacher, and both of them share the same aids (machines) and methods. Moreover they have practically the same working environment, too.

J.Voronina also points out that pedagogy and ergonomics have common goals: increased efficiency of the teaching/learning (working – auth.) process, good health (aspect of safety) and personal development (convenience, satisfaction with the contents, forms and results of one's activities). At the same time, introducing ergonomics into educational processes and environment is not a simple attempt to replace the functions of pedagogy, pedagogical psychology and physiology with something new but emergence of a new sphere of cognition. This means that the fundamental focus of pedagogical ergonomics is not educational goals and contents in themselves, but the methods and tactics, how to pass study material (information) on to students [11].

Although there are also differences: V. Kučinskas believes that pedagogical ergonomics considers both the teacher and the student, thus stressing that they both work in a common environment and both do common work, J.Voronina in turn applies ergonomics solely to the student. In this case the teacher assumes a secondary role. Meanwhile Kučinskas insists that the basic feature of modern pedagogical process is cooperation.

Teachers and students certainly do have differing demands regarding school environment due to their considerably large age gap, different life experience and values as pointed above. We have to consider also the fact that part of the teacher's and the student's work is completed individually and involves no direct cooperation. All those factors affect the way we view pedagogical ergonomics.

ERGONOMICALLY ORIENTED RESEARCH IN SCHOOLS

More or less systematic ergonomics research, which included analysis of school working environment, was started in the 1960s; although separate environment ergonomics` factors had been analyzed before that. For instance, the prominent Baltic scientist G. F. Parrot, who later became the rector at Tartu University, in the turn of 18th/19th century measured oxygen levels in a school in Riga and concluded that within a couple of hours the amount of oxygen had considerably decreased [12]. Later, in the 1860s and 1870s, German scientists and physicians wrote about the *school ailments* brought about by insufficient physical activity, poor lighting, etc. [13]. The Swiss-born Russian scientist F. Erisman in 1891 wrote, that [school] hygiene was [the field], which had to demand for more concise and less complicated school curricula [14].

The research carried out in the late 20th and early 21st century is mostly devoted to evaluation students' health condition paying too little attention to the school environment factors. In Sweden research revealed that poor psychological climate triggered health problems among students [15]. In Latvia between 1998 and 2003 it was detected that every sixth student was suffering from chronic breathing and digestion system problems [16]. That was the first time the modern school environment was suspected to have impact on students' health, pointing out that approximately 14% of students in Riga had been registered as computer or the Internet addicts. Apart from that several other factors, such as too heavy schoolbags, furniture of unsuitable size, were mentioned as possibly harmful, respectively – inadequate to students' anthropometric parameters.

During the last 12 years in Latvia, mostly due to research carried out at Riga Teacher Training and Educational Management Academy in the context of school computerization, the ergonomic environment of school computer labs has been analyzed [17], along with computer usage habits of students at different ages and of teachers [17; 18; 19], also in the international context [20]. The research has revealed, that considerable numbers of students (even as many as 15-25%) and sometimes also teachers completely neglect the ergonomic demands for creative work on the computer, moreover many admit that they are not even acquainted with those demands.

Another quite acute ergonomics` problem in many countries is the weight of the school bag [21, 22, 23]. It has been and still is under research; unfortunately no unequivocal solution has been reached. And the criteria regarding the acceptable weight for school bags differ from country to country. For example, in Latvia the acceptable weight is correlated to the age of the student; in Lithuania there are regulations regarding the recommended weight of an empty school bag; while in a number of other countries those two parameters are not regulated, but the weight of the school bag is demanded not to exceed the students' weight by more than 10-12% (1).

During the comparative pilot research in Latvia and Lithuania in 2007/2008, it was detected that on average neither full nor empty school bags within the two weeks of the experiment did not exceed the limits. However, the range between the maximum and minimum weights in one and the same form varies: in Latvia in Form 4 it ranges from 2.21 kg to 5.38 kg (standard: maximum 3.5 – 4.0 kg), but in Lithuania – respectively from 2.25 to 4.42 kg. Also in the 6th Form the difference between average minimum and average maximum weight is great – from 2.91 to 5.76 kg in Latvia, and from 3.15 to 6.50 kg in Lithuania (standard: 4.0 – 4.5 kg). This reveals two problems: firstly, the weight of school bags is not reasonably balanced; and secondly – students and parents are insufficiently educated regarding the problem [22].

There has been research also into the factors of school working environment and how it is evaluated by students and teachers. The research has shown (Table 1) that among senior

students (Form 12) the average evaluation ($M_{average}$) is often slightly lower than that of younger students (Form 9), however the difference usually is statistically insignificant. Meanwhile most teachers evaluate the same components much higher, and the difference between students' and teachers' evaluations is statistically significant (Table 1). This is hard to explain from the position of classical ergonomics; obviously teachers identify themselves with the particular school to a higher degree than their students.

Unfortunately, there is little research into the influence of working environment and its separate factors on teaching/learning processes; relatively more often the effect of school environment on students' health is studied [24]. Interesting publications on the influence of school environment have been written at Maribor University (Slovenia) [25-28]. It has to be noted also that recently several encyclopedias have appeared, like the book about a safe and healthy school environment [4], and the book «Ergonomics for children» [3], which analyzes various safety and health problems among children aged 2-18. Our own studies of the subject point out that one of the basic factors for a child friendly school is ergonomic working environment [29].

Table 1. Evaluation of different components in school[1] [26]
$1 \leq M_{average} \leq 6$

COMPONENTS IN SCHOOL ENVIRONMENT	2001/02		2002/03		2009/2010		
	students	teachers	students	teachers	students	teachers	statistics
310 – are you satisfied with timetable[a]/ schedule[b]	3.2	4.5	3.6	4.3	3.4	5.1	p<0.001
401 – do you like to be in school	3.7	4.7	3.6	4.8	3.7	5.2	p<0.001
601 – do you discuss the impact of school environment on students (progress in school, health)	2.9	3.9	3.3	3.9	3.2	4.9	p<0.001
602 – do you feel safe at school	2.6	4.6	4.2	4.5	4.4	5.1	p<0.001
701 – is your workplace satisfactory	3.6	3.7	2.7	3.9	3.7	4.7	p<0.001
P01 – overall microclimate at school (air, lighting, noise etc.)	--	--	--	--	4.0	4.8	-

[1] Likert scale (1= no; 6= the greatest extent); [a] for students; [b] for teachers

In Latvian schools very little attention is paid to ensuring the use of appropriate furniture. Pilot researches have revealed that in particular schools and classrooms only one out of three students spends their whole working day at a desk of appropriate size, and only one out of five has a chair of appropriate height. Thus we have to conclude, that the system common in Latvian schools when each subject is taught in a different classroom fails to ensure that all students throughout their whole working (studying) day can use furniture suitable to their anthropometric parameters [30]. Overall inappropriate furniture along with too heavy school bags and the need to improve the ergonomic culture in the ICT use are considered the most topical problems of pedagogical ergonomics.

CONCLUSIONS

Ergonomics in school (educational environment) have to not only reach its classical goal – working environment adjusted to the needs of workers (pupils, teachers) but also include informing and educating components as a compulsory precondition for a successful teaching/learning process and for the socializing of pupils as future employees.

In Latvian schools mostly microergonomic problems are analyzed, the problems that directly concern each worker (student, teacher) during their contact with their working place and working environment. The most essential problems in Latvian schools are unsuitable furniture (failing to meet the anthropometric parameters of students), the weight of school bags, and computer use issues both for students and teachers versus ergonomic culture via introducing ergonomically correct working skills for the use of the modern ICT.

Previous investigations in pedagogical ergonomics both in the world and in Latvia have been mostly focusing on solutions to pupils' health problems and paying minor attention to teachers' working environment as well as to the impact of school working environment on the efficiency of educational processes. By extending the studies of occupational health and working safety in the context of school ergonomics larger attention will be attracted to the importance of the ergonomic component of an efficient teaching/learning process in modern education.

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ERGONOMIC ISSUES OF SCHOOL FURNISHING

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ABSTRACT

The ergonomics of school furniture is an important factor which influences both the health of pupils and their concentration upon assimilation of the educational material. Furnishing a classroom has to be complied both with modern conditions for organization of a complete educational process (use of computers, multimedia etc.), and with the individual anthropometric indicators of the students.

KEY WORDS: Ergonomics, Anthropometric Dimensions, School Furniture

INTRODUCTION

The lack of compliance between school furniture and height and body proportion of a student can result in tension of some muscle groups, painful bone alterations and eventually – abnormal figure. As per data of the Ministry of Healthcare and the Ministry of Education and Science, made on students of primary schools in Sofia, show that [1] 80 percent of the children have had spinal curvatures. In support of the said, experts report in figures that from 25 first year pupils in one class, only five are healthy. Seventeen children have an irregular posture, two have a first degree of scoliosis, and one has a second degree. In order the process of education to be complete, school furniture has to create conditions for effective work, comfort and ergonomics. Experts indicate as reason the irregular posture in sitting position, and a heavy back pack.

Pupils in primary school age are one of the most vulnerable to spinal curvatures. Due to the undevelopment of the muscle system and especially, delay in the development of the deep chest muscles and the large flexibility of the spinal column, the risk of curvatures of the spinal column and deformation of the thorax in consequence of continuous static effort and irregular working position, is too big [2].

AIM OF THE RESEARCH, MATERIALS AND METHODS

The goal of this research was to study the degree of ergonomics in a school furnishing, in classrooms of pupils from primary classes.

Subject of the study is school desks whose design and ergonomics influence the work and the health pupils. Under ergonomics in the present work, we mean the adaptation of school furniture complied with anthropometric and physiological indicators of pupils with the purpose to provide conditions of comfort, safety, and aesthetics in the teaching process.

RESULTS AND DISCUSSION

Well known are more than 200 various models of desks, but a successful combination of all pedagogical, ergonomic and economic requirements is present in only a few of them. Russian hygienist F. F. Erisman was the first to offer a construction of a school desk, which

was for many years known as «the Erisman desk type» [3, 4]. For the first time a project of a classroom prepared by him was demonstrated in 1875 in Petersburg. In Bulgarian school they used several types of desks, as the most widespread during the second half of the past century was the model improved by the Physical education and school hygiene institute at the Bulgarian Academy of Sciences and adopted as a state standard for the country. [5]. During the last years social – economic changes gave their reflection in Bulgarian schools, too. It seems as if, lately, specialists in Bulgaria being occupied in the issue of school environment furnishing have not many.

Classroom is the main studying premise where pupils spend most of their time, due to which its furnishing and structure have to be paid proper attention. E. Pisareva [6] emphasizes her attention on the area, the shape, the arrangement, the lighting of a classroom. She shares an opinion that new ways of study: «Work in bigger or smaller groups and individual work with pupils, as well as the development of technologies condition the changes in the functional and visual building of furniture».

In order the process of study to be complete, study furniture has to create conditions for effective work, comfort and ergonomics. Accordingly to Mutafov and Ivanov [7] study furniture premises has to be light, free and mobile.

Each year researchers in the USA, Canada, and the United Kingdom, France and other countries engage in the task to construct furniture (study desks, chairs), which can be flexibly re – arranged with the purpose to research and find a suitable design of furniture and a conceptual schedule of the space in a classroom. In this way they seek for a more favorable scenario for assimilation of educational material. [8]

Our research among principals of key Varna town schools found that the furniture in classrooms of pupils of primary study age is implemented on the base of the personal choice of furniture by the principal, depending on the budget with which the school disposes for a school year. This is dictated by the fact that for 3-4 years there has been a delegated budget integrated in the educational system all over the country (each school disposes of various finance resources).

After effected research of several furniture companies it was found that the most wide spread size which is offered for pupils of 1-4 class of one-seat desk is 70-50-h 64 cm, and that of a two-seat desk is – 120-50-h 64 cm. (after company «Mebeli Korekt Stil» (Correct style furniture). As per «Mebel factor» a suitable size of one – seated desk is 69-50-h 64 cm, and for two – seat desk is – 118-50-h 64 cm. [9, 10, 11].

Another issue which is outlined in the primary course of some schools (Secondary school of general education «St. Kliment Ohridski» – Varna) is that in a classroom there go two classes of pupils (in two consecutive shifts: first and second), for example first and fourth class. This suggests that in the classroom there should be combined desks in two sizes, so that to be suitable for pupils.

From what was said so far, we can summarize that classroom furnishing is a task which has to be related to individual anthropometric size of pupils.

In the average Bulgarian school desks in a classroom of pupils (1-4 year) are most often organized in 4 rows by 6 one – seat desks, or in 3 rows by 4 two-seat desks.

A classic desk which is a prototype of the construction of Erisman consists of a desk with a table top for writing, a seat and a back, linked between each other. Models which are used nowadays have two types. The first type uses the prototype of the construction of Erisman, and the second one – there the working place is organized by a table top for writing and a separate chair.

It is very important that pupils in the early stages of their physical development build a habit to seat in a correct position, namely – a pupil has to be in straight position while body is vertical and head is slightly leaning forward [7].

At the second model of school furniture (table for writing and a separate chair), observed is a difficulty of pupils to adjust the distance between their chair and the table as per their anthropometric characteristics. The main requirement for distance is not observed here. [3] Due to the lack of habits for work in a correct working position, for the pupils from primary courses this model of school furniture is absolutely unsuitable.

Observations show that in a mass Bulgarian schools desks in a classroom are not complied with individual height characteristics of pupils. Rooms are furnished with furniture configurations of desks with a size for primary school age – 7-10 years of age, which is not complied with the various anthropometric characteristics of pupils. In this way a desk is not ergonomic for children of a smaller height. This is a precondition for having of an uncomfortable sitting position, which leads to curvatures of the spinal column. An uncomfortable position is also a factor for acceleration of the occurrence of fatigue and tiredness among pupils. Sitting for hours on uncomfortable chairs, pupils loose concentration and interest in teaching material.

In modern conditions furnishing of classrooms is granted to companies producing furniture which determine the size marking and individual deviations in the pupils' height is not taken into account.

In schools one offers standardized furniture as per the BSS (Bulgarian state standard), but mostly consisting of a separate table and a chair, and not of an interlinked construction. With a view to physiological peculiarities of children in primary school age it is more expedient to use desks.

Given examples show that modern school furniture in a mass Bulgarian schools are not ergonomic enough concerning the comfort and the creation of conditions for efficiency of the educational process. That is why our opinion is that upon choosing school furniture it is good to have a consultation with specialists – medical and ergonomic ones.

CONCLUSIONS

As a conclusion we can note that for improvement of the ergonomics of school furniture it is necessary to pay attention to individual needs of pupils while furnishing a classroom. They have to have the opportunity for flexible transformation with the purpose of providing an ergonomic working place for each pupil.

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ORGANIZATION AND MANAGEMENT OF MEDIATION SYSTEM: MACRO-ERGONOMIC ASPECTS

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ABSTRACT

Management and decision making competence of organizational system managers are the main intellectual tools that provide system ergonomic working ability. Unskilled mediation system managers make poor decisions and reach erroneous conclusions, but their incompetence denies them the metacognitive ability to recognize their mistakes. By taking into account a body of the basic non-conflictogenic management and decision making principles, it would be possible to ensure qualitative or ergonomic mediation services, which combines different organizational mediation service subsystems and are understood and accepted by the society.

KEY WORDS: Mediation, Macro-ergonomics, Non-Conflictogenic Management and Decision Making, System, Manager

INTRODUCTION

The number of conflicts, disputes and disagreements in the world grow from day to day. The number of court proceedings grows at the same rate. The capacity of the state justice system is insufficient for the amount of work. And the state budget resources are insufficient too support the resolution of disputes. This creates a tension in the relationship between the justice system and the society, the justice system and the state government, the state government and the society and within the society.

With the goal to improve the work of the state justice system and to relieve the possibilities of resolving actual disputes, the world's politicians and experts are looking for alternatives to court proceedings. Mediation is one of those methods, which is one of the alternative possibilities to court proceedings offered by the private sector that is used ever more.

Mediation does not only play the role of resolving disputes and conflicts. In the ergonomic context, mediation is considered as macro-ergonomic instrument that stabilizes the work of the state economic sector. A lot of hopes are put on the potential possibilities of mediation to harmonize both the economic and social environment by representatives of the public and private sector alike.

However, in many places in Europe, including Latvia, the institutionalization process of the potential ergonomic instrument mediation occurs very ineffectively and without significant results. The simplified understanding of mediation, which comes together with the tradition of social mediation of communities, negatively affects the political thought and the results of the mediation institutionalization processes carried out by the state government. This complicates not only the development of a national mediation service system, but also the performance and competitiveness of a society.

The aim of the study is following: on the basis of verities from scientific literature and empirical experience from expertise, to discover problems from drawing up the mediation services quality that are unexplored in ergonomics scientific studies, and offer their solutions.

MATERIALS AND METHODS

The study was carried out in the holistic context of the systematic approach. The following instruments were used in the study and its description:

1. review of scientific studies, selection of the necessary theory analyses and positions;
2. meta-analysis of the published studies related to the professional competence of Latvians;
3. interview results of five Latvian experts relevant to the study topic, chosen by the author;
4. synthesis of recommendations suitable for overcoming macro-ergonomic problems related to the determining mediation quality based in theory of non-conflictologenic management and decision making.

RESULTS AND DISCUSSION

Globally mediation has long developed as a simplified, voluntary work method for solving disputes carried out in the amateur level and offered to the society. However, in many places around the world, including Europe and Latvia as well, state governments are currently working with mediation institutionalization processes. These processes are encouraged by Directive 2008/52/EC of the European Parliament and of the Council of 21 May 2008 «On certain aspects of mediation in civil and commercial matters» [1]. The laws and regulations of the European Union urges the governments of the member states to define mediator competences and quality requirements for mediation results, organise the provision of education and training necessary for qualification, ensure mediation service quality control in the state carried out by the public sector. The authorities of the European Union emphasize that the member state public sectors have to do everything possible to create real and effective mediation systems within the states.

When studying the regulations cognizable for the Latvian justice system, we can state a logic feature, namely: these regulations accent the process effectiveness and result quality provision require [2, 3]. However, empirical studies show us that the lack of guidelines and the related weak competence capacity encumbers the work of politicians, managers and specialists of the Latvian public sector. The persons involved in the institutionalization can't understand how to deal with a task, and also encumbering the work process of developing the system itself, as well as doing the same to the communication processes with the society.

Within the scholastic and empirical discussions related to mediation ever more often information appears regarding the failures of the mediation institutionalization process: low quality development of laws and regulations regulating mediation, disputes between the mediators themselves about the choice of the type of mediation, relation of low mediator qualification to the deformation of the point of mediation etc. The fact that the creation of new laws and regulations isn't meaningful has been emphasized: the terms set and other minimal requirements are met in the work of the state government institutions, but these regulations don't involve forms, which ensure a correct mediation content and an effective process.

When looking from an ergonomic point of view, we can say that the institutionalization process of mediation is not positively ergonomic, besides, mediation itself, which should become a macro-economical instrument, becomes the opposite due to low quality management – ergonomically negative and conflictogenic environment.

Ergonomics in the original translation from the Ancient Greek language means school about work (*ergon*) – human work and force, *nomos* – law, school, and rules. The initial studies on ergonomics are focused on the coordination of the mutual relationship between humans and technology. Modern ergonomics has moved much further forward in its studies and discoveries. It has become a congruent with the new paradigm of economics and management sciences, which sees a person and his career or management competences as the main component in the work process [4, 5, 6].

Ergonomics is the study of the human interaction with the tools workers use, the work process, and the environment workers function in. The goal is to fit the qualitative job and healthy workplace to the person. Ergonomics recognizes the capabilities, differences, and limitations of individuals, and adjusts the tools or environment accordingly. Ergonomic as a branch of science should pay much more attention to studies about the macro-ergonomic environment, and the focus on the external environment items affecting a person's work should be more secondary, primarily moving towards human competence. Without competence, a person is without the ability to correctly use material instruments as well as good methodology. Without a career or self-managed competence, a person is without the ability to organise a system and manage its work processes.

Not only practices based on empirical experience, but also the modern science is returning to the old view that a person is a single, indivisible bio-psycho-social entity. The expert of medical sciences Orem emphasizes that the care of a human health includes not only the resolving if physical and mental, but also development problems. Orem emphasizes that the natural state of an individual is the ability of self-care, which she defines as «*a body of practical actions, which individuals initiate and carry out for themselves, upon their own initiative, maintaining and preserving life, health and good feelings*» [7]. The internal resources necessary for an individual's self-care are: strength, will power, knowledge, but external: environmental physical factors, social factors, mental factors, psychological factors.

Thereby the human performance is primarily dependent not on the structure of technology, but the quality of a person's entirety. In the work environment the quality of a person's entirety is directly dependent on the organization of the work system and especially – its management. However, the quality of the organization and management is dependent on the manager's competence. «The goal of the management of any organization is to duly determine the objective tendencies of worker management, the impact factors, as well as the potential, to effectively use it in the work process. The basis of organizational development is the human capital, but the task of the management is to consolidate people's knowledge, experience and innovations as the process driving forces» [8].

Even the concept created by the psychology expert Rogers on a *person-centered approach* and his doctrine on *fully-functioned person* [9] are still the basis of modern economic, psychological, sociological, philosophical and management paradigms. The person-centered approach ever more often is used as the basis for human resources and career management. Modern theoreticians and practitioners still refer to Rogers, by using the verities from his works.

The advantages of a systematic and holistic approach in solving work and private life problems are also revealed by the theoretical stances of Bloch, Mogilevkin (Могилевкин), Patton and MacMahon [5, 10, 11, 12]. These scientists are unified by the fact that the utilization and management of human resources in the 21st century has to set new goals and has to look for new methods, making them dynamic and elastic in the changing environment, able to work with an alternating goal.

The scientific concepts mentioned are congruent with the definition of macro-ergonomics. According to Hendrick and Kleiner, macroergonomics is «the subdiscipline of ergonomics that focuses on the design of the overall work system. Conceptually, a top-down sociotechnical systems approach to the design of work systems and the carry-through of the overall work system characteristics to the microergonomic design of human-job, human-machine, and human-software interfaces to ensure that the entire work system is fully harmonized» [13]. A work system consists of: personnel subsystem, technological subsystem, internal environment, organization and management; and external environment [14].

As a result, we can assert that the management science is directly related to the ergonomics, while both of these – with people's health. Effective management theories and guidelines, which are used by competent persons, form an ergonomic or healthy work system.

A study was carried out in the 2nd quarter of 2011 by the University of Latvia (UL) management doctoral science and the foundation «Institute of Conflictology» (IC) to evaluate the effectiveness of the Latvian state government mediation institution processes the quality of their results. The study found out the opinions of 5 experts representing the public society and interested in the quality of mediation services. The experts studied the state government work results which are directly available in the public information space, evaluating them as artefacts of public administration work culture. In the context of artefacts, also the state government communication with the direct mediation subjects – society as the potential user of the services and the potential service providers – was studied.

The experts evaluated the Latvians state government work culture on a scale of 10. The 10 grades of the evaluation are arranged in negative, neutral and positive. The average evaluation of experts arranged itself in these mathematical evaluation ratio: positive evaluation – 0.8 grades, neutral evaluation – 0.8 grades, negative evaluation – 8.4. The study actually showed unbalanced state government decisions on policies and regulations, realized during mediation institutionalization process in Latvia, as well as negative tendencies regarding the organization and management of the mediation system. (Scientific article «Mediation institutionalization culture in Latvia» by L. Landzmane is being prepared for publishing in the 14. International scholastic conference «Society and Culture: Borders and New Horizons» collected articles).

The tendency of state government strategic planning not being in balance with the reality can be considered as an overall problem for Latvia's state government. In the 1st quarter of 2011, UL and IC carried out a study, which looked at the conflictological aspects of Latvian international competitiveness. For obtaining results for the empirical part of the study, the goals included in the Latvian state government decisions were compared to results of research based on statistical results. Even this study revealed actual unbalanced decisions given in the state government policies and regulations, inadequacy of Latvian resource capacity to the goals formed by the state government. (Scientific article «The conflictological aspects of the economy's international competitiveness» by L. Landzmane is being prepared for publishing in «LU collected articles. Management Science, 2011.»)

The scholars Dunning and Kruger explain incompetence as an objective phenomenon, asserting that a person can think, judge and decide within the borders of their own knowledge, because sometimes a person can't even apprehend other competences, unless he finds out about it [15]. Kruger and Dunning noted earlier studies suggesting that ignorance of standards of performance is behind a great deal of incompetence. As Kruger and Dunning

conclude, «the miscalibration of the incompetent stems from an error about the self, where as the miscalibration of the highly competent stems from an error about others» [15].

The theses put forward by both scholars are congruent with the verities of sociology and conflictology, which considers the determination and inclusion of competence criteria in the regulations (professionalization and institutionalization) as the only possible, therefore practicable, instrument for preventively and directly regulating people's internal and external conflicts. If it is not done, a person automatically tends to incompetence.

To solve the inability of management science to deal with the problems of the modern times, conflictology is rapidly developing in the USA, Russia, and Australia and in many other places around the world. Conflictology (Latin: conflictus – «clash, discord» and Greek: λογία – «teaching, knowledge of») – a branch of science, whose goal is to gain knowledge about the regularity of origination, formation, development and termination of disagreements, contradictions and clashes in nature, humans and society. The theories offered by conflictology, by empirically checking observations and experiments, form systems, processes, methods and instruments suitable for practice. The scholastic stances and guidelines are developed in the conflictology environment for the good of management sciences – for making the management of social and economical processes more effective [16, 17].

The issues studied by the conflictology scholars include the ergonomic issues – the welfare of state and its population, work organization, human performance and competitiveness. Conflictology theoreticians emphasize that the basis of competitive advantages is the ability of non-conflictogenic management, including – the inability of leaders to make non-conflictogenic decisions («conflictogenic» – term used in conflictology). Conflictology indicates that the effect of incompetent decisions on the work of a manageable system is always direct and significant. It reduces the possibility to work effectively, reduces competitiveness, creates and enhances conflicts, negatively affecting the work environment ergonomics. The conflicts are not created by the decisions in themselves, but the contradictions, obstacles and barriers that arise from carrying out these decisions and in the process of achieving goals. Science admits that even an increased ability of the work colleagues can deal with conflictogenic situations, doesn't reduce necessity of a competent management. It should be done, with the prevention of conflicts in the manageable environment and positive ergonomics on mind [16].

By taking into account the congruence of ergonomics and conflictology, the recommendations developed by representatives of conflictology can be used in ergonomics. To improve the management of an organizational system (increase positive macro-ergonomics), the scholars of conflictology, Ancupov and Baklanovski (Анцупов, Баклановский) recommend to follow the principles of an non-conflictogenic management. The management competence should be realized systematically, dividing the decision-making process into stages and management models.

The preparation of the decision is considered a priority: stage 1: Descriptive module (key question: What is?); stage 2: Evolutionary-dynamic module (key question: What tendencies?); stage 3: Explanatory module (key question: Why so?); stage 4: Prediction module (key question: What will be?); stage 5: Target module (key question: What do we want?).

An important part of a non-conflictogenic of macro-ergonomic management process is a non-conflictogenic or ergonomically positive decision-making: stage 1: Content decision-making (key question: What to do?); stage 2: Technological decision-making (key

question: How to do?); stage 3: Trial of execution of decision; stage 4: Evaluation of the results of the trial of execution of decision; stage 5: Optimization of the decision.

The work of a manager doesn't end with ensuring a macro-ergonomic management of a system with well-grounded decision-making, but only starts. The progress and development of modern events is dynamic, varied and complicated. It is impossible to predict details and contexts, as well as their effect on the progress of an ergonomic process. Within the decision execution, there are usually situations, which force the decision to be specified, reviewed and sometimes remade. After the decision-making, dynamic actions and decision-making from the manager begin: stage 1: Execution of the optimized decision; stage 2: Evaluation of the work results; stage 3: Operative correction of actions and decisions; stage 4: Evaluation of the final work results; stage 5: Decision about ending the actions (related to the execution of decision). [16].

This paper used relatively new meta-science field conflictology positions, guidelines and methodology. Conflictology theory helped understand and evaluate the system, including: the conflictogenic aspects of the public sector and its subsystems, offers guidelines and methodology for non-conflictogenic decision-making.

When comparing conflictology and ergonomic theories and methodologies, we can deduce that they are different within the focus of the research, even though the overall goals of both are synergic and congruent – they anticipate the harmonization of the human society and human life quality.

As a result of the study it is possible to advance a hypothesis that within the ergonomic science and practices, discussions about the ergonomic use of material items or theoretical methodology can be ineffective, if they don't primarily involve discussions about the role of a person in the organization and management processes, including: in the processes of setting goals and decision-making.

The theoretical stances and empirical studies found in science determine that even the organization and management of mediation, including the mediation institutionalization processes should be evaluated both quantitatively as well as qualitatively. The organization and management of a mediation service system processes is the direct result of a person's performance. However a person's performance in the organization and management of systems and processes is dependent on the healthy or ergonomically positive competences.

CONCLUSIONS

1. Today science ever more actively is asked to take part by using new multi- and inter-disciplinary, systematic, holistic and integrative approaches. These approaches are especially topical when science takes part in the solving of problems of the organization and management of economic and social processes in the new era.
2. The research was carried out by using the scientific theories and statements of holistic approach and system theories as the basis.
3. By taking into account a body of basic non-conflictogenic management and decision making principles, it would be possible to ensure qualitative or ergonomic mediation services, which combines different organizational mediation service subsystems and are understood and accepted by the society.
4. By integrating non-conflictogenic management and decision making principles in the theoretical and practical economics, it would be possible to develop new methodology, which could be offered for the harmonization of the work management of other areas, for reaching the ergonomic goals.

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SURVEY OF WORKPLACE HEALTH PROMOTION PROGRAMMES

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ABSTRACT

The aim of this paper is to summarize the main results of international literature on workplace health promotion and to review the best practices of workplace health promotion programmes. The programmes, summaries and recommendations of the World Health Organization, the European Union and the European Network for Workplace Health Promotion are reviewed. The first part defines workplace health promotion. The second one describes the quality criteria of workplace health promotion programmes. The third part shows the Move Europe, and other European-wide campaigns of the European Network for Workplace Health Promotion where these criteria have been used in selecting models of good practices of workplace health promotion. The last programme (MEPMIS) showed in this article is an example for adaptation of good practices in EU.

KEY WORDS: WHP, Quality Criteria, Programmes, Move Europe, Campaign, Models of Good Practice, MEPMIS

1. THE DEFINITIONS OF WORKPLACE HEALTH PROMOTION

Workplace health promotion (WHP) is a modern company policy, which aims at disease prevention and improves possibilities of health and well being at workplaces. To reach these aims, a wider range of tools have to be used than in traditional occupational health and safety, namely personal development and orientation of the organisation in the above direction. WHP includes all measures applied by employees, employers and civil organisations, which serve the improvement of employees' health and well-being. At workplaces, like in all settings of health promotion, accidents and illnesses can be prevented, healthy and safe circumstances can be provided, and those information and methods can be advocated, which enable healthy behaviour and lifestyle.

1.1. THE DEFINITION OF WHP BY EUROPEAN NETWORK FOR WORKPLACE HEALTH PROMOTION

Since its establishment in 1996 «Healthy Employees in a Healthy Organisation» has been the vision of the European Network for Workplace Health Promotion (ENWHP). The Network was founded when the European Union adopted the Action Programme on Health Promotion, Education, Information and Training to improve public health standards in Europe. In the Action Programme workplaces were accorded a special role. WHP has verifiable effects and serves common interest as well as it promotes social and economic prosperity. Since its establishment the ENWHP has grown steadily and has currently 31 members from national health and safety and public health organisations of the EU Member States, Switzerland and countries of the European Economic Area. Over these years the network has made quite an impact: successfully formulating a general definition for workplace health promotion in Europe; developing standardised criteria for

good quality WHP and publishing reports with models of good practice (MOGP) from a wide range of industrial sectors. The ENWHP has also developed a European toolbox of successful practices and identified strategies to help keep workers longer in employment. In addition, national forums were established by the members of ENWHP in recent years to disseminate information on WHP to a wider audience.

In the Luxembourg Declaration [1] members of the ENWHP agreed on a common understanding of WHP: «Workplace Health Promotion (WHP) is the combined efforts of employers, employees and society to improve the health and well-being of people at work. This can be achieved through a combination of:

- improving the work organisation and the working environment;
- promoting active participation;
- encouraging personal development.

1.2. THE ENWHP'S CLASSIFICATION SYSTEM

The ENWHP developed a «toolbox» which can be used to identify, collect and evaluate programmes, MOGPs or instruments suitable for improving or promoting health at workplaces, particularly for giving solutions to health related problems such as ageing, disability, alcohol abuse, smoking, unhealthy eating habits, poor mental health and stress.

A WHP tool can have different forms:

- concepts and instruments for developing commitment from various types of stakeholders (i.e. social marketing, policy development or networking methods);
- instruments for identifying needs and problems related to WHP (i.e. evaluated questionnaires);
- instruments and programmes for WHP intervention and implementation (i.e. training courses, relaxation or exercise programmes);
- instruments for evaluating WHP activities (i.e. process- and outcome-related instruments and indicators);
- models of Good Practice (in large companies, small and medium enterprises (SME), public administration).

The toolbox deals with the question of how or with which methods and practices good WHP can be achieved. Aims of the toolbox are:

1. Identify and assess useful WHP methods and instruments from every European country.
2. Organise a European 'exchange pool' of tools for WHP.
3. Deliver strategic input for the national forum work.

The term «toolbox« is very strongly associated with the level of specific instruments and measures. However, this toolbox also covers projects and programmes. Therefore an inclusive approach was developed which covered the MOGP outcomes (projects, some of them reflecting corporate wide programmes) as well.

ENWHP classifies WHP activities according to the following 4 aspects [2]:

- types of tool categories: programmes, MOGPs, and instruments;
- lifestyle Issues: nutrition, exercise, smoking, alcohol, mental health and stress;
- work organisation/ personnel and corporate health policy issues: ageing workforce, work-life balance, diversity, gender equality, leadership, training, disability management, work satisfaction and networking;
- setting: SME, Larger sized companies, Health care, Public administration, School.

«The toolbox contains effective WHP methods and instruments which are being used in practical context in all European countries. The collection therefore represents a true European 'exchange pool' for WHP practitioners and decision makers in the fields of human resource management, occupational health and safety and public health.» [3]

2. MEASUREMENT METHODS OF SUCCESSFUL WORKPLACE HEALTH PROMOTION PROGRAMMES

Several organizations have evaluated the success of WHP actions so far. In this article the most complex and most commonly used criteria in international practice are discussed: the criterion systems developed by WHO and ENWHP – with the support of the European Union.

2.1. WORLD HEALTH ORGANIZATION CRITERIA

One of the first international models for evaluating WHP actions was the scheme developed in the 90'ies by the Australian Queensland State Steering Committee with the support of the World Health Organization (WHO) Regional Office for the Western Pacific [4]. It includes twelve principles that conduct WHP on an agreed basis by employers, employees and – where appropriate – health professionals. The principles of effective WHP, in order of priority, are as follows: Workplace health promotion programs should

1. be cost-effective and may not be expensive
2. acknowledge and support workplace health and safety
3. be managed by the workplace (rather than a government agency or private consulting firm)
4. include an assessment of needs to identify health problems/concerns in the workplace
5. require voluntary participation
6. include training in health promotion principles
7. be sustainable
8. acknowledge social justice principles
9. include evaluation processes
10. use mixed strategies as appropriate
11. involve family members (where appropriate)
12. consider the structures, cultures, laws and policies of the workplace.

According to the authors of the above article [4] key indicators of a successful workplace health promotion initiative are:

- Participation*:* all staff must be involved in all phases.
- Project Management: measures and programs should be based on the problem-solving cycle: needs analysis, setting priorities, planning, implementation, continuous monitoring and evaluation.
- Integration*:* programs should be integrated into a company's regular management practices and should strive to formalize workplace health promotion strategies into a company's corporate plan.
- Comprehensiveness*:* programs must include individual-directed and environment-directed measures from various fields.

These factors collectively display a clear shift from the behaviour orientation to a combination of behaviour-related and organization-related measures.

The WHO Regional Office for the Western Pacific [5] developed the following guiding principles of healthy workplaces: 1. comprehensive, 2. participatory and empowering, 3. multi-sectoral and multidisciplinary cooperation, 4. social justice, and 5. sustainability. On the basis of these guiding principles they elaborated a checklist that workplaces can use as a tool for identifying workplace health problems. The list involves six main topics and criteria for healthy workplaces: 1. workplace policies, 2. organizational environment, 3. physical environment, 4. lifestyles and personal health skills 5. health services, and 6. impact on the external environment.

2.2. THE ENWHP CRITERIA

In the following section the complex evaluation system developed by ENWHP is described.

The ENWHP evolved a uniform criterion-system, a toolbox, and makes its collected knowledge accessible through conferences, publications and internet based services, while continuously keeping them up to date. The Network started to collect MOGPs in the field of WHP in 1997. The system of quality criteria was developed in 1999 on the basis of these collected experiences. It covers the following six areas. [6, 7]:

1. **Workplace Health Promotion and Corporate Policy:** The success of workplace health promotion depends on being perceived as a vital managerial responsibility and its integration into existing management systems.
2. **Human Resources & Work Organization**: The most important task of health-promoting human resources and work organization is to consider the skills of the staff. The crucial factor for the success of workplace health promotion is that all employees are actively involved as much as possible in planning and decision making.
3. **Planning Workplace Health Promotion:** Workplace health promotion is successful when it is based on a clear concept which is continuously reviewed, improved and communicated to all staff.
4. **Social Responsibility:** Another crucial factor for the success of workplace health promotion is whether and how the organization fulfils its responsibility in dealing with natural resources. Social responsibility includes the role of the organization at local, regional, national and international level regarding its support of health-promoting initiatives.
5. **Implementation of Workplace Health Promotion:** Workplace health promotion comprises measures for health-promoting job design and the support of healthy behaviour. It is successful when these measures are permanently interlinked and systematically implemented.
6. **Results of Workplace Health Promotion:** The success of workplace health promotion can be measured by a number of short, medium and long-term indicators.

The above criteria can be mostly implemented at large corporations, at multi-national companies, and in the public service. They are however too complex to evaluate the WHP practice of SMEs. Therefore ENWHP simplified the criteria and created a less complex system for SMEs focusing on three main areas: 1. leadership and participation, 2. business process, and 3. results.

3. CRITERIA USED IN SELECTING MODELS OF GOOD PRACTICES

3.1. MOVE EUROPE

After having developed the quality criteria ENWHP initiated another large MOGP collection in 2006. The initiative was coordinated by ISPESL/University of Perugia with the title Move Europe. Twenty six European countries took part in the 3 years programme. The initiative received financial founding from the Directorate General for Health and Consumers of the European Union. The program mobilized companies in a comprehensive campaign for the realization of the vision: «Healthy Employees at Healthy Workplaces». The main aims of the campaign were:

- collecting and rewarding the best European WHP practices based on uniform criteria, and contributing to their dissemination.
- contributing to the recognition of the positive impacts of WHP
- providing practical evidence for managers that WHP is a returning investment
- sharing experiences of lifestyle related WHP programs with the participating European countries.

The quality criteria were the basis of the online «Company Health Check». By filling in that questionnaire companies could join the Move Europe initiative. Based on the Company Health Check, another questionnaire was used to evaluate the WHP programs of the companies. The following criteria were used in the questionnaires to identify properly planned and implemented WHP MOGPs:

1. supported by and involvement from management,
2. supported by and active involvement/participation of employees,
3. ongoing communication between and towards all stakeholders,
4. supported by the corporate policy,
5. integrated in the corporate strategy, systems and processes,
6. based on a structured approach,
7. based on a needs analysis and/or risk assessment,
8. supported by the necessary material resources,
9. providing information and training on WHP,
10. evaluation and monitoring of the program,
11. based on effective measures and scientific knowledge,
12. characterised by continuous improvement,
13. comprehensive.

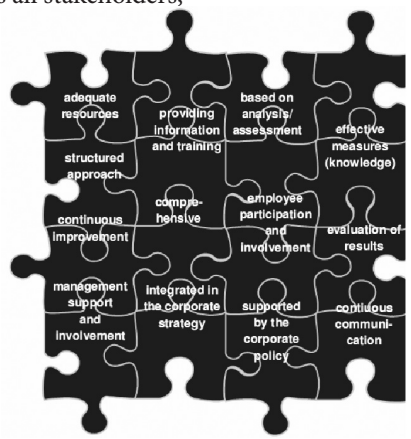

Fig. 1. Best Practice according to ENWHP's quality criteria [recource: www.enwhp.org]

In addition to the quality criteria, the adaptability of the workplace health promotion program is also a measurable aspect. On the basis of the following adaptability criteria it can be decided, if the WHP program is a good practice or not:

1. the possibility to apply the WHP programme/activities in other situations/circumstances,
2. accessibility,
3. the efficiency of the project – costs related to quality.

Based on the great success of the Move Europe campaign ENWHP's subsequent initiatives have focused on specific themes of WHP such as mental health and chronic diseases at the workplace, using the same criteria.

3.2. FURTHER INITIATIVES FOR SELECTING MODELS OF GOOD PRACTICES

In 2009-2010 the 8th ENWHP pan-European initiative was led by BKK Bundesverband Germany. It had the following aims: increasing awareness of the needs and benefits of mental health promotion at work, attracting companies to participate in the campaign, convincing employers that it is worth investing in mental health promotion, designing practical measures and models of promoting mental health at the workplace and encouraging the exchange of experiences [8]. Examples of good practices were collected using the same criteria as in the Move Europe campaign.

ENWHP's next initiative, Promoting Healthy Work for Employees with Chronic Illness – Public Health and Work (PHWork) will be carried out under the leadership of Prevent, Belgium. The aim of the project is to develop guidelines for workplaces on how people with chronic illness can stay at and return to work. It will focus on management strategies, interventions and good practices targeted on specific chronic illnesses taking into account the size and the sector of the company. The campaign disseminating the guidelines will target companies, convincing them to incorporate these interventions into their health and human resources management strategy. Based on the criteria used in the previous initiatives of ENWHP MOGPs will be selected on how to retain people with chronic illness at work and make it possible for them to continue in employment during their treatment and to return to the labour market after it [9].

There is another example of the adaptation of good practices: the MEPMIS project. The inappropriate use of substances by employees causes problems in companies for many of European employers. These include increased sickness absence, lower levels of performance and reduced productivity of staff. That in turn can undermine the firm's competitiveness and position on the market. The MEPMIS project is working to tackle these problems. The project is creating an e-learning package, accessed via the MEPMIS website, which teaches line managers practical ways in which they can help minimise the impact that the inappropriate use of substances has on their organization.

Project objectives are 1) to identify the learning and skill needs of line managers in European SMEs in terms of addressing substances use, work and employment; 2) to use the experience gained in two UK training projects to develop a training resource; 3) to identify and incorporate innovative experience from the UK, Hungary, Ireland, Italy, the Netherlands and Poland into the resource; 4) to develop the resource to be published – including textual development, piloting, evaluation, publication, launch and dissemination.

The expected outcomes of the project are a dedicated website which provides an e-learning platform, expertise and capacity to develop and provide 'face to face' training courses in each of the partner countries, and resources on the subject of substances and work which can be used by line managers and supervisors in SMEs and larger companies. The adapted e-learning is available at www.alcoholdrugsandwork.eu.

CONCLUSION

This paper summarizes the quality criteria for good workplace health promotion programs gathered and developed by international organisations such as the World

Health Organization and the European Network for Workplace Health Promotion. Their programmes and recommendations are described and reviewed where these criteria have been used in selecting models of good practices of workplace health promotion.

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IDENTIFICATION OF SITTING POSITIONS WITH ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

The seating time of wheelchair users can exceed 18 hours, but the adverse effects of sitting position can be reduced with good sitting behavior, i.e. regular position changes, dynamic sitting. The sitting of people with spinal injury should be static because of the loss of sensation, that leads to persistently high local pressures creating the conditions for the development of pressure ulcers.

To learn the good sitting behavior, to operate a patient-handling or biofeedback device the duration and the quality of the actual sitting positions should be on-line instrumentally evaluated.

It was published that the identifying of sitting positions possible with pressure mapping instrument applying cluster analysis. In this paper sitting positions are identified by the application of artificial neural networks to processing the data of a pressure mapping instrument.

KEY WORDS: Wheel-Chair, Pressure Mapping, Artificial Neural Networks

INTRODUCTION

According to the latest census from 2001 there are about 580,000 people who consider themselves disabled, out of the ten million Hungarian citizens. Out of this population 320,000 are people live with physical disabilities including 50,000 wheel chair users.

The goal of the Guruló («Rolling») project is to provide clients with assistive tools adapted to their current personal needs based on an ICF-examination. [2] The € 5,2 million project was started in September 2008 and created a national network of seven regional assistive tools workshops with a central workshop being at MEREK headquarters in Budapest. The network aims to effectively help the vocational integration of 4000 people with disabilities by March, 2012.

The role of workshops are not only safety audit, maintenance and repair of assistive technology, but to perform adjustments and individual settings of assistive tools using ICF methodology to evaluate the problem of the clients. Teams consist of physiotherapists, orthopedists and two mechanics has also added value services like guidance, or training clients and their families about the appropriate use and proper settings of items.

Workshop also acts as methodological centers offering courses to students and professionals about the use of ICF and the adjustment and proper use of assistive tools. Addition to the ICF evaluation a computerized pressure mapping device is used as an instrument in deciding about proper body position, to help the design of seating and to support training the proper sitting position.

SITTING IN WHEELCHAIRS

The harmful effects of the permanent seating position could be reduced by a favorable seat design, or the frequently changed body position, namely by the dynamic sitting.

The risk of sitting is higher with the use of wheel-chair and in the case of failure of sense a long term static overload emerges, causing a stable local high pressure value that creates further conditions for pressure ulcer.

To decrease the risk of harmful effects of sitting the sitting pattern should improved by learning a proper sitting behavior or by using devices which instrumentally monitor the actual sitting position and the dynamics of the seating, evaluate the current risk, and give feedback to the end user visually or e.g. tangibly.

The basic idea of the proper sitting behavior is setting of the optimal time sequence of different optimal or at least acceptable sitting positions. The principal is that the person should know the favorable body positions, should know how to take on the favorable body positions, and would be able to move to change among these positions.

Unfavorable body-positions are frequently observed because the favorable body position does not certainly mean that it is a comfortable one. The pain or the uncomfortable feeling originated from the long lasting static sitting normally leads to body movements such modifying the pressure distribution.

In the case of wheel-chair usage on the seating or contact surface pressure peaks could appear and may last for a while leading to pressure ulcer. There is a coherence between breakdown of cell tissue, as well the length of impact, and its intensity, if the intensity or the length of impact increases, there is more chance for the breakdown of cell tissue. [3] So it is very important that the pressure load of certain parts of the body surface do not last too long, so the pressure peaks could shift, with the frequent body position changes.

This situation is more unfavorable for the vertebral paralyzed, because the lack of sense does not cause discomfort, preventing the change of body position spontaneously.

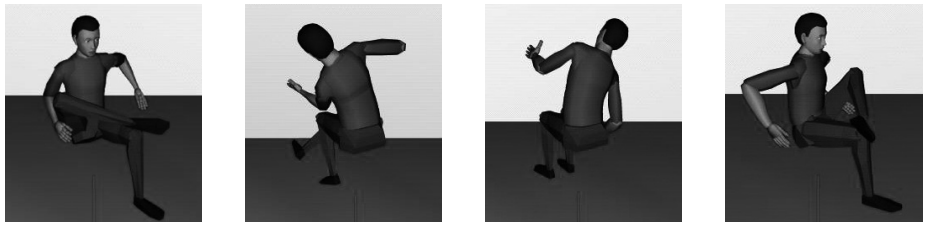
Among experiments done for the prevention of pressure ulcer by tactile feedback some base on pressure mapping. In these cases the pressure distribution is measured and processed on-line, and it forms and indicator which trigger the feedback.

By monitoring persisting pressure peaks or by recognition of patterns of the measurement points the critical postures should be identified from pressure distribution. A method is described in detail by Tan, who has 14 different posture pressure distribution patterns identified using cluster analysis for pattern recognition. [4]

METHODS

An mFlex 16*16 sensor pressure mapping mat device was used to record a total of 212 pressure distribution of one person in four seating positions (leaning left, leaning right, right foot on left knee, left foot on right knee). The measurement was recorded in the range of 0 … 200 mm Hg. (Figure 1.)

IBM SPSS Statistics 19 was used to data analysis. Independent variables used in the assessment were the measurement values A1... P16, the target variables was the sitting position.



right ankle on left knee leaning left leaning right left ankle on right knee

Fig. 1. Seating positions.

RESULTS

Artificial neural network are used extensively for the solution different problems, including pattern recognition. Generally Artificial Neural Networks are basic input and output devices, with the neurons organized into layers.

In the IBM SPSS Statistics 19 the multilayer perceptron is a supervised learning network with up to two hidden layers. The MLP network is a function of one or more predictors (also called inputs or independent variables) that minimizes the prediction error of one or more target variables (also called outputs).

The samples are divided into thee partition. The training sample involves the data records used to train the neural network. The testing sample is an independent set of data records used to track prediction error during training in order to prevent overtraining. The holdout sample is another independent set of data records used to assess the final neural network. [5]

Using all the 256 measurement points with 200 different values as input variable in Artificial Neural Network generation means so high diversity that to train the network an extremely high number of samples needed. Obviously with 212 samples no valid cases remained for testing or holdout, so the Artificial Neural Network generation failed.

First possibility to decrease the diversity of the input samples is the limitation of inputs. For this purpose 4 measurement points was selected on the pressure sensor mat (D4 D13 M4 M13) in the area where the movement is quite intensive (Figure 2.). With the selection of these four points only 4 input variables remained on the range of 0 … 200 mmHg.

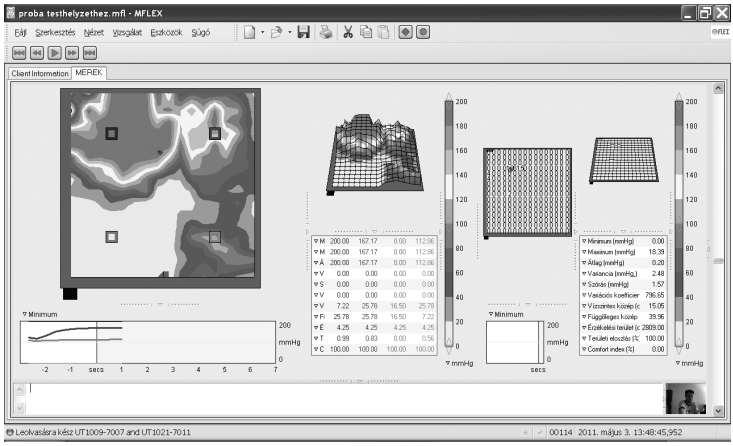


Fig. 2. Pressure distribution with the measurement points selected D4 D13 M4 M13 (blue, red, green, pink respectively)

Second possibility to decrease the diversity of the input samples is the limitation of resolution. If the measurement accuracy drastically reduced than the diversity of the input values decreases as well. To set the sensibility to 50 mmHg the input variables should be recoded into 4 categories (0 thru 50=1) (51 thru 100=2) (101 thru 150=3) (151 thru 201=4). The SPSS syntax:

```
DATASET ACTIVATE DataSet1.
RECODE D4 (0 thru 50=1) (51 thru 100=2) (101 thru 150=3) (151 thru 201=4) INTO D4_tr.
RECODE D13 (0 thru 50=1) (51 thru 100=2) (101 thru 150=3) (151 thru 201=4) INTO D13_tr.
RECODE M4 (0 thru 50=1) (51 thru 100=2) (101 thru 150=3) (151 thru 201=4) INTO M4_tr.
RECODE M13 (0 thru 50=1) (51 thru 100=2) (101 thru 150=3) (151 thru 201=4) INTO M13_tr.
*Multilayer Perceptron Network.
MLP mod (MLEVEL=N) BY D4_tr D13_tr M4_tr M13_tr
  /PARTITION TRAINING=7 TESTING=3 HOLDOUT=2
  /ARCHITECTURE AUTOMATIC=YES (MINUNITS=1 MAXUNITS=50)
  /CRITERIA TRAINING=BATCH OPTIMIZATION=SCALEDCONJUGATE
      LAMBDAINITIAL=0.0000005 SIGMAINITIAL=0.00005 INTERVALCENTER=0
      INTERVALOFFSET=0.5 MEMSIZE=1000
  /PRINT CPS NETWORKINFO SUMMARY CLASSIFICATION
  /PLOT NETWORK
  /SAVE PREDVAL
  /STOPPINGRULES ERRORSTEPS= 1 (DATA=AUTO) TRAININGTIMER=ON
      (MAXTIME=15) MAXEPOCHS=AUTO ERRORCHANGE=1.0E-4
      ERRORRATIO=0.0010
  /MISSING USERMISSING=EXCLUDE.
```

The ANN was created with four input variables selected and the input variables was recorded into four categories (1…50 mm Hg, 51…100 mm Hg etc.) when the error criteria satisfied (0.0001). The rate of Correct Predictions of the training partition was 97.7%, and 100% of the test and holdout partition (Figure 3, Table 1).

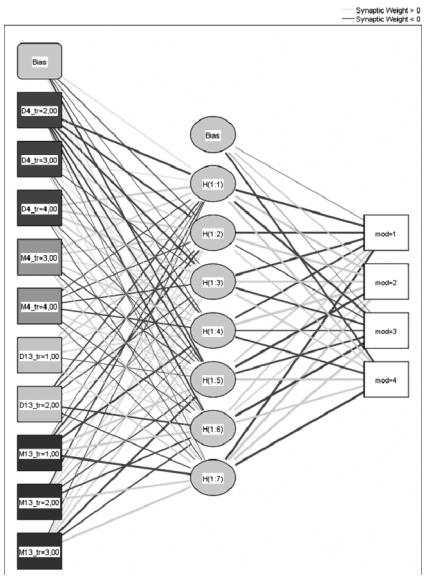


Fig. 3. The ANN generated with 4 measurement points, transformed values.

Table 1. Result of MLP analysis with 4 measurement points, transformed values

Sample	Observed	Predicted				
		Left ankle on right knee	Right ankle on left knee	Left	Right	Percent Correct
Training	Left ankle on right knee	39	0	0	0	100,0%
	Right ankle on left knee	0	29	0	0	100,0%
	Left	1	0	27	0	96,4%
	Right	2	0	0	35	94,6%
	Overall Percent	31,6%	21,8%	20,3%	26,3%	97,7%
Testing	Left ankle on right knee	15	0	0	0	100,0%
	Right ankle on left knee	0	15	0	0	100,0%
	Left	0	0	11	0	100,0%
	Right	0	0	0	9	100,0%
	Overall Percent	30,0%	30,0%	22,0%	18,0%	100,0%
Holdout	Left ankle on right knee	12	0	0	0	100,0%
	Right ankle on left knee	0	6	0	0	100,0%
	Left	0	0	9	0	100,0%
	Right	0	0	0	2	100,0%
	Overall Percent	41,4%	20,7%	31,0%	6,9%	100,0%

Dependent Variable: Seating type

Understanding the high correct prediction rate the training rate was decreased to 30 % meaning 63 samples to learn. This case the overall correct prediction rate of the sitting position was 94,1% including 40 % test and 30 % holdout samples.

CONCLUSIONS

This research confirmed that different sitting postures can be discriminated based on data processing of Pressure Mapping with Artificial Neural Networks analysis.

It was found that with a limited number of low resolution sensor, and with a few measurements seating positions can be discriminated applying Artificial Neural Networks. The study demonstrated that postures can be monitored by pressure sensors, that can provide a basis of trainings for good seating behavior or biofeedback devices.

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STRATEGY- MAKING PROCESS IN SMALL LATVIAN COMPANIES: THEORY AND PRAXIS

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ABSTRACT

In today's economy the creation of the long-term competitive advantage, which is a result of the strategic enterprise management, becomes more and more important. Also the Government of Latvia emphasizes that the country's future development strongly depends on the enterprise ability to compete in the global markets. Continuous company development based on the strategic leadership principles is a must in order to operate successfully in the international market. Researches show that strategic management is not so widely used concept in Latvian companies; therefore the authors' aim is to investigate the decision- making process in the small Latvian enterprises.

KEY WORDS: Strategic Management, Decision-Making Process, Small Enterprises

INTRODUCTION

Strategic decision-making process in the last decades has been the essential part of the management studies. Despite the huge amount of researches related to the management topic, still strategic decision-making process studies have been limited. It is crucial to research and draw conclusions regarding the strategic decision-making process influence on the company's success, as well as which factors and obstacles affect the decision-making process. It is worth mentioning that analyze of the strategic decision-making process is divided into two categories: the content analyze and the process analyze [1]. The content analyze includes analyze of the strategies themselves, for instance, decisions of enterprise portfolio management, diversification or mergers. On the other hand, analyze of the process focuses on the factors, which affect strategic decision-making process and realization. In the recent years especially the process analyze has got the biggest attention.

In Latvia the strategic management topic has not been researched so much, even less papers about the decision-making process and its influence on the companies' success. The authors of this article are aware of two considerable papers related to this topic:

1) In year 2003 Gints Mednis and Diana Tomberg have investigated the strategic management process in small and medium sized enterprises in Latvia and Estonia;
2) In year 2005 Janis Caune has done a research about creation of competitive advantage and its transfer between Latvian companies.

The first of those could be treated as a process analyzing paper, whereas the second analyses the content. Based on that it is obvious that the strategic management process analyze has not been actual neither for scientists, nor for entrepreneurs.

Because of so limited research regarding the strategic management processes in Latvian companies, the authors have conducted a survey in the electronic environment targeting 43 Latvian small enterprises, where the employee amount does not exceed 25 people, the turnover is less than 10 million euros, and they have been in business for at least 2 years.

Those parameters have been chosen because micro and small enterprises account for the biggest part in the national economy. As a result, it is essential to understand behavior of those companies when making strategic decisions. The study has been conducted in April, 2011.

The Ministry of Economics reacting to the economic crisis has prepared several articles regarding the situation of Latvian economics, and proposals how to improve it. One of the conclusions made is the fact that till the years 2007, 2008 Latvian companies were competing in the global markets by lower price products, which were possible because of the cheaper labour force. The report about political trends of the economic recovery in the medium term underlines that the only way how to balance the budget in the medium term is to increase the economic competitiveness by increased productivity and higher value added for the produced products. It would be wise to change the current economic model from labour extensive to knowledge extensive economy [2]. The proposed economic model requires augmented usage of strategic management processes in the country government as well as in the company management.

The aim of this research is to gather information regarding the strategic management processes in small enterprises. In addition, the situation analyze in Latvian companies will be made based on the theoretical and practical information acquired abroad.

RESULTS AND DISCUSSION

1. MACROECONOMIC SITUATION IN LATVIA AND ITS INFLUENCE ON THE STRATEGIC DECISION MAKING IN LATVIAN ENTERPRISES

The world financial crisis has considerably affected the economics of Latvia. GDP has decreased by ¼, unemployment rate has almost quadrupled. The seriousness of the crisis in Latvia was strengthened by misbalanced external sector shaped in the years of high growth rates [3]. Huge amounts of foreign capital investments in the country supported the significant economy growth in years 2004- 2007, but actually FDI encouraged internal consumption, not the development of entrepreneurship practices. As a result, import of goods and services from foreign countries exceeded export of our goods. Currently because of the falling internal demand (high unemployment, lower wages, fewer credits, and consumer carefulness) and less imports, foreign trade balance has leveled off. Many producers have found new export markets; hence internally decreased demand is compensated. In the medium term the main growth stimulus is the extended export opportunities. Therefore crucial factor for continuous growth is industrial competitiveness in both, internal and external, markets [3]. It is substantial to base the competitive advantage not on the cheap resources, but on the innovations and new product discoveries. This entrepreneurship model depends much on the strategic decision-making processes; therefore the authors believe that the application of the strategic management methods in the management ensures the companies' competitiveness.

Every year the World Economic Forum in cooperation with the Harvard University delivers an Index about overall country competitiveness. In year 2009 Latvia was placed 68th out of 131 countries. The global competitiveness index is based on 12 indicators, which characterize the main factors for country's competitiveness. The mentioned factors are divided into three groups: the basic requirements (institutional burden, infrastructure quality, macroeconomic stability, quality of the educational and health system), efficiency supportive factors (quality of the higher education system, product market efficiency,

labour market, financial market sophistication, development of technologies, market size) and innovation and development factors (the quality of entrepreneurhip, innovation) [2].

The basic requirements for Latvia have been evaluated as good, efficiency supportive aspects have received moderate evaluation, but innovative and development factors- very low. For example, Estonia regarding technology acquisition is 29th, while Latvia- in the low 88th place [2]. In this research, authors are interested in the third factor group. Innovation and the quality of the entrepreneurship development are the main factors in the creation of knowledge based economy model. Latvia scores very low when compared to neighbor countries, as well as internationally. The low score of cluster development (113th), the quality of research facilities (66th), as well as weak cooperation between universities and industries in the field of research (86th) could be highlighted. The current economic crisis has detected the vulnerability of the development of the Latvian economy and inability to compete in the global markets. Therefore economic recovery should be solved in the same time with the competitiveness problems, which consequently is not possible without the changed economic model [2]. Additionally, the research conducted in 2011 (Innovation Union Scoreboard) places Latvia as the last one amongst other European countries. However, indicators related to innovation have increased by 2.71% in the last 5 years in Latvia while the average growth in European Union has remained as low as 0.85%. On the other hand, the investments in research and development have been 0.47% from GDP in Latvia, whereas Europe average is 2.07% of GDP [4].

Analyze of the structure of the Latvian enterprises outlines that in 2009 most of the entities have been micro or small sized companies. 82.5% out of all entities are micro enterprises with no more than 10 employees and turnover is less than 2 million euro per year. Meanwhile small enterprises account for 14.1%. The amount of employees can be up to 25, but the turnover- up to 10 million euro per year [4]. Regarding their legal forms limited liability companies, farms and sole proprietorship are the most common forms [5]. This suggests that the enterprise structure in Latvia is fragmented. Furthermore, if the amount of entities per 1000 inhabitants is calculated, this indicator is far behind others in EU, even though it has increased almost twice in the recent years in Latvia (In 2011 seventeen entities/ 1000 inhabitants, in 2009 thirty-two companies per 1000 people, while in EU 51 entity per 1000 inhabitants) [4].

The statistics of Latvian established- liquidated enterprises (LLC) show that in the first business years the amount of established LLC exceeds the liquidated ones, but in the next years the proportion changes inversely. Currently out of 115 245 operating Latvian companies (LLC) only 14650 have been in business for more than 15 years, while 53 643 entity has less than 6 years [6]. According to the authors the life cycle of the companies is rather short in Latvia compared to the enterprises in other countries. The reasons might be as following:

- Rather short entrepreneurship experience
- In the last 20 years Latvia has experienced 2 serious financial breakdowns: Crisis in Russia (20th century, the late 90ties) and the world financial crisis (2008-2010)
- The absence of a clear economic policy in the country
- Strategic management levers are rarely used in the enterprise management
- The processes of globalization has supported international and aggressive competition

Considering the dynamics of macroeconomic, national economy's weak ability to compete, enterprise structure (large amount of micro and small enterprises), entrepreneur

individual parameters (education, experience, responsibility) and the culture of decision-making, it is crucial to search for the best strategic management model that could be applied to Latvia's micro and small sized companies.

2. STRATEGIC DECISION-MAKING PROCESS IN THE SMALL SIZE ENTERPRISES

Strategic management enables the company to be the initiator when building and controlling the company's future, not the passive observer. The results of the survey suggests that organizations, which use the principles of the strategic management, gain more money and are more successful than the companies, which do not use those principles. Successful organizations plan systematically in order to be prepared for the future changes in the internal and external environment [7, p.24].

Various researchers have classified the strategic management theories, grouping different management methods and levers by their similar features. In this paper the authors have examined the classification of strategic management theories done by Mintzberg, Ahlstrand and Lapmel in 1998. This classification distributes strategic management amongst 10 schools. The first three schools (design, planning, positioning) are prescriptive in nature – more concerned with how strategies should be formulated than with how they necessarily do form. Design and planning schools have developed during the sixties and seventies in the 20th century. The positioning school was very popular during the eighties and one of the most famous scholars was Michael Porter. Representatives of positioning school considered that there are limited amount of successful strategies to manage the company, therefore very significant is precise analyze of external environment. Positioning school has developed a number of well-known theories and methods: generic strategies, Boston matrix, experience curve, General Electric matrix, Porter's 5 Ps, Porter's value chain, etc. The next direction covers 6 schools (entrepreneurial, cognitive, learning, power, cultural, environmental), which emphasize the role of different aspects to formulate the strategy. The common value is to support idea that strategy formulation is never ending process, taking into account changes of environment. The third direction represents configuration school, which very often calls as a «roof school». This school combines methods and techniques from all previous mentioned theories [8, p.6-7].

Verreynne concludes that the research papers about strategic management processes especially in the small entities are in a very limited amount. Mainly the theories and levers of strategic management theory have been dedicated to the large enterprises, which have different aims and resources compared to small sized companies, where usually the owner is also the general manager [9].

Verreynne and Miller, and Toulouse, in their studies draw conclusions that the strategic management methods are applied in the small size entities. Miller and Toulouse in their research, which covers 97 Canadian small enterprises, state that the successful companies have their policy for the development of the strategy, vision and aims, as well as for the decision-making [10]. Even more, Verreynne in her study infers (surveying 477 small companies in New Zealand) that a positive correlation exists between the usage of strategic management practices and overall company success. Those entities, which apply strategic management methods, have a longer life cycle and capture bigger market share. However, the research of the New Zealand's companies indicates that the small organizations prefer rather simplistic, adaptive, entrepreneurial and participative than rational strategy-making processes. It means that the small entities conceives and applies the strategic management more informally and simply compared to the large corporations, which makes this process very formal and rational. The competence of the general manager, internal (employees)

and external (customers, business partners) advisor involvement play an important role in a successful strategic management processes [9].

In year 2003, Tomberg and Mednis have concluded that strategic management is rarely used in the companies; the managers are focusing on the problems in a functional level. The short and long term development issues are just informally discussed with employees [11]. The small sized enterprise survey from year 2011 made by Rozenbergs and Sarkane- Gaile demonstrates that 41.9% of the entities have formulated their strategic and financial goals for the development. Furthermore, 35% deem that they have partially stated goals. Those results indicate that the situation has been improving a lot. In the same poll 70% respondents confirm the existence of defined vision and desired goals, which are to be realized in accordance to their internal and external capacity. Only few respondents apply rational strategic management process [12]. Therefore, analyzing Mintzberg's and its corporate authors' theory classification, one can say that nowadays in Latvia's small companies the following strategic management school features can be observed: environmental school (adaptation to the changes in external environment), learning school (continuous manager's and team's adaptation and learning from the market), as well as entrepreneurial school (entrepreneur's vision for development, while adapting to the environmental changes). This cognition corresponds with Verreynne's study in New Zealand.

Dameron and Torset in their paper have realized the growing trend that the strategic management processes involve information flow and interaction between various parties, when based on an extensive cooperation, the strategies are developed. It is not a formal and strictly regulated process, contrary, it involves brainstorming, discussions, exchange of experiences, which results in a creation of strategies. Researchers highlight the role of the director, which is supposed to inspire the colleagues for a creative work, provide considerable challenges, and promote the importance of the intuition for the future business perspectives. Meanwhile, nobody expects very formal and regulated approach for the strategic management processes [13].

The study in Latvia's states that the managers of the Latvia's small companies up till now have relied on their intuition and previously gained experience. The study indicated that 17.3% of the respondents believe in a powerful general director as a key for the success who in 36.8% situations makes the strategic decisions intuitively, based on his experience [12].

Most of the entrepreneurs have the university degree, but only half of them have achieved it in the business studies [14]. Basically entrepreneurs have learned management while working (i.e., while gaining practical experience) and sharing experiences with other businessmen. When developing their own business, entrepreneurs have not been able to rely on systematic and long- term country and regional development policies, as a result organizations are forced to adapt quickly to the changes in the external environment. It has to be admitted that often companies have not been willing to plan their development strategy, saying that there is too much general uncertainty. According to Mednis' and Tomberg's research and the authors acquired data, managers most of the time are solving operational questions; thereby almost no time is dedicated for the long term development plans [11]. The senior level managers spend no more than 3% of their time for the corporate future planning. In order to arrive at the unique future vision the directors have to devote much more time for the long term planning [15]. The research of 2011 presents that 65.1% of the managers spend up to 15% of their time for the strategic planning, whereas other 23.3% spend up to 30% of their working time. According to the authors, entrepreneurs more and more realize the importance of strategic management for the sake of the company's development [12].

The small Latvian enterprises should strive for increased usage of strategic management methods in the company management, and in addition to intuition, experience and reacting to the changes in the environment also methods of the other schools could be applied. Latvia's managers could focus on the configuration school's methods, which suggest usage of all school methods if applicable. The essential point of this school is to understand that in every economy and organisation unpredictable transformation periods alternate with stable economic growth. In the economy and industry growth periods it is necessary to effectively manage the organization (secure the position in the market, improve the cost efficiency, promote the brand, train the personnel, invest in R&D, etc.), whereas in the unpredictable periods all forces should be focused on as quick as possible return to the stable position. An entity, which in the growth periods have performed reasonable processes in order to increase its competitiveness, in the times of changes can enjoy some advantages and try to convert them into the company benefits.

In Latvia the decision-making process can be described as a centralized, meaning that the information flow mostly is directed to the general director, therefore he is the main decision maker. There is a lack of standardized everyday tasks; as a result considerable amount of the gained information is kept in the heads of the managers. Often it is a case that the medium level managers do not have sufficient information to make the decisions, which would remove the burden from the top level managers regarding the functional level decision-making. Also Mintzberg states the same in his study, saying that the main information channel for the general manager is verbal communication, which means that this information stays at them and is not communicated to others [16, p.21-31]. Adler and Borys have proposed and approved a hypothesis that in a dynamic and unpredictable environment (which could be a description for Latvia's economy) the culture of centralized strategic decision-making is more desired, where operational (functional) decisions preferably should be made in a decentralized manner [17]. If so, senior level managers are able to concentrate on crucial strategic decision-making, using the most precise information, and deputing everyday decision-making to the mid-level managers. Consequently, employees are more motivated and more loyal to the company. The authors argue that the quantitative size of Latvian companies (96.6% of companies are micro and small size entities) restricts the usage of such a proposal, because the amount of administrative employees is very small and the manager is not able to delegate the functional decision-making to the lower level managers. Even more, the economic crisis impelled organizations to dismiss the employees. Because of those reasons the director is forced to manage the business himself.

Mintzberg writes that he has managed to challenge one of the main management ideologies about the manager as a systematically thinking person who manages the company according to a plan. His research shows that managers are impatient, able to concentrate only on the short, quick and independent actions. Entrepreneurs are result-driven, not process-driven [16, p.21-31]. This suggests that in the most of the cases they are not able to focus on continuous and uniform planning process. The paper of Mednis and Tromberg confirms this trend also in the Latvian entities, when the managers are working on various processes in the same time, not dedicating enough time to acquire the information and make the decisions [11].

Papdakis, Lioukas and Chambers have made the conclusion that the education in the field of economics plays an important role. Managing directors with a university degree in the field of business administration are more exigent regarding the quantity of gathered information and the quality of the decision-making process. Positive correlation exists

between the managers, good business administration education, decisions made and the achievements of the company [18]. In the same time a significant aspect is director's personal qualities, which shapes the manner how he realizes the strategic management processes in the company. Energetic businessmen with leadership abilities are oriented towards quick and motivated strategic management process implementation [19]. Education and personal characteristics is another group of factors, which determines the existence and quality of the strategic management in the company. Even though most of the respondents have Bachelor or Master Degree [11, 14], only half of the degrees are in the field of business. Therefore the managers admit that they miss courses related to the strategic management issues in order to enhance their professional qualifications [11]. Rozenbergs and Gaile-Sarkane in their study about the factors, which affect strategic decision-making in Latvia's SME, state that even if the external environment is an essential aspect, nevertheless more significant influencers are individual and organizational factors. The role of the top manager in the strategic decision-making process has to be emphasized. Manager's education, experience, intuition, characteristics (leadership skills) shape the organizational culture, decision-making process, communication methods, information sampling models and the principles of task delegation [20].

The impact of external environment is crucial when decisions related to the company's development or downsizing, meaning- if a company has to make a decision where the new branch should be located, then external factors (taxation, legislation, quality of education, infrastructure, availability of resources, customs, etc.) are very important for the decision-making, but when the decision has been made then individual and organizational factors become the dominators. The situation when the role of the external environment might be decisive is rapid changes in economic and political environment, namely, crisis, war, change of political system and other factors, which might stimulate quick and decisive decision-making [20].

CONCLUSIONS

In the scientific literature strategic management processes have been extensively investigated; however, amongst the researchers no common agreement about strategic decision-making process and its dependence on dynamically changing environment and other factors exists. Only few studies have been done about the strategic management processes in small companies. Strategic management process is analyzed in different sciences, as a result, various schools of management have been developed, which research this problem. A lot about strategic management has been discussed with a regard to the leadership, decision-making process, risk management and other interdisciplinary contexts. Nevertheless, it is true that practically no study about strategic decision-making in Latvia has been conducted. One of the explanations might be the business environment in Latvia where micro and small sized enterprises are dominant.

Summarizing the results of the research, authors conclude that:

1. Strategic management methods have been increasingly applied in Latvian companies (55% understand the significance of strategic management), even though mostly it is more instinctive process. One can say that strategic management methods are still not sufficiently applied in companies;
2. In Latvia's enterprises formal and academic strategic management use is not practiced on a large scale. Companies plan their development informally, considering changes in the external environment

3. In Latvia the most widely used is the environmental school (adaptation to the changes in external environment), learning school (continuous manager's and team's adaptation and learning from the market), as well as entrepreneurial school (entrepreneur's vision for development, while adapting to the environmental changes).
4. Latvia's managers could focus on the configuration school's methods, which suggest usage of all school methods if applicable. The essential point of this school is to understand that in every economy and organization unpredictable transformation periods alternate with stable growth periods. In the economy and industry growth periods it is necessary to effectively manage the organization (secure the position in the market, improve the cost efficiency, promote the brand, train the personnel, invest in R&D, etc.), whereas in the unpredictable periods all forces should be focused on as quick as possible return to the firm position.
5. Individual and organizational factors significantly influence strategic management and decision-making process; actually internal factors are more important than external factors for the strategic management in the organization. The role of the top manager in the strategic decision-making process has to be emphasized. Manager's education, experience, intuition, characteristics (leadership skills) shape the organizational culture, decision-making process, communication methods, information sampling models and the principles of task delegation.

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INFLUENCE OF WORKING ENVIRONMENT RISKS ON THE WORK ABILITY OF THE EMPLOYED IN GRAIN RELOADING ENTERPRISES

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ABSTRACT

In this research, working conditions are analyzed to identify the risks of the working environment, the employees work ability index and the most urgent deficiencies in working places are determined and the measures for protection of the workers' health and reducing the influence of unhealthy environment risk factors are recommended. Concluding that despite on heavy work conditions employees work ability is moderate and good.

KEY WORDS: Dust, Grain Reloading, Air Pollution, Work Ability

INTRODUCTION

Work intensity has caused huge health problems for employees in the various sectors of the Latvian economy. The number of occupational diseases has grown rapidly during last years.

The volume of a grain reloading increases continuously in the state. So, the occupational health problems also increase in enterprises of the corresponding industry. In a working environment, different risk factors and the combinations of these factors adversely affect the human health. The strength of the working environmental impact on health depends on the exposure level and the amount of the certain risk factor [1]. A joint-stock company «Rīgas ostas elevators» was chosen for this study. The research purpose was to analyze the risks of working environment in the mentioned enterprise and to evaluate its influence on the work ability of the employed.

METHODS

For risk identification, the survey of 76 workers was conducted. A physical load, an air pollution with grain dust was examined and the work ability index was determined. For analysis of air pollution, the method of determination of air pollution index (API) at working places was selected. Finnish 5-point system is used for general evaluation of the risk [2]. This system was combined with several modified matrices for evaluation of different risks: for API, noise, light, microclimate and load. The method was developed and the index of working environment risk of the enterprise was calculated.

The work ability index (WAI) describes the ability of a worker to perform definite work taking into account the specific work tasks, individual preparedness of a worker, his health condition and labor resources. The concept of this method has been developed in Finnish Institute of Occupational Health [3]. Using work ability index it allows an employer to establish the shortcomings of work in an organization in time. Such shortcomings are often connected with the decrease in labor resources and increase in work load.

In determining the work ability index, evaluation questionnaires are used. They are composed of seven parts:

1. ability to work (current ability to work vs. the best ability);
2. ability to work vs. the requirements of accomplished task;
3. number of diseases diagnosed in workers;
4. decrease in labor resources due illness;
5. absence during last 12 months due illness;
6. prognosis of work ability for at least next two years;
7. mental ability to work.

Number of points is determined for each part.

It is possible to complement the questionnaires and include additional criteria in them that allow obtaining a more precise evaluation, for example, the modified questionnaire with additional items has been developed [4]. The total maximum possible number of points for describing the work ability index in rank scale is 52. They are divided into four categories – see Table 1.

Table 1. Ranking of work ability for modified questionnaire [4]

No.	Category	Description of the ability to work	Number of points
1	I	bad ability to work	7-27
2	II	average ability to work	28-36
3	III	good ability to work	37-43
4	IV	very good ability to work	44-52

For analysis of the air pollution, the method of determination of the air pollution index in the working places of the transporter operator and loader was chosen [5]. Calculation of the air pollution index (API):

$$API = \frac{C / OEL \times t}{8} \times 100\% , \quad (1)$$

where:

C – average concentration of chemical in the air of working environment (mg/m^3),
OEL – threshold of occupational exposition for eight-hour working day (mg/m^3),
t – period of time during which workers are subjected to exposition of chemicals (h).

According to OSHA (USA), the level of chemical risk is:

Table 2. Level of chemical risk according to OSHA [5]

API, %	Condition
0….5	Good
>50	Average
>100	Unhealthy
200….299	Very unhealthy
300+	Dangerous
500	Very dangerous

API is a simply applicable method that expresses the risk level depending on how long a worker has to work in unhealthy working environment conditions. Occupational exposure limit (OEL) is calculated for 8-hours working time, but if a working time is variable it is possible to calculate risk degree using the API method and to determine measures for the workers protection and reduction of working environmental risk factors according to the matrix description.

Finnish 5-point system is used for general evaluation of risk. Matrix is often used for assessment of working environmental risks at enterprises with relatively simple technological industrial processes and it is one of the most popular general risk evaluation systems in Latvia [5]. Risks are evaluated according to 5-point system.

RESULTS AND DISCUSSION

The work ability index describes the ability of a worker to perform definite work, taking into account specific work tasks, individual preparedness of a worker, his health condition and mental labor resources. The largest number of workers – 70% belongs to the age group from 41 to 50 years, 12% is in the group from 25 to 40 years and the rest 18% are 51-65 years and older. According to the survey results, good work ability is in the group of workers who are 25-40 and 41-50 years old. Workers belonging to the age group 50 years and older show average ability to work. 18% of all workers who participated in the survey belong to this group. While processing and examining the survey data one should take into account that objectivity of the data is influenced by various by-factors – economic as well as psychological. According to the survey data, authors concluded that the work ability is affected also by the length of service. In addition, work at an enterprise is connected with increased physical load which is variable depending on the enterprise working regime. This factor also influences workers' ability to work.

In the survey results, workers from the age group over 50 years also showed such diagnosed diseases as radiculitis, cervical osteochondrosis and high blood pressure. The workers of this age group have been working at the enterprise for more than 25 years, but some of the workers – almost 40 years.

Using the formula (1) for API calculation we calculate the index for different plant cultures using dust measurement results. Calculations are made for 7-hour working time as well as for 11-hour working time. API calculation is done for two working places – of transporter operator and loader. According to measurement results, the dust concentration in these working places is the biggest at the enterprise.

The obtained results show that loaders and transporter operators are primarily exposed to the dust influence. The objective laboratory measurement results as well as calculation results confirm that the most dust is released while treating rye grain loads, but during the landing cargo the highest dust concentration is in the loader's working place.

Worker has unhealthy working conditions and risk index corresponds to the third degree when the working time amounts to 7 hours in elevator shop. But, working 11 hours in such conditions, risk index reaches fourth degree.

Using API, it is possible to calculate time (t) depending on the dust concentration C and risk index degree. This calculation can be used for planning workers' of stay at their working place according to the dust concentration during grain unloading.

After modifying the API formula (1) if unknown quantity in this case is *t*, but variable quantity – API:

$$t = \frac{API \times 8 \times OEL}{100\% \times C}, \tag{2}$$

In this case it is probable to plan working time taking into account harmful working environment factors, the dust concentration, for OEL should not be exceeded.

In this investigation authors combine the quantified Finnish methods with various modified matrices for evaluating different risks:

1. noise;
2. light;
3. microclimate;
4. load;
5. API method of the air pollution.

Combining the matrixes of different risks in table 3 with Finnish 5-point matrix, one can elaborate a complex evaluation system, where the risks expressed qualitatively or quantitavely are expressed by risk index in the end. The index is calculated for each working environment risk factor separately.

Table 3. Risk index of evaluating different risk factors

Nr.	Risk index	API, %	Noise exposition, $L_{EX, 8h}$, dB(A)	Light
1.	Ri = 1..3	<10	< 80	Normal (500 lx)
2.	Ri = 4..6	10-50	80- 85	+/- 10-25%
3.	Ri= 8..10	50-100	85-87	75-50 % from normal
4.	Ri = 11..15	100-200	87-90	50-10% from normal
5.	Ri = 16..20	>200	>90	10% from normal

CONCLUSIONS

It is concluded that the dust concentration exceeds occupational exposure limit. The dust concentration in working places depends on grain sort processed and degree of grain cleanness. Employees work ability in grain reloading enterprise is average or good. Practical recommendations are directed towards reducing dust concentration in workers' breathing area, planning working time depending on the grain culture processed, using individual protection means and performing compulsory health examinations. Methods of the air pollution index should be used in planning working time.

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ECOLOGICAL APPROACH TO LABOR PROTECTION

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ABSTRACT

The observations and studies the author has carried out for a long time prove that one of the major causes of accidents is insufficient staff competence, formal approach to labour protection and work in general, which forms over a long period of time and under the influence of several factors. In order to evaluate the influence of these factors on labour protection a theoretical research based on triangulation strategy has been carried out. Ergonomics is a theoretical basis for implementing safe work. The International Ergonomics Association has adopted the definition of ergonomics characterizing ergonomics as a systems-oriented discipline which now extends across all aspects of human activity. Also ecological approach is system-oriented where ecosystem and hronosystem models are used. Arendt's phenomenology of practical life helps to understand the attitude to work. Three human activities – labour, work, and action- corresponding to the three basic conditions under which humans live have been formulated in it. Ecological environment models have been studied and adapted in the research. They may facilitate empirical studies increasing possibility to have a better mutual compliance between internal environment (a human) and external environment and promote transition from labour protection to safe work or action.

KEY WORDS: Ergonomics, Labor protection, Safe working environment, Ecological approach, Human activities

INTRODUCTION

The observations and studies that the author has carried out for more than 20 years while working in the field of labour protection and the preliminary studies [1] and [2] prove that one of the major causes of accidents is insufficient staff competence, formal approach to labour protection and work in general. In number of cases instructions are formal and their content is not always connected with actual risks faced in working environment. The most significant internal environment (employee) and external environment (working environment) and their mutual compliance that influence possibility for safe work are not sufficiently assessed. The aim of the research is to study and adapt theoretical models of interaction between a human and environment that would help to understand how the training of employees in labour protection could facilitate the transition from labour protection to safe work.

THE METHODOLOGY OF THE RESEARCH

The methodology of the research is based on ***triangulation strategy*** [7]. Have been used *Theoretical triangulations* – the research has been based on ergonomics [15] and [16], ecology of human development [3], [4], [5] and [6] education ecology [8], [10], [11], [12] and Arendt's Phenomenology of Practical Life [13]. A reflection of the author's personal experience has been used. A theoretical research has been carried out: models of interaction between a human and environment have been determined and adapted.

RESULTS

Ergonomics is the most significant theoretical basis for implementing safe work. Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance (IEA Council, August 2000) [15]. Ergonomics is a systems-oriented discipline, which now extends across all aspects of human activity [16]. Unfortunately only within the framework of ergonomics we are unable to study all aspects of human activity, especially those connected with internal environment – a human. Ecological approach enables to view work risks in time and space, especially those processes connected with the development of competences and attitude of the employed.

Ecological approach underlies sustainable development of labour protection. In order to more thoroughly understand the processes occurring in the constantly changing working environment, which are affected by development of the society, continuous improvement of technological process and involvement of labour power, forming an integral part of production process, in those processes the author has approbated environmental models enabling to view labour protection process from the point of view of ecology. In human ecology there prevail two trends [10] and [11]:

- ecology of human development
- ecology of systems development

An ecological approach enables to study working environment and labour protection system-an integral part of this environment – as a living organism by checking its viability and development in the constantly changing conditions.

Finnish scientist Hirsto L. [8] developed her bioecological model based on Bronfenbrenner`s U. [3], [4], [5] and Hulermann`s K. [9] concept, by supplementing it with an inner multilevel endosystem of a human as a subject of interaction (Fig.1).

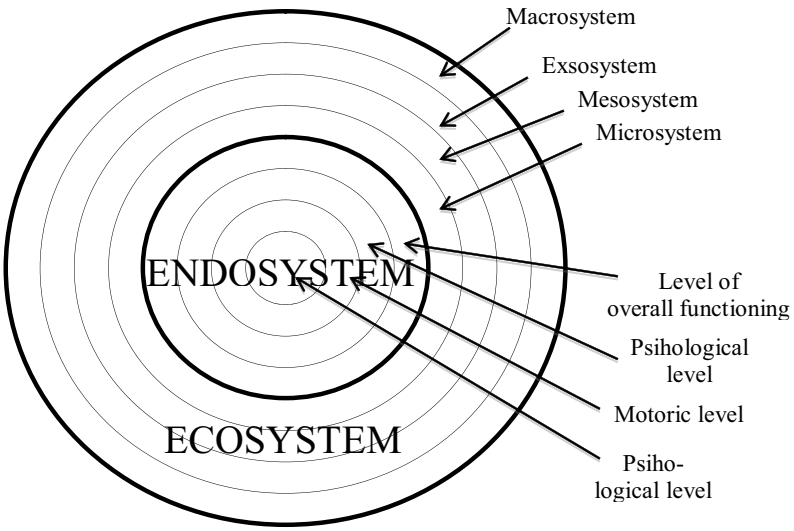

Fig.1. Hirsto`s bioecological model [8].

Scientist calls this model a bioecological model, where a human is in the central part of multi-level ecosystem. The model includes four ecos or environmental levels:

- microsystem;
- mesosystem;
- ecosystem;
- macrosystem.

In Hirsto`s model endosystem also consists of four levels, which are included in the substructure of microsystem.

Endosystem has the following levels:

- physiological level, babies are born with certain psycho-physiological qualities determining their abilities;
- motoric level, anthropometric indicators, ability to withstand enduring physical and mental strain etc.;
- psychological level including knowledge, skills, ability to acquire new things, develop satisfaction with life etc.;
- level of overall functioning is the top level of the previous levels including such very important component of competence as responsible use of knowledge, skills and attitudes, etc.;

Considering the ecosystem we can look at each level separately and determine their relation to working environment:

- Microsystem – work place (including all risks inherent to working environment);
- Mesosystem- an enterprise or an institution consisting of several microsystems having uniform working traditions and labour protection traditions and sharing a common occupational health and safety policy;
- Exsosystem-state and local government level, laws, Regulations, requirements set forth by local governments, social factors, etc.
- Macrosystem- the world, the European Union, continuous scientific development, updating of technological process, regulations governing labour protection issued by the EU, etc.

By using the above mentioned model and extending it to working environment, we can come to a conclusion that each level of ecosystem may affect endosystem and change balance between eco-and endo levels. For better understanding of processes taking place in the ecosystem the author proposes Hirsto`s [8] model of environmental levels related to learning environment which has been tested in working environment.

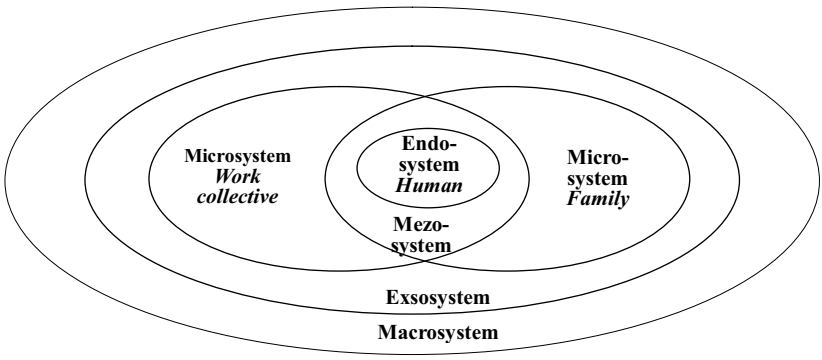

Fig. 2. Environmental levels with respect to learning environments [8].

Endo-system characterizes an employee's changing values, knowledge, skills, attitudes, ability to acquire new knowledge, skills and abilities necessary for the performance of his work duties under labour protection requirements (labour protection competence). On micro-level there is an interaction between a human and all environmental elements that are closest to him. The most typical examples of the environment of microsystem level are family, colleagues at work, friends, acquaintances, etc., providing an employee with an informal understanding of labour protection, not always this information is accurate and reflects the true importance of labour protection.

Mezosystem consists of a number of microsystems, for example an enterprise with its labour protection policy and a family having safe labour traditions. This is a level where an employee can be provided with the knowledge and understanding required for the performance of safe work. This firstly involves giving instructions to employees, provided that the education process is carried out properly, not just formally, the author`s research proves that 83% of the given instructions are formal [1]. It is possible to provide employees with knowledge and skills and understanding of the importance of labour protection in working process. A family is also given an important role, particularly in a personality formation stage, as shown by theresearch 31% of senior students acquire knowledge on labour protection in the family [2]. A human behaviour is usually determined by processes occurring in a number of microsystems.

Exsosystemis formed by a setting where a human is not directly involved in at least one microenvironment but he is indirectly exposed to its influence, such as country, region, and municipality. In the latter an employee is not directly included, but usually is affected indirectly. Macrosystem consists of microsystems and mezosystems and ecosystems. It has no explicit setting, but has an established culture and subculture.

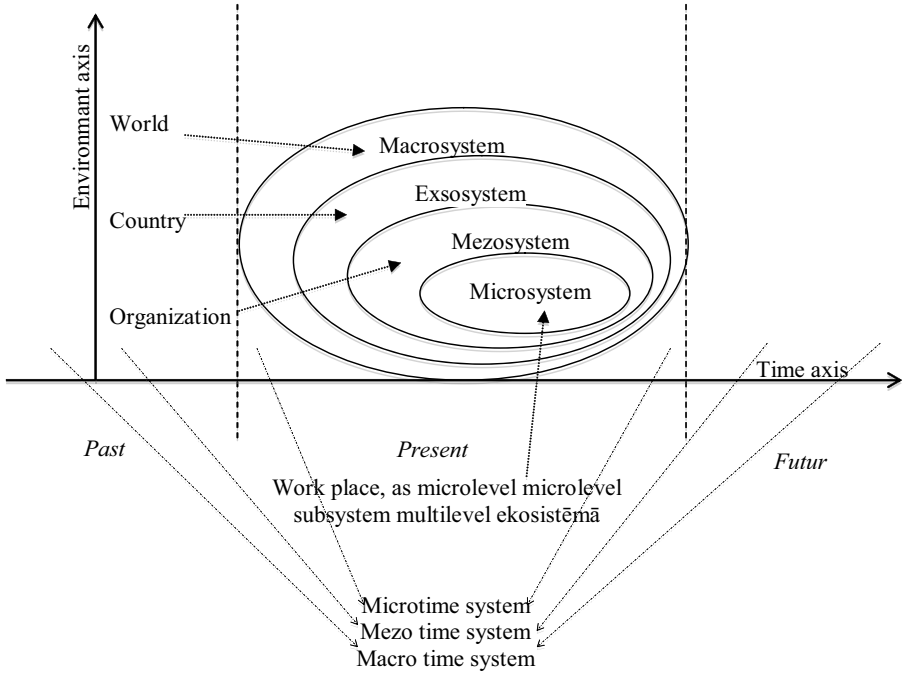

Fig.3. Model of hrono and eko system model. Author`s interpretation on the basis of Bronfenbrenner U. [3, 4, 5] and Katane I. [10]

The time axis in the ecosystem model makes it possible to identify the changes taking place in the system of working environmental from the past to the future. Taking into account that micro-level directly comes into contact with endosystem, the development of endosystem subject-employee through time can be analysed.

Processes taking place in the working environment in relation to labourprotection can be viewed in three levelhronosystem:

1. Microtime – things happening at the moment, instructing employees, educating, workplace monitoring, daily training.
2. Mezotime – recent past, near future. Providing an employee with initial instructions, introductorytraining, repeated or planned instructions.
3. Macrotime – future, past, employee's experience gained at school, in a family, the possible prospective development trends of labour protection, history of labour protection, possibility to view processes in the distant past and future. One of the future aims is definitely a sustainable development of labour protection, which would allow employees to maintain their physical and mental resources as long as possible in order to fully perform their work duties, taking into account that there is a tendency to increase the retirement age.

In the distant future it might be possible to create a safe and harmless working environment. Theoretically it is possible, but practically it is not.What could be the ways of reaching such safe and healthy working environment?

In order to make out how to create a safe and healthy working environment I will use levels of human activities developed by Hannah Arendt[13].

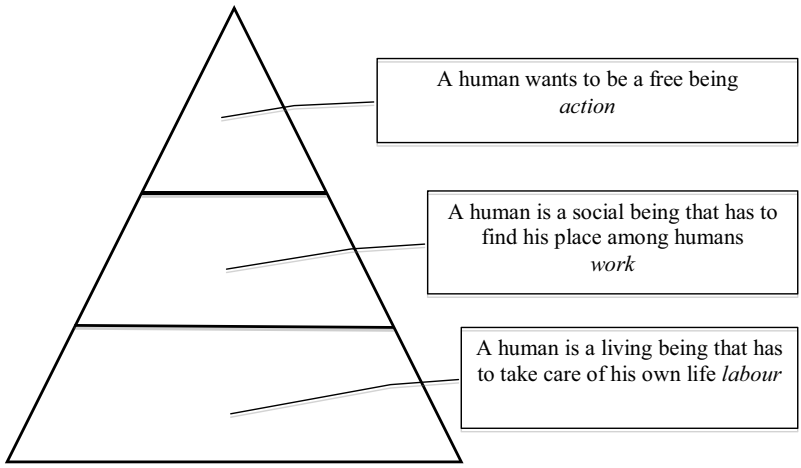

Fig. 4. Human activities – labour, work, and action. Adapted from Arendt H. [13].

Hannah Arendt`s levels of human activities are the following:

- Labour-a human is a living being, level of naked life, bodily service to body, long-term repetitive work, striving to satisfy vital needs for survival, characterizes a human asan animal, working is anonymous and does not create anything lasting, this level means that labour protection is on the lowest level, where the parties involved in the working process have not been formally informed aboutlabour protection requirements or fails tofollow them, as more attention is given to having sufficient financial means;

- Work-a human is a social being, a humanmakes things useful not only for himself but also for others, that involves communication with other people, and makes a human feel like the one who has to settle intothe human world, this level could mean that the parties involved in the work process understand the importance of labour protection, but anyway consider financial well-being to be more significant;
- Action-a human wants to be a free being, he is communicative and public, he needs freedom, with no connection to thingsand restrictive powers, there is always some initiative, beginning of a movement, like a human birth, this level indicates that all the parties performing work understand the importance of labour protection and doeverything possible to create a safe and healthy working environment, where human health is very important, and is defined as complete physical, mental and social well-being, and no diseases or other pathologies are spotted.

Action is the highest point to be striven for. A human is communicative, public, free, and has initiative. It is important to determine the factors affecting a position of employment relationship (working environment) at a certain time, as that would lead to the change a notion of labour protection:

- labour protection;
- worksafety (protection);
- action safety (protection).

The word (term) *work* has been mentioned as the first noun in a frequency dictionary of the Latvian language [14]. In some dialects in Latvian the word *work* means *live*, in the course of time it has obtained a meaning *work*, so there is an evident analogy with action.

CONCLUSIONS

1. Ecological approach gives possibility to view the processes going on in working environment as a whole, as living organism inspace and time.
2. The use of ecologicalenvironmental models in exploring working environment and the ongoing processes has provided possibility to study processes in labour protection as endo and ecosystems, which are constantly evolving.
3. The use of ecological environment models is recommended for the development of labour protection policy in companies and development of strategic planning of labour protection at the national level, as the models help to justify the importance and trend for the sustainable development of labour protection.
4. The prevention of formal approach plays a significant role in providing labour protection training to employees this can only be achieved through a coordinated and targeted action at all levels of the system.
5. Theoretically it is possible to create harmless working environment for a human life and health, but public attitudes towards working process have to change and means of production have to turn into new quality.

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THE ROLE OF ERGONOMICS IN THE SUSTAINABLE DEVELOPMENT OF THE LIFESTYLE BUSINESS

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ABSTRACT

The purpose of the article is to evaluate the role of ergonomics of the latest business philosophy – sustainable development of lifestyle business. Different qualitative methods are used. The researches define that the lifestyle business can be a foundation of the prosperous life. Lifestyle business in its philosophical matter is directed to sustainability and development and not to concentrating the capital. In certain countries lifestyle business is a standard therefore entrepreneurs who concentrate primary on gaining wealth are not perceived as normal. In order to promote welfare in entrepreneurship it is also important to have a good will. The good will is the highest quality and condition for any other good things. The good will opposite to happiness is on its own, without our mightiness and power. In Latvia ergonomics in high extent is based on a good will. Society does not have enough strong perception of its role and nature and it is not possible to see its benefits and losses.

KEY WORDS: Ergonomics, Lifestyle Business, Sustainable Development, Happiness, Welfare.

INTRODUCTION

To understand how ergonomics can promote welfare and the sustainable development of lifestyle entrepreneurs, it is important to define the nature of sustainability, happiness, welfare, money and development. The objective of the study is to ascertain to what extent people can determine the welfare of their life through their choice of business profile, and how ergonomics can promote sustainable development, because people in need of improved welfare are at the heart of every development. However, ambiguous interpretation of the term welfare often causes confusion. This article seeks to define what welfare is and how ergonomics influences people's welfare, because in this article the idea of ergonomics is positioned in the sense of welfare. The relevance of the field studied in the article is determined by the fact that in the time since the field of ergonomic science was founded and the monetary system has expanded globally, people have not become happier.

Economic growth is no ticket to a better life. Concurrently, ergonomics concerns people's welfare. The article seeks to ascertain why we do not generate good will in sustainable development planning. To determine this, the first task is to define sustainable development. The second is to articulate welfare and the role of money as a pre-requisite for happiness. The third is define the lifestyle business and finally to determine the role of ergonomics in the sustainable development of the lifestyle business. The conclusions will define the foundations of a good life. Can ergonomics facilitate sustainability for the lifestyle business? The conclusions will define practical application of the research results, innovation elements, results of the scientific discussion and realization of the set work objectives and tasks.

1. WHAT IS SUSTAINABLE DEVELOPMENT?

The concept of sustainability was used for the first time at a meeting of *the World Council of Churches* in 1974. The concept was subsequently presented at the *International Union for Conservation of Nature and Natural Resources* in 1980 [1]. In 1987, the *United Nations World Commission on Environment and Development* in the person of Gro Harlem Brundtland published a report *'Our Common Future',* which argued that the relationship between environmental conservation and economic growth could be managed through a new proposition – sustainable development [2]. Many current development trends leave an even greater number of people impoverished and vulnerable, at the same time destroying the surrounding environment. How will such development serve the world in the next century when twice as many people will depend on this same environment?[2, p.4]. In meeting the needs of the present we cannot compromise the ability of future generations to meet their needs. [2, p.8]. Support for the new concept was expressed at the 1992 Rio de Janeiro *United Nations Conference on Environment and Development – UNCED.*

Since then, people have posited the term differently for economic growth and environmental protection. The book *'The Sustainable Society'* was the first to expound the related problem of how to balance limits on growth with concerns about social justice [3, p.342]. Sustainable development – integration of conservation and development to ensure that modification to the planet to indeed secure the survival and well-being of all people [4] Sustainable development – integration of conservation and development to ensure that modification to the planet to indeed secure the survival and well-being of all people [4].

The original course set by humanity was sustainable, but it was threatened by rapid technological development at which time man's spiritual growth began to fall behind. Money and material benefits were considered not as a goal, but rather as a means of welfare. The field of sustainable development has emerged in response to the mounting ecological and social challenges stemming from the traditional economic paradigm [5]. In the wake of the rapid technological boom at the end of the 20th century, attitudes towards material values radically changed, with their acquisition considered as self-sufficient. But everyone, including economists, knows perfectly well that the economy takes in raw materials from environment and gives back waste. So why is this undisputed fact ignored in the circular flow paradigm? Economists are interested in scarcity [6, p.34]. Sustainable development can be ensured if there is not only an interaction between economic growth, the social sphere and environmental protection, between economic sectors and thematic elements, but the active involvement of the public in shaping growth is ensured [7, p.13]. If one wishes to give the concept of sustainable development a constructive meaning, one has to try to nurture the principles of sustainability with suitable means that would make it possible to regulate globalisation differently [7, p.28].

Expansion means getting bigger; *development* means getting better, which may or may not involve expansion. This is no mere semantic distinction. Many communities have wasted a lot of time and energy pursuing *expansion* because that's what they thought they needed, when what they really needed was *development* [8]. A similar division between *growth* and *development* is also illustrated by Herman Daly. *Growth* is the increase of quantity in size. Economic growth is based on the unlimited transformation of natural capital into artificial capital. We exhaust the Earth's resources in our own interests and define sustainability as if it were a business in liquidation [9, p.248]. Human growth after maturity is cancer [8, p.12]. In many people's minds, growth has become a synonym for increased wealth. They say that we have to have growth, in order to become so rich that we can afford clean up costs and the poverty of conservation. That is, all problems are easier to resolve when we

are richer [10]. The foundation for any development or growth is a certain environment or soil that encourages or delays developmental growth.

Growth means increasing size, but development means increasing quality and diversity. Development increases the value of both state and private investments, whereas growth tends to demand an increase in these investments that must not exceed their value [11]. The growth in the value of the economy is most frequently determined through Gross Domestic Product. Sustainability debates are not just about how the environment competes with growth. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation [2, p.43]. Products can either be composed of materials that biodegrade and become food for *biological cycles*, or of technical (sometimes toxic) materials that stay in closed-loop *technical cycles,* where they continually circulate as valuable nutrients for industry [12].

The true interests of the people include physical survival, stable relations in society, a meaningful social and cultural identity, and remunerated and socially useful work. Safeguarding these interests requires conditions where the necessary resources are physically and economically accessible to everyone [13]. Sustainable development is increased welfare. Individual welfare is important and it forms overall satisfaction and sustainability which cannot be numerically measured in economic terms.

2. DEFINITION OF WELFARE

Public happiness cannot always be equated with income. If we want people to become happier, we must know what condition causes happiness and how to cultivate it [14, p.4]. People's happiness can be measured according to six key factors – the proportion of people who believe that other people can be trusted; the proportion belonging to social organisations; the divorce level; the employment level; quality of government; and religious faiths [14, p.226]. The feeling of happiness is not solely dependent on the situation itself, but also on attitudes towards that which is happening. People are happier, if they're compassionate. The impact of happiness on health is undeniable. In each society, wealthy people are happier than the poor, but wealthier societies are not happier than poorer ones [14, p.44]. We increase living standards for ourselves in the same way that alcoholics and drugs addicts increase the size of their does. As soon as there is a new experience, its intensity must be increased to maintain it. Psychologists call this process adaptation. Welfare is the highest possible approach to economic resources, the highest level of welfare [15, p.58]. Welfare can be related to collective or individual material status, but predominately it will be linked to various interpretations of social justice. Welfare elements and their possible relations fall to the conscience of the state; secondly, welfare can be posited according to the category, greater and lesser [16, p.10].

Happiness is the highest value, because it is the foundation and beginning; for its sake we all do everything else [17, p.44]. The emotional side of happiness consists of what we generally call a feeling of well-being: finding a way in which to enrich our lives with a feeling of satisfaction or fulfilment through it [18]. What is a happy life? It is an orderly mind and lasting peace. Anybody can enjoy this, if you possess greatness of mind [19, p.449]. The question arises as to whether happiness can be taught or acquired through practice, attained in another way, or whether it occurs in accordance with divine will or is it just a lucky instance [17, p.39]. This is the goodness which guarantees and sets the standard for all our actions [20, p.8]. Happiness is desirable in itself, and it cannot be means to anything else. Happiness, therefore, is something ultimate and self-sufficient [21].

3. THE ROLE OF MONEY AMONG THE CONDITIONS FOR A HAPPY LIFE

Is money a pre-requisite for a happy life? Economics is – or ought to be – about the happiness of individuals; particularly because economic growth, unemployment and inflation, as well as institutional factors such as government, affect individual welfare [22]. The task of property and government policy works towards increasing people's happiness [23]. WHAT is Money? Money now is the NOTHING you get for SOMETHING before you can get ANYTHING [24, p.24]. In economics, happiness is defined as expedience and in psychology it is known as subjective welfare. Economic growth itself does not seem to bring happiness, except very temporarily. After a short time, people get used to their new standard of living and go back to being as (un)happy as they were before, but at a higher level of consumption [25]. We can do something for prosperity, but it can do nothing for us. [26, p.291].

Even though the pleasure which we derive from the power of money is fleeting, its power is so great that we want to feel it more often. This attainment of pleasure is a characteristic which reflects contemporary life in a highly symbolic way. For people living at one time and earning different incomes, money is a certain indicator of superiority. Economic matters are only significant is so far as they make people happy [27]. While the majority of happiness studies reveal that, on average, people in affluent countries are mostly happier than those in poor countries, studies reveal only a slight connection between an increase in income and the average level of happiness. On average, affluent countries are happier than poorer ones; happiness appears to grow together with income to a certain point, but not over it [28, p.5]. Economics is – or ought to be – about the happiness of individuals; particularly because economic growth, unemployment and inflation, as well as institutional factors such as government, affect individual welfare [22]. At the end of the 19th century, the majority of English economists believed that economics concerns happiness [14]. Economic growth itself does not seem to bring happiness, except very temporarily. After a short time, people get used to their new standard of living and go back to being as (un)happy as they were before, but at a higher level of consumption [29]. The task of property and government policy works towards increasing people's happiness [23]. The future, of course, remains unknown to us, but in any case we consider happiness to be a goal and fulfilment. If this is true, we will describe those among the living as happy people to whom the aforementioned words apply and will continue to do so [17, p.42]. Economic theories are geared towards increasing happiness and welfare. Therefore, economic policy is important to economic growth.

4. THE LIFESTYLE BUSINESS

Good science has to begin with good definitions [30]. Therefore, it is important to define what an entrepreneur is and what types of company there are, in order to understand who lifestyle entrepreneurs are. We see entrepreneurship as the creation of new enterprising activities, that is, innovation, new venture and strategic renewal [31]. An entrepreneur establishes and manages a business for profit and growth. The entrepreneur is characterized principally by innovative behaviour and implementation of strategic management practices in business [32]. The entrepreneur is commonly found at the helm of a small business organization, where innovation is the key to survival [33, p.128]. Entrepreneurs are recognised by demonstrating their self-restraint [34]. Entrepreneurs were more likely to be «pushed» rather than «pulled» toward entrepreneurship [35]. In the lifestyle business, the entrepreneur is concurrently the business' owner and employee. The owner perceives entrepreneurship as an affirmation of his personality, mutually

closely linked to the needs and wishes of the family [32]. In many industries, the function of the worker has totally and invariably significantly changed since the introduction of mechanical power. Increasingly, he does not work in the physical sense, but is directing an inanimate source of power to do what, left alone, it could not do [36, p.318].

In classic entrepreneurial literature, entrepreneurial activities are divided into three types. Salary-replacement firms provide their owners with income levels comparable to what they would have earned working for much larger firms [37, p.717]. Entrepreneurial firms engage in product-market innovation, undertake somewhat risky ventures, and are the first to come up with proactive innovations, beating competitors to the punch [38]. And lifestyle companies are established with the potential for a life cycle of several years characterised by due profits, the lifestyle and interests favoured by the owner, and remaining under the same ownership and management [39].

The first use of the term «*lifestyle entrepreneur*» was by University of New Hampshire professor William Wetzel in a 1987 magazine article. Tom Richman, «The hottest entrepreneur in America,» *Inc.*9 (February, 1987): 50. This article describes a category of entrepreneurs with «one overarching distinction: they've all started companies because it as the best way, sometimes the only way, they could get the work they wanted, where they wanted, and on the terms that they wanted.» So William Wetzel suggested the term «lifestyle entrepreneur». Such businesses lack wealth generation potential. They may generate attractive profits for the small entrepreneur without the promise of huge profits. Lifestyle ventures generally are not run for the financial benefit of someone else, such as investors who backed the enterprise in hopes of achieving a rich return [40]. Small firms are the vehicle in which entrepreneurship thrives [41]. Technology, global communication and modern innovations in the lifestyle business are much more important that in individual other types of companies, because they determine the elasticity of work in relation to location and time [42]. Every country and culture has a different understanding of business. Accordingly, in individual countries, the lifestyle business is accepted as the norm and business owners focused on the pursuit of wealth are considered to be unusual [40]. In Latvia, the lifestyle business is long-established in the form of farming. Nowadays too, entrepreneurs increasingly choose to shape their business on the basis of certain knowledge and skills.

Making money is an art and working is an art, and good business is the best art of all [43]. Enjoyable work facilitating a certain lifestyle and providing sufficient income to cater for one's needs is to a great extent at the forefront of the conditions for a good life. Because, what is a happy life? It is an orderly mind and lasting peace. Anybody can enjoy this, if you possess greatness of mind. It can be yours, if you are unflappable, steadfast and firm which you will resolutely apply to a good judgment just attained [44].

5. THE ROLE OF ERGONOMICS IN THE SUSTAINABLE DEVELOPMENT OF THE LIFESTYLE BUSINESS

In today's dynamic word, social ergonomics is increasingly significant. A balance has to be found between comfort, sustainability, well-being, welfare, development and peace. Traditional modes of thinking have to adapt to the marriage between man and technology. Business thinking can no longer be solely based on the potential for growth and expansion. The work environment and climate have to change. And in order for the changes to be productive, people's thinking must change first; in regard to the nature of welfare and the extent to which our lives are regulated by money. We also have to consider our use of money – do we use it to create new beginnings or use it to deal with consequences?

Simply stated, ergonomics is the process of translating human actions and needs into the physical forms of engineered or built systems. It involves designing tasks and the work or activity environment for human safety, comfort and satisfaction, as well as for optimum performance [45]. Ergonomics offers us solutions, additional elements that can improve the quality of life and work for employees, owners, entrepreneurs and anybody, nurturing productivity and sustainability. Ergonomics involves studies of accident analysis and prevention, understanding of human movement and cognitive functioning, as well as performance and safety evaluations [46]. Ergonomics delivers development. Growth is an increase in size, while development is an increase in quality and diversity. Development increases the value of both public and private investments, while growth tends to require increases in these investments that may or may not increase value [11]. Ergonomics is based on good will. And this is positive, because it means that our actions can produce achievements. Will is the sole determinant for happiness, if it decides to act [47]. Talent, character and success can be used for bad goals and even happiness can be corrupted. This is not what good will achieves, that which means something; good will, even if unsatisfied and disappointed in its efforts, is inherently good [48, p.107].

CONCLUSIONS

In order to spread our welfare, good will is also indirectly important to entrepreneurship. Good will is the highest good and the pre-requisite for all other benefits, and good will exists in its own right, without our greatness and power, in the absence of happiness. In Latvia, ergonomics is primarily based on good will, because society's inadequate understanding of its role, meaning, significance and long-term benefits prevents it from initiating constructive improvements that more often than are not measurable in monetary terms alone. I have analysed how wide-ranging people's understanding of money is and how unequivocally it is perceived. Public education in social ergonomics is important, emphasising the benefits and prospective reward. The lifestyle business is flexible and conducive to the enjoyment of a certain lifestyle and arrangement of professional activities as needs be. It offers temporal, financial and physical freedom and being less susceptible to the fluctuations of economic cycles, it is inherently stable and sustainable. The results of the study show that the lifestyle business can be the foundation for a happy life, because if a person acts in accordance with his interests and abilities, professional achievements follow. Furthermore, the lifestyle business offers stability, sustainability and happiness, because actions are dictated by personal interests and lifestyle. Ergonomics is equally attuned to sustainability. Moreover, ergonomics ensures people's welfare in the most direct way possible. Society itself is incapable of nurturing the spread of happiness. Modern societies yearn for the concept of a common good combining all benefits for their members.

The article is a scientific discussion which analyses various viewpoints with the assistance of qualitative methods applied from various perspectives. The article contains an innovative postulation for a good life built on ergonomics and lifestyle business. The study can be applied through a new understanding of the role of money among the conditions for a good life and the major role of social ergonomics in ensuring social sustainability. Similarly worthy of consideration is the contribution of the lifestyle business within the bounds of a happy, balanced, fulfilled and sustainable life. The conclusions arise from the results of the study that determined the eclectic appraisal of the lifestyle business as being potentially suited for sustainable activity.

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