

Special Article

Risk Assessment in Finland: Theory and Practice

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The Finnish risk assessment practice is based on the Occupational Safety and Health Act aiming to improve working conditions in order to maintain the employees' work ability, and to prevent occupational accidents and diseases. In practice there are hundreds of risk assessment methods in use. A simple method is used in SME's and more complex risk evaluation methods in larger work places. Does the risk management function in the work places in Finland? According to our experience something more is needed. That is, understanding of common and company related benefits of risk management. The wider conclusion is that commitment for risk assessment in Finland is high enough. However, in those enterprises where OSH management was at an acceptable level or above it, there were also more varied and more successfully accomplished actions to remove or reduce the risks than in enterprises, where OSH management was in lower level. In risk assessment it is important to process active technical prevention and exact communication, increase work place attraction and increase job satisfaction and motivation. Investments in occupational safety and health are also good business. Low absenteeism due to illness or accidents increases directly the production results by improved quality and quantity of the product. In general Finnish studies have consistently shown that the return of an invested euro is three to seven-fold. In national level, according to our calculations the savings could be even 20% of our gross national product.

Key Words: Risk assessment, Risk management, Occupational health service

Introduction

In Finland risk assessment process has been carried out in practice for past 20 years and according to Finnish modern Act for about 10 years. This article presents the legislative background and the methods used in the Finnish risk assessment practices. Because there are many studies on the value and benefits of risk assessment in work places and effects of the new act relating to risk evaluation, these studies give interesting information and are reviewed here. Also the benefits for companies due to evaluating risks at work are shortly described.

Hence, this is a holistic review of the development and benefits of risk assessment at Finnish work places done during past ten years and gives a good overview how to proceed successfully with workplace risk assessments.

Legislative Background of Risk Assessment in Finland

The Finnish risk assessment practice is based on European directive 89/391/EEC and the aim of the Finnish acts is similar. The Occupational Safety and Health (OSH) Act (738/2002) is a general law applying to all work, with only a few exceptions. The Act includes basic provisions and general objectives concerning occupational safety and health. It lays down the minimum level of safety and health at work. The aim of the Act is to improve the work environment and working conditions in order to safeguard and maintain the employees'

Received: July 28, 2010, **Accepted:** August 27, 2010

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work ability, and to prevent occupational accidents, diseases, and other physical or mental health problems related to work or the work environment. The employer shall systematically and on his/her own initiative identify the hazards and risk factors related to the work or working conditions, eliminate or remedy them, and assess the effects of the remaining risks to the employees' health and safety.

The Act describes the employer's general obligations, procedures related to work and working conditions, provisions on special work situations in shared work places, and the duties of other persons having an impact on safety at work. The act emphasizes the co-operation between the employer and employees. However, the co-operation does not diminish or abolish the employer's responsibility to carry out any measures necessary for the safety and health of the employees.

As in EU, also in Finland, the risk assessment is a process in which all work processes are evaluated systemically, thinking which factors or processes might cause injuries or damages, and if hazards could be eliminated and what preventive measures or shields should be used. The risk assessment is a foundation for successful management of occupational health services and a key to decrease work related accidents and diseases.

The purpose of the Act on Occupational Health Services (OHS) (1,383/2001) is to ensure a safe and healthy work environment, to prevent work related diseases and accidents, and to promote work ability and functional capacity of employees, as well as to provide preventive occupational health services for the employees. Each employer is obligated to organize services for his/her employees. The organization and content of the services need to be based on a company wide plan, and in the case of external service providers, on a formal contract between the employer and the service provider. Workers or their representatives have the right to participate in the planning of OHS for the work place. The content of occupational health services is primarily preventive. Curative activities are, however, also permitted as a voluntary activity of the OHS. About 80% of the occupational health services for enterprises comprise also curative services.

Municipal health care centres are responsible for providing occupational health services to employers who request them. Employers may also organize occupational health services themselves or through private service providers. The compliance of the employer is inspected by the OSH Authorities, whereas the health content, competence and activities of the health personnel are supervised by health authorities. The Social Insurance Institution reimburses employers 50% of the costs of arranging occupational health services and 60% of the expenses of work place surveys. The role of OHS in Finland

is very important because one of their duties is to survey every work place. They will also have a lot to contribute because of their work place level knowledge based on experience in assessing health effects. The role of occupational health services will be even more important because of the lack of employees in the future.

Laws of safety and health, and occupational health care determine the Finnish system when assessing work conditions. A risk assessment is an obligatory duty of an employer at Finnish work places. The employer has the main responsibility on health and safety in them. Every work place must have safety officers and the enterprise having more than 10 workers has to have also a safety representative. For occupational health service (OHS) a work place survey is essential in co-operating with enterprises. A work place survey means identification and assessment of health risks and loading factors at the work place and making suggestions for improvement on health basis. Work place survey is a base for an action plan of OHS. In Finland, there are four different OHS providers: municipal health care centres, OHS units of enterprises, private medical centres, and a joint model of OHS units. There is a need for discussion on how occupational health and work place safety personnel can work together in assessing work conditions.

According to the Act on Accident Insurance (608/1948; 681/2005) the employer is responsible for insuring his/her employees for cases of occupational accidents and occupational diseases. According to the Act, each employer who employs a person for more than 12 days a year must provide occupational accident insurance for him/her. In Finland, occupational accident insurance is technically operated by 12 private accident insurance companies under the supervision of the Ministry of Social Affairs and Health. For the big companies paying more than a preset limit premium, the level of the premium is defined on the basis of the accident rates in the individual company. For smaller companies paying smaller premiums than the preset limit premium, the premium is set defined on the average risk of the branch. Corresponding legislation has been passed also for self-employed farmers (1,026/1981). Other self-employed persons can take the insurance on a voluntary basis.

Accidents at work are still commonplace. According to the statistics of the Federation of accident insurance institutions, during the period 1996-2005, there were an average of 100,000 accidents at work and 15,000 accidents while commuting to and from work. In 2005, about 54,000 (49%) of work place accidents led to at least four days' absence from work [1].

About 1.5 million employees are exposed to physical risks in the working environment, in Finland such as noise,

vibration, exceptional temperature conditions, and radiation. The total number of those exposed to high noise levels (over 85 dB) has not fundamentally changed, but the number exposed in, for example, construction-related occupations has increased, while in the metal industry, the number has fallen. About half of the economically active population, just over a million employees, are exposed to chemical substances or indoor air impurities at work. This number has not changed much since the late 1990's. The most common chemical exposure factors are dusts, detergents, and solvents. Although according to the interviews, there is now less use of harmful chemicals and hazards are reported slightly more often than before. The reason for this is most likely to be the more common awareness of smaller hazards [2]. About 1.7 million people work indoors in Finland. In 2006, the most common problems in the indoor air of offices were dry air or draught, dust, stuffy air, heat, noise, and unpleasant smells. Damages caused by mould or damp are accompanied by the smell of mould or an earth cellar, which was reported by a total of 15% of all respondents (11% in 2000) [2].

As in previous years, about one in four respondents regarded their work tasks as either fairly physically strenuous or very strenuous. The estimates of the physical strenuousness of work seem to have fallen among those working in the health and social services sector, as well as among men working in machine workshops and structural metalwork. The frequency of repetitive work movements and uncomfortable working positions decreased significantly, especially among women [1,2].

Methods Used in Risk Evaluation

Since January 2003 when the new Law of Occupational Safety (738/2002) came into operation, it has been obligatory for every company in Finland to perform risk evaluation. The new law emphasizes the meaning of systematic and continuous actions to improve working environment and working conditions. To fulfil the aims and methods given in the laws, different standards like BS 8800, BS 18004, OHSAS 18001, ISO 14001, ISO 9000 are used. Because of the demand of a systematic and continuous evaluation, the all phases of risk assessment are very important: planning, hazard identification, defining the magnitude of risk, prioritizing risks, choosing preventive measures, communication and follow-up and feedback. Especially communication relating to nearly every phase is more important than believed, when we evaluate benefits and results of actions. It is also important to understand and develop safety culture of the company. To fulfil the demands of the laws, companies should have management system that also takes occupational safety and health issues into consideration.

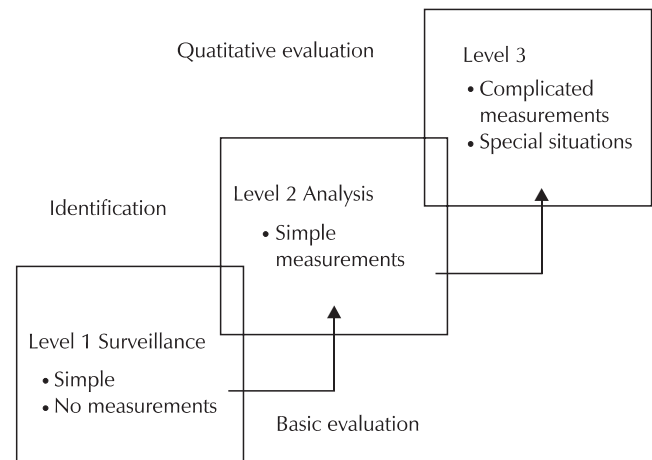


Fig. 1. Risk assessment in three different levels.

The same aim is supported by the law of OHS. And the aim of these activities is: How does management influence succeeding in risk control.

In practice we have even hundreds of risk assessment methods in use but luckily only a few of them are in wider use. The simpler method is used in SME's and real risk evaluation methods in larger work places (> 50 employees). The idea is that in a simple case we can already, in the basic evaluation and surveillance to determine if there are any risks. And if there is lack of information or knowledge we should move to second or third level made by the specialized experts (Fig. 1) [3].

In SME's we often have used a method described in Table 1. It is the first evaluation clarifying, if there are risks or not. If the answer to a question is yes, we should make a more sophisticated evaluation or some prioritized preventive actions. In large work places we have used a method recommended by our Ministry of Social and Health Affairs. There is a list of about one hundred different factors like noise, chemicals, difficult position, mental load etc. The presence of factors should be evaluated by a certain method described in Table 2 [4].

When all the factors have been evaluated separately, we have risk levels determined for all of them. The next step is to prioritize required measures to reduce the risks. In cases of very high risk level, measures should be started immediately, in cases of high risk level quickly and in cases of medium level within a suitable time table [5].

Situation in Work Life

In Finland we have now good laws, regulations and methods guiding us in measures to encourage improvements in safety and health of workers. Is that enough? Does the risk manage-

Table 1. A simple risk evaluation form used by SME's

Physical factors	Chemical and biological factors	Accidents
<input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Thermal conditions <input type="checkbox"/> Illumination <input type="checkbox"/> Radiation <input type="checkbox"/> Others What: _____	<input type="checkbox"/> Flammables and explosives <input type="checkbox"/> Carcinogenic <input type="checkbox"/> Allergic <input type="checkbox"/> Hazardous chemicals <input type="checkbox"/> Dusts and fibres <input type="checkbox"/> Gases, vapours, smokes, mists and so on <input type="checkbox"/> Infection <input type="checkbox"/> Molds and fungi <input type="checkbox"/> Others What _____	<input type="checkbox"/> Falling down <input type="checkbox"/> Slipping, stumbling, or falling <input type="checkbox"/> Falling obstacles <input type="checkbox"/> Wounds <input type="checkbox"/> Dangerous tools, machinery and equipment <input type="checkbox"/> Others What: _____
Physical load	Mental load	
<input type="checkbox"/> Difficult work postures <input type="checkbox"/> Heavy loads, carrying, difficult moving of obstacles <input type="checkbox"/> Repetitive working movements <input type="checkbox"/> Continuous sitting or standing <input type="checkbox"/> Others What: _____	<input type="checkbox"/> Difficult mental environment <input type="checkbox"/> Lacking supervision or cooperation, discrimination, non-equal treatment <input type="checkbox"/> Threat of physical or mental violence <input type="checkbox"/> Busy, no brakes or too busy work <input type="checkbox"/> Others What: _____	
Environmental risks		
<input type="checkbox"/> Storing and treatment of chemicals <input type="checkbox"/> Transportation of chemicals <input type="checkbox"/> Fuels and oils <input type="checkbox"/> Waste treatment <input type="checkbox"/> Air pollution and noise <input type="checkbox"/> Emission to ground and water <input type="checkbox"/> Emissions in malfunctions <input type="checkbox"/> Others What: _____		
Find those risks that concern your company		
Name five most important risk factors from above mentioned factors at your company:	1. _____ 2. _____ 3. _____ 4. _____ 5. _____	

ment function in our work places? According to our experience we need something more. That is, understanding of common and company related benefits of risk management. In the following text there are some results basing on a few studies made to evaluate the effect of risk assessment and situation in work places.

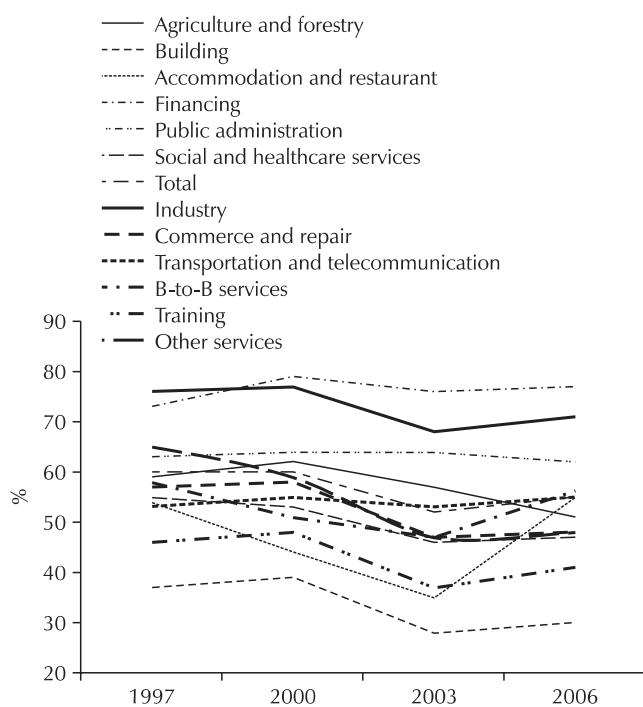
In Finnish annual barometer to work places we have asked them: Has somebody from your OHS surveyed your work place during the past three years. The results are presented in Fig. 2 [6]. As seen in the Fig. 2, in agriculture and in industry about 70% of the work places have made the work place survey but in building sector only 30%. The total percentage has been between 50 and 60. The conclusion from the result is that there is a polarization of risks in work life [6].

In 2008 and 2009 there was a study, the objective of which was to examine the impacts of the occupational safety and health (OHS) legislation in the risk assessment in work places. The risk assessment activities as a part of the OHS management were also evaluated.

The target groups of the survey study consisted of OSH representatives of employers and employees as well as of occupational health care service providers from different parts of the country. The study was carried out using questionnaire surveys in September and October 2008. The employer respondent group (N = 6,710) was extracted from the Finnish Registers of Occupational Safety Personnel. The representatives of the employers passed on the separate, targeted questionnaires to the representatives of their employees (N = 5,306) and to

Table 2. Definition of level of accident risk by evaluating consequence and likelihood

Likelihood (frequency of exposure to the hazard)	Severity of harm		
	Slight harm Lost time < 3 days. Temporary slight harm: sprains, bruises	Moderate harm Lost time 3-30 days. Long-term, severe harm, permanent slight harm: fractures, burns	Extreme harm Lost time > 30 days. Permanent disability, death
Unlikely Occasional hazardous situations, exist seldom.	1 Very low risk	2 Low risk	3 Medium risk
Likely Daily. Incidents have occurred.	2 Low risk	3 Medium risk	4 High risk
Very likely Hazardous situation exists often and regularly. Accidents exist.	3 Medium risk	4 High risk	5 Very high risk

**Fig. 2.** The percentages of work place surveys on different branches of work life. The answers to the question: Has somebody from your OHS surveyed your work place during past three years.

the representatives of the health service providers of their work place (N = 1,016) [7].

From the results we could conclude, that upper management was committed in developing health and safety at work (over 90%), responsibilities of OSH were named (95%), employees receives enough OSH-training (about 70%), and superiors were familiar with the obligations laid down in the OSH Act (about 80%). The wider conclusion was that commitment

for risk assessment was high enough.

The responses of the representatives of the occupational health services (n = 469, 46%) indicated that risks of accidents, physical and mental stress factors, as well as physical and chemical risk factors were considered well in their assessments. Three out of four employer respondents, two-thirds of employees and two-thirds of occupational health services felt that the legislative regulations had also promoted the engagement of the upper management. Occupational health services were used as experts in risk assessment quite often (68%) and OHS had also participated in development process based on risk assessment very often (66%).

OSH Act had thus activated work places to carry out risk assessment very well. OSH Act had a good impact in commitment of upper management, execution of risk assessment in work places, development of working environment in work places, as well as work instructions (81%). Suggested improvements were e.g. more integrated legislation and more specific guidelines. These comments related to the facts that our legislation included many laws and they are not easily understandable.

To conclude, the results indicated that the risk assessment required active training, which should cover issues concerning the assessment of health and safety of working conditions and issues of safety management. The training should be targeted to the management, superiors and employees as well as at the actors in occupational health services. However, according to the questionnaire to occupational safety experts, 20% of responders did not use the results of risk assessment in work place survey and only 40% used it in an effective way [8]. Hence more co-operation is still needed between OSH and OHS experts.

It is easy to make a list of means of risk management for following things: quality system, the corporate social responsibility, planning of work and working methods, increase of working time, reservation of labour, prevention operation, personal protective equipment, familiarization and supervision of work as well as controlling the residual risk. Still after this kind of guidance several questions have remained in companies relating to the diversity of controlling actions. The best result is gained by integrating technical (machines, equipment, shields, work environment) and functional (competence, education), preventive and protective actions. There is also a lack of short conclusion of results and recommendations for management with timetable compatible with management system and yearly plan of action.

Most improvements suggested by OHS were carried through in safety management and work environment (Table 3). About half of the recommended actions by OHS have been accomplished. Recommendations for the management and work of the foremen were best accepted by private occupational health care units. However, their suggestions were most often left undone. The best parameter for the success of co-operation was the duration of co-operation (> 5 years), the number or personnel at the enterprise (> 250 persons), the proposer (doctor → work environment, nurse → training, guidance, extra guides for workers), and the occupational health care unit (own occupational health) [9].

Safety personnel thought that findings of outsiders open eyes at work places and help to deal with problems that belong to nobody or are commonly shared. All persons must maintain their activity to improve the working conditions. Risk assessment and work place survey have basically the same goal, and combining them must be encouraged. Emphasis should be in risk management activities more than only in

the evaluation of the situation. Resources for this activity will probably be reduced in future (competition, outsourcing, recession). Occupational health organisation is so great a tool to improve Finnish working conditions that it should not be neglected. However, safety and health responsibility is on the employer in a negative and positive way. Occupational health personnel work as consultants and consultants have only the responsibility and power of a consultant [9].

In relating to the question, what should be evaluated, we got the answer in one of our projects among SMEs [10]. The aim of this study was to examine how management influences succeeding in risk control and what benefits or possible disadvantages risk evaluation causes to SMEs. OSH management levels of SMEs were measured with safety-ten -method, which is developed especially for SMEs to evaluate the quality of their safety management. Risk evaluations in SMEs were made by the own staff of the companies and researchers from the Finnish Institute of Occupational Health. Six companies took part in this study and number of employees in these companies was between 10 and 280. In those enterprises, where OSH management was at an acceptable level or above it, there were also more varied and more successfully accomplished actions to remove or reduce the risks than in enterprises, where OSH management was in lower level (Fig. 3).

Every company had made quite appropriate actions in hazard identification. The biggest differences between OSH managements of the enterprises were in planning of functions, co-operation with interest groups, documentation and controlling of flow of information. New quality management systems included also occupational safety and health issues. According to this study it was also possible to achieve excellent OSH management level by using methods of new quality management systems. The most common consequences and benefits

Table 3. How the proposals had been implemented in the work places?

The target of proposals (number)	Implementation level				
	Well	Moderately	Poorly/Not at all	Unfinished	Do not know
Leadership (n = 111)	17.1	18.9	11.7	40.5	11.7
Work performance (n = 240)	27.9	23.8	3.3	35.4	9.6
Work environment (n = 228)	22.4	22.8	7.9	36.8	10.1
Tools, devices, machines (n = 136)	29.4	23.5	5.1	33.8	8.1
Training, guidance (n = 114)	24.6	21.9	4.4	36.0	13.2
PPE, protection (n = 138)	46.4	13.8	2.2	24.6	13.0
Promotion of work ability (n = 45)	48.9	17.8	6.7	20.0	6.7
Activities of OHS (n = 91)	48.4	8.8	4.4	31.9	6.6

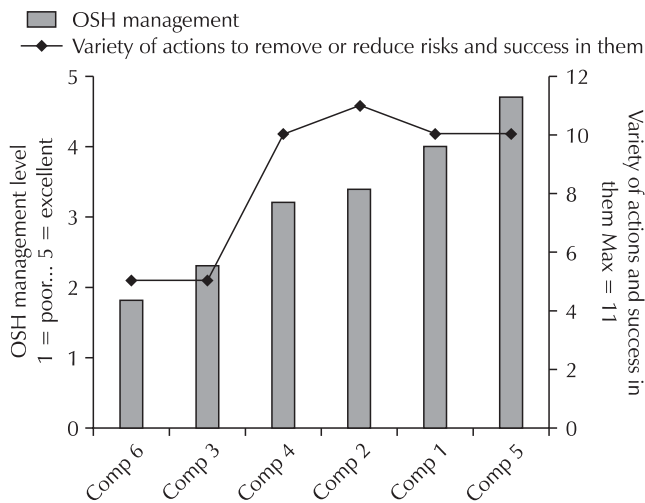


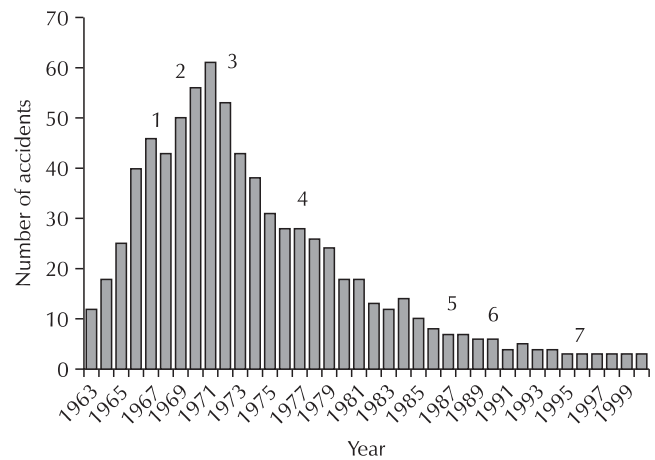
Fig. 3. OSH managements influence on succeeding in risk control.

Table 4. Consequences and benefits of risk evaluations

Benefit	Percentage (%)
Discovery of new risks	71
Definition of right risk values	64
Implementation of protective equipment	71
Changes to machines and tools	67
Improvements to ergonomics	67
Improvements to working environment	71

due to risk evaluations were the discovery of new risks (71%), the implementation of new protective equipment (71%) and various improvements to working environment (71%) and ergonomics (67%) (Table 4). Succeeding in risk control is difficult without using some kind of OSH management system. OSH management systems are similar to quality management systems and they help companies to execute systematic, continuous and effective actions to remove or to reduce risks or to improve working environment and conditions [10].

In the company level in the best companies risk management has been very manifold and actions have been done in many ways. At the beginning of 70's the starting point was to follow the laws according to the given aims and threshold limit values. In 2000's the work places have again activated because of the new laws and risk management activities and in addition to the voluntary zero accident activity and international benchmarking of the companies. In the Fig. 4 there is an example of a larger company, which has succeeded very well in reduction of accidents. Every time they have innovated a method to



1. The creation of safety organization 1972
2. Work place detection of each function 1973
3. Safety plan of action since 1976
4. Safety training for the personnel
5. Promotion of mental safety
6. Safety inspections as safety pair-action
7. Zero-accidents program, focused safety work, risk assessment

Fig. 4. Accident frequency and effect of risk management actions during last decades in a large Finnish company.

reduce accidents, they have also been very successful [11].

Discussion and Conclusions

According to the Finnish statistics, interviews and expert evaluations the work environment has improved from 1970's and 1980's in almost all branches, concerning accidents, occupational hygiene, ergonomic and psychosocial factors. Changes in production technology, legislation and safety and health work have improved. However, the development in 1990's and 2000's has not been as rapid as earlier. There is still much work to be done: thousands of new occupational diseases and 100,000 accidents occur every year, and more than 25% of workers evaluate work environment to be harmful when physical, chemical and biological factors are considered.

Even though we can conclude that situation in Finland is much better than we expected, there is still need for improvements in risk assessment activity, amount and quality of preventive actions and co-operation between OHS and OSH experts. The benefits of risk assessment according to surveys are usually accepted to be as follows: they make possible accurate measures, safety culture promotion, systematic development work and prioritizing the activities [12]. In risk assessment it is important to process active technical prevention and exact communication, increase work place attraction and increase job satisfaction and motivation. We should use the results of

risk assessment in training for improving risk awareness, and choosing personal protective equipment.

Investment in occupational safety and health is also a good business. Low absenteeism due to illness or accidents increases directly the production results by improved quality and quantity of the product. Furthermore, the direct costs due to hiring replacing personnel and their training, are avoided. Other indirect costs are not mentioned, but in general Finnish studies have consistently shown that the return of an invested euro is three to seven-fold [13].

However, just now we need understanding the benefits of risk assessment not only from the legal point of view but also for the benefits of companies and individuals and even the whole nation. The effects on economical savings and productivity are the most important. In national level productivity will increase because of longer time in work life, later retirement and increase of presence. According to our calculations the savings could be even 20% of our gross national product. In company level the increase of productivity is a result from the image of work place, learning, profit, quality, competitiveness, and mutual respect [14].

In the studies [13-15] made in Finland, only 30% of the questionnaire respondents considered reporting of absenteeism to be sufficient. Ill-being at work may also cause substantial losses for both the companies and the society. The annual costs of lack of well-being would be over 10 times higher than annual investments in it. Many development cases of well-being in companies, meant as a rationale for investment, were reported.

The payback period was less than half a year in 60% of the cases ($N = 28$).

Because of the lack of workforce, in the coming years, the attractivity could also improve the above mentioned negative trends existing in Finland. Work environment must be improved further. Physical and mental work loads must be relieved and the image of work must be improved. Anyway, our thinking will be changed possibly in an unpredictable direction. Productivity and well-being are elements of attractivity. Therefore, we need more studies in this field.

The understanding of the benefits of risk assessment means in practice the change from management to leadership - more knowledge and skill to superiors at work place. At the same time part of the activities, usually guided by the authorities, will be ruled by work places themselves.

In Fig. 5 it is described, which are the main factors of OSH management and how much they can vary in the companies. Because the quality of OSH management and success in risk management relate to each other, it is very important to evaluate also risk management system [10]. Of course, there are also critical opinions against risk assessment. It has been evaluated that the resolution of risk definition matrix and quantitative results is not good enough. [16] According to our practical results the divergence can be one class in the scale up to five. Internationally risk management and control actions need also more analytical assessment [12]. If the results don't support risk management, risk assessment can be too mechanical. There maybe was no relationship to management

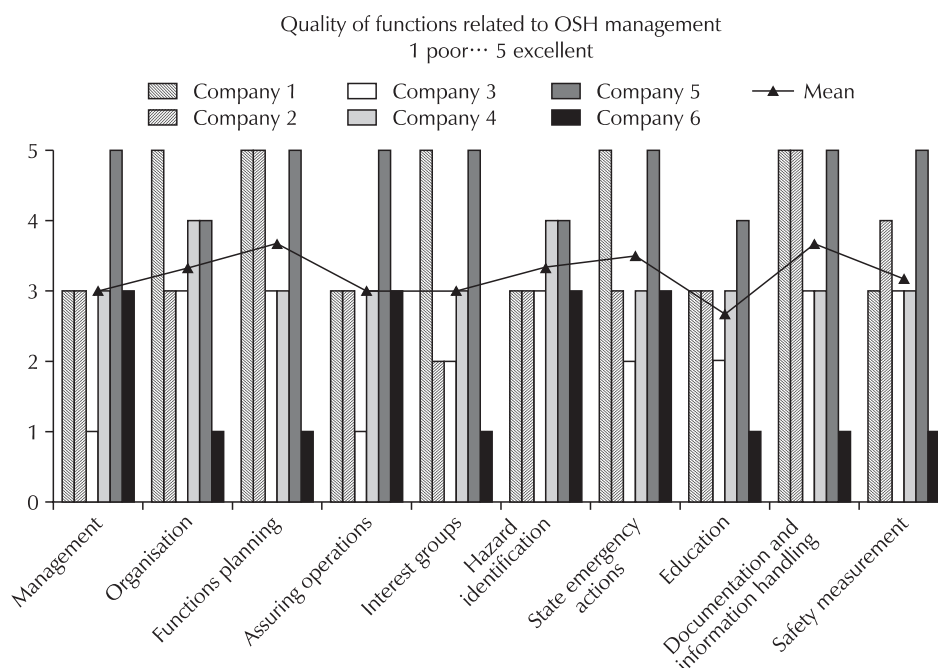


Fig. 5. Quality of functions related to OSH management.

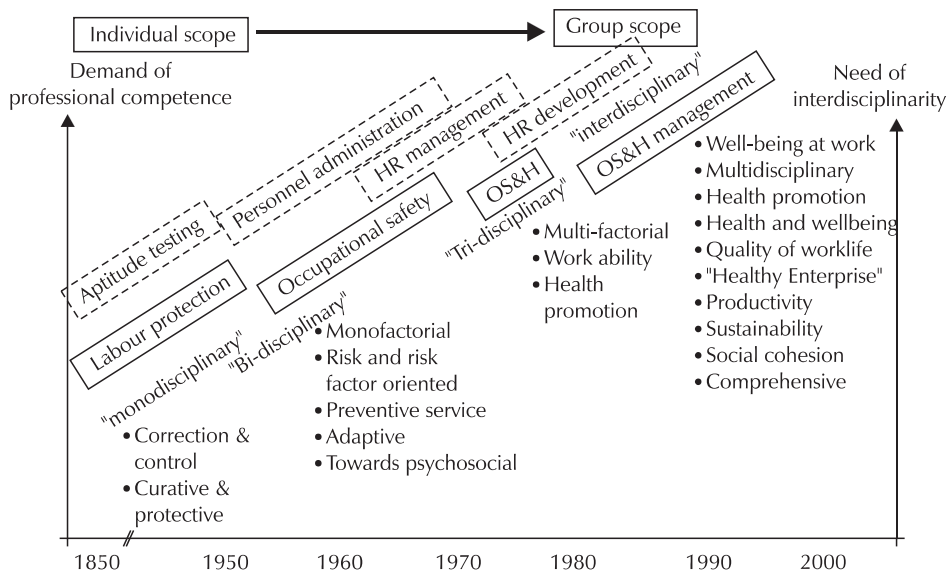


Fig. 6. Development of concept of well-being at work.

and leadership, no relationship to planning procedure, not enough communication or there is deficient understanding of the methods.

According to our experience the main questions are as follows. First, the results of risk assessments were not used enough (50%) in risk management actions. Second, zero accident is a powerful idea - knowledge, skill and attitude to change the risk management. Among these points, attitudes are the most important. They can be changed in one week e.g. in the case of the change of owner - resulting zero accident. There is also much information at work places given by different authorities and not used by anyone. In Finland the solution could be that occupational health services could report and analyze this information more widely and deeply than nowadays.

Future challenges of safety and health at work places will relate to well-being at work (Fig. 6). This concept includes not only those negative, risk related factors but also positive, motivation increasing factors resulting attractiveness, competitiveness, and productivity of work places. The development of the concept is very clearly a consequence of needs and skills in work places. In Finland both the government and trade union rely on this concept, when productivity should be increased in the near future [17]. The risk assessment has become a part of normal safety activities in Finnish work places functioning well enough and it will stay as the base of future concepts as well-being at work.

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