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FOREWORD

Vision Zero Summit 2019, 12 – 14 November 2019, Helsinki

The Vision Zero Summit was held on 12 - 14 November 2019 in Helsinki Finland, and organized by the Finnish Institute of Occupational Health, with the support of our partners.

Vision Zero is a strategy and a holistic mindset. It is continuous improvement of safety, health, and wellbeing at work, not just a numerical goal. This summit focused on discussing different aspects of Vision Zero, taking the Vision Zero thinking and actions to the next level, and sharing best practices and lessons learned. One theme of the Summit was worded as Rethinking Vision Zero, which is a reminder that there are many perspectives to Vision Zero.

Vision Zero Summit was one of the side events of Finland's Presidency of the Council of the EU.

One of the Vision Zero Summit's goal was to provide new ideas and perspectives, as well as strengthen participants professional networks.

This Proceedings publication is a compilation of the papers presented on 12 – 14 November 2019 in the Vision Zero Summit 2019 in Helsinki.

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Table of Contents

Human factors as a philosophy and practice to renew Vision Zero

Anna-Maria Teperi, Finnish Institute of Occupational Health, Finland

Abstract

Vision Zero (VZ) is a prevention and commitment strategy for safe work without fatal or serious occupational diseases or accidents. National and international actions have been the sharing of good practices through networking. Simultaneously, the latest safety research has raised a new view (Safety-II), which focuses on human variety and success behind safety. However, VZ has been criticized for causing a risk of hiding incident data while targeting 'zero'. According to some, Safety-II has produced a good philosophy, but has lacked practical implications. This study shows how interventions applying the holistic Human Factors (HF) perspective in 2000-2019 have facilitated a more analytical understanding, a positive view of safety as human action and more open discussion at workplaces, making Safety-II more concrete. Applying HF with the Safety-II view may further concretize and renew Vision Zero, and best utilize its potential in international networks.

Introduction

Vision Zero (VZ) began as a prevention and commitment strategy for safe work with no fatal or serious occupational diseases or accidents. Its original aim was to communicate a clear message to companies that accidents are preventable and that striving for zero accidents is ethical business. A clear link has been built to productivity and quality in industrial companies. One form of action has been sharing good practices through networking in national and international forums to improve safety levels. (Zwetsloot et al., 2013).

However, VZ has focused on pragmatic needs and discussion, and lacks a clear, solid theoretical basis due to limited scientific evidence. Some recent safety debates have criticized the aims and means of VZ, even regarded it as 'a religion' or as causing opposite results, causing risks of hiding incident data while targeting 'zero' or 'no harm' (e.g. Sherratt, 2014; discussion at Policy and Practice in Health and Safety, 2017).

At the same time, the latest safety research has introduced resilience and Safety I-II paradigms to show the difference between traditional and new safety thinking (Hollnagel, 2018). Safety-II has pointed out the need to see issues working well, and to understand the human variability and limited resources behind safety cases. Its aim is to help individuals and organizations anticipate, cope, recover and learn from operations. In contrast, traditional safety thinking (Safety-I) has focused on calculating risks and finding technical issues or individual errors as reasons for accidents, leading to incorrect conclusions and narrow corrective actions, as well as a lack of commitment and motivation for safety management among operative personnel. For some time, Human Factors (HF), as a multi-scientific discipline, has aimed to support overall system performance, efficiency, safety and well-being among those working in systems. However, HF has also been defined as using narrow aspects and findings and fragmented results, concluding in individual- and error-based assumptions (Teperi et al, 2015; 2017; 2019). The new era of HF sees humans as a positive capacity in systems (Dekker, 2017). The move from the 'old to the new view' in HF (Dekker, 2017), as well as in safety management (Hollnagel, 2018), is summarized in Figure 1.

Figure 1. Evolving paradigms of safety management and HF perspective

SUPPORT SYSTEM AND HUMAN RESILIENCE:
Ability to anticipate, cope, recover and learn.
HELP PEOPLE SUCCEED.

SAFETY I

FACTORS WEAKENING SAFETY

- Unsuccessful actions
- Risks
- Errors

PARADIGM SHIFT IN SAFETY THINKING

SAFETY II

FACTORS MAINTAINING SAFETY

- Things working well
- Understanding human variation
- Limited resources

INDIVIDUALS AND ERRORS IN FOCUS

- "Bad Apple Theory"
- "Find the weakest link and throw them away"
- Latent systemic failures remain in system

= OLD THINKING

CHANGE IN HF-THINKING

ORGANISATION, SYSTEM, RESOURCES AND DEVELOPMENT IN FOCUS

- Several contributing factors behind the cases
- Learning is main goal of investigation
- Human error is starting point for improvement – not the conclusion

= NEW THINKING

Designed by Elido 2019

Teperi & Kannisto, 2018, based on Dekker, 2017, Hollnagel, 2018 | © FIOH

The challenge is how to synthesize the 'original good purpose' of Vision Zero, to align it with the new view of 'human- and organizational-centred safety', and how to find concrete actions to realize the new safety view, utilizing Vision Zero's networking potential.

This study presents interventions which apply a holistic HF perspective with a theoretical framework and concrete tools in 2000–2019, aiming to focus on safety from the human side.

Execution

In safety critical fields, applying HF to safety management is mandatory. Industries also face increasing social-ethical pressure. Moreover, the new ISO 45001 demands more active implementation of human-centred actions at workplaces.

The following case studies summarize interventions from 2000–2019 which are also based on the need to renew safety culture by better mastery of HF, i.e., to better understand the human performance behind operations and incidents. All the interventions used the HF Tool ™ framework and practical tools, originally designed in aviation (Teperi, 2012) and further modified in research and development interventions by FIOH (Teperi et al, 2017a,b; 2019). The tool consists of 4–5 levels: individual-, work-, group- and organizational level, as well as system level. The HF Tool™ provides toolkit to raise HF competence and awareness, and includes basic training, the HF trainers' program, introduction for top management, investigation tools and suggestions for corrective actions. For example, it uses a 'positive timeline' to focus on positive factors during the operations and incidents.

The interventions were research projects with a workplace development orientation. Table 1 summarizes the actions, material and methods.

Table 1. Application of HF in safety management; research data and findings during last 18 years in safety critical fields.

Field, years	Air Traffic Management (ATM), 2000–2012	Nuclear energy industry, 2015–2018	Maritime sector, 2016–2017	Aviation maintenance, 2016–2017	Railway sector, 2015–2019	Construction industry, 2017–2019
Actions and aims	Design of original HF tool. Implementing HF in SMS (basic, refresher and trainers' training, incident reporting and investigation, risk assessment). Participation of all organizational levels in HF tool use.	Modifying HF tool for nuclear energy industry. Using it to analyze operational experiences in nuclear power plants; training safety experts. Improving mastery of HF with concrete toolkit.	Modifying HF tool for maritime. Testing it with seafarers, safety experts and managers at workshops, to assess and develop maritime safety culture. Participation of partners from different positions in maritime system (regulator, companies).	Modifying HF tool for aviation maintenance. Using HF as a framework to define safety critical parts of aviation maintenance work processes, and to renew occupational health practices. Participation of all organizational levels.	Modifying HF tool for railway sector. Implementing HF in training and incident investigations, to develop safety culture. 60 HF trainers trained, who further trained 1000 personnel. Participation of all organizational levels.	Modifying HF tool for construction industry, including the fifth 'system' level.
Data and methods	Interviews (n=21) Surveys (n=142, n=155) Open questions for safety and quality groups of airports (n=46) Analysis of incident reports (n=3163)	Interviews (n=20) Document analysis Intervention material of workshops	Interviews (n=20) NOSACQ-survey (n=427) Intervention material of 4 workshops	Interviews (n=27) Work process analysis models from 6 tasks in 3 units Brain work index (n=379) Work observation of most critical tasks	Interviews (n=9) Intervention material workshops with three companies from airport operations, ATM and railway). Indicators for HF efficiency. Data collection in progress.	Study protocol article published, intervention results in progress.
Detailed original scientific article	Teperi, 2012; Teperi, Leppänen, Norros, 2015	Teperi, Puro, Ratilainen, 2017	Teperi, Puro, Lappalainen, Perttula, 2019	Teperi, Asikainen, Ala-Laurinaho, Valtonen, Paajanen, 2019	To be published in 2020 www.ttl.fi/prohf	Nykänen, Puro, Tiikkaja, Kannisto et al., 2019

Findings

The main findings of the interventions are summarized as follows. In ATM, although several hindrances were recognized during the ten years of HF implementation, the organization adopted the HF tool in their safety management system (and it is still in use). According to results, it helped units learn and analyse both positive and negative HF-related causal factors of incidents, enabling ATM operators to reflect their work. The benefits of the HF tool were its visuality, user-friendliness and the congruence of its contents with existing HF tools. The lessons learnt revealed the need for continuous training and more active communicating of the corrective actions based on the HF tool use (Teperi et al., 2015).

In nuclear power plants, the study revealed that currently, the reporting and analysis of operative events focuses mainly on technical and risk aspects, and HF is not very concrete. The new HF tool offered a more accurate picture of the analysed events, including the successes, thus offering a path for Safety-II type of safety management. The users found the HF tool clear and easy to use, and useful for investigation, training and self-evaluation, and monitoring safety trends. HF competence and implementation still needs to be concretized in the nuclear sector. (Teperi et al., 2017a).

We found that maritime organizations had no similar kind of HF tool in use. The tool was regarded as an opportunity to involve the operative personnel in reporting and analysing incidents and understanding human performance. Use of the HF tool could help root a positive safety culture in the maritime industry. (Teperi et al., 2017b).

In aviation maintenance, the HF tool offered a holistic framework for co-operation of all organizational levels. By combining with other methods, the safety critical demands and features of the work process from a human point of view were defined, for better mastery in everyday operations and also by occupational health care personnel (Teperi et al., 2018).

In the railway sector, preliminary findings indicate that HF application has supported the renewal of safety culture. After four years of implementation, risk awareness has been complimented with a focus on successes and issues that go well. Incident analysis is seen as more analytic, including human variability with a holistic view. Corrective actions have been more accurate and slow systemic moves have been accepted instead of 'quick fixes'. Workers better understand their own and others' errors, with a deeper view to operative reality. Top management followed the HF programme with interest. Improved quality of communication and openness of discussion were also mentioned.

To sum up, HF applications in safety management have realized Safety-II and new HF view aims. The reported benefits are better understanding of human variability behind operations, and moving the focus from errors and risks to the positive potential of people. A more analytical evaluation and learning of human contribution not only as individual actions, but also at work-, group-, organizational and system levels are recognized, especially at incident investigations. Several organizational levels and system partners are committed to HF actions in safety management activities, supporting open discussions and trust as a key to anticipation. HF thinking and the toolkit have provided an understanding and a reflection on human performance as a part of a system.

Conclusions

This paper aimed to show how applying a holistic HF perspective as a philosophy and practice in the last 18 years has promoted Safety-II thinking and offered concrete tools to transform it from scientific debate to practice. The HF perspective, in its modern, broad definition, may give further potential to enrich Vision Zero. Whether through Vision Zero's seven golden rules or the Safety-II perspective, we need practical programmes, processes, practices and tools, to realize good targets. Exploration of the efficiency of HF actions are needed, too. Based on our research, at least five aspects are needed for proper implementation of safety improvements: anticipation, a participative approach, a focus on factors that work well (successes), commitment at all organizational levels, and systemic, collaborative orientation. Dedication, motivation and competence are needed as well as tough, long-term work, and coping with tensions at different development phases. These 'tensions' may be utilized to combine HF research and practice with

the Safety-II perspective and Vision Zero's international networking potential. The aim is not to have conflicting paradigms and parallel paths, but to compliment and synthesize these.

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The journey to Vision Zero at L'Oréal in a VUCA world

Philippe Delbecq, L'Oréal, France

Abstract

The protection of people and wellbeing at work are part of L'Oréal's DNA for already a long time.

Over the past decade, the Group has developed and deployed worldwide a significant amount of mandatory requirements (NFPA, ATEX, Seveso, etc) associated to programs and tools to deliver sound results at the shop floor.

In order to support this, L'Oréal has also developed a strategic frame of risk management that is supported by 8 Health and Safety pillars that describe how Health & Safety are put in practice, taking into consideration different languages and also different cultures, even within the same countries.

This enables the sites to adapt the H&S programs to their own culture while applying the concept of the right tool at the right time.

All sites are audited upon and measured against our systems, tools and methods, while a Health & Safety culture program has been implemented to review senior and line management leadership, employee participation as well as the effectiveness of our programs.

The communication is articulated around a carefully selected metric system to drive out the system towards excellence and beyond.

Despite more and more solicitations of employees in a VUCA world, these pillars have been a beacon of focus for everybody and enabled L'Oréal to continuously improve the H&S performance and reach a lost time frequency rate below 1. However, this still means that 140 people are injured per year in L'Oréal. Totally unacceptable.

By focusing on the very essential and giving sense to safety through a platform of centralized methods and tools, a culture has been developed which now promotes and encourages self-initiative and creativity, moving from applying imposed safety to creating positive safety.

In this context, one specific initiative deserves to be shared and that is Safe@work - Safe@home. When the program was launched, the master idea was to develop a mindset that gave a reason to "why is Safety important to me" and make health and safety personal for every employee, no matter where they are in the world. L'Oréal collaborated with RoSPA to focus efforts to where a difference can be made in accidents within society. Not only has been seen a change in the mindset of employees in promoting safety outside of work but also the way they see safety in work.

Safety is therefore not imposed but becomes a way of life by taking individual culture to the next level. It's early days for sure but this initiative with no roadmap or KPI will change hearts and minds. Reducing accidents @work and @home is critical to the Vision Zero mindset. It was this common mindset and objective that brought Vison Zero and L'Oréal together.

The simple observation of the distribution of home accidents drawn by Rospa motivated L'Oréal to be a model to follow, a spearhead for spreading the industry's awareness of the importance of accident prevention outside the occupational perimeter.

L'Oréal is convinced that raising awareness in people will save lives. The obvious first target is children under 5 and several campaigns have started in Brazil and China so far with India following next year. It's not a question of resources but simply doing the right thing and spreading our culture!

The L'Oréal group encourages all companies to join Vision Zero in a positive safety approach to reduce the risk of accidents both at work and outside of work in the spirit of Safe@Work-Safe@Home, so as to give people a sense of 'why safety'!

This will ultimately reduce work-related accidents while giving participants in the process a real sense of pride in their contribution in an area that is largely beyond the scope of their occupational activities, and by giving them sense of "why they should work safely" will make employees become better ambassadors of safety in work"

Zero Harm and Vision Zero in local, national, European and global context

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Keywords: Zero Harm, Safe Work, Healthy Workers, Social value, Economic costs

Abstract

Background. In terms of Vision Zero much has been concentrated on safety issues at work. In health issues at work, insufficient emphasis has been placed on preventive action. This is not usually considered as a key area of most health organisations, such as health centres, hospitals, and most health professionals. A paradigm change is necessary to introduce Zero Harm at work. covering all risk factors and consequences. Methods. Studying experiences at all levels and identifying sectoral, age and gender variables at work. Exposure data were used to identify risk factors including related associations and the level, direction and strength of association of the risk/outcome pairs. Results. Latest data indicate – based still on restricted number of risk factors and exposures - tell that 2.78 billion workers globally lose their lives due to exposures at work globally. Lost value was 3.94% of global GDP. In the EU28 the number of fatal cases was 204,000 and 476 billion EUR or 3.26% of the EU GDP. In Sweden we identified some 4300 deaths. Major killers are cancer and cardiovascular diseases. Conclusion. Future objectives for action should include mapping of exposures. Vision Zero should be applied to all risk factors and Zero Harm to all negative outcomes.

Introduction

In the past Global estimates of fatal work-related injuries and illnesses have been produced by ILO for more than 20 years. The outcomes have been thoroughly reported by the ILO and in peer-reviewed scientific journals (Takala et al. 2017). For the latest report, the WSH Institute of the Ministry of Manpower in Singapore collaborated with the Ministry of Social Affairs and Health, Occupational Safety and Health Division of Finland (STM), and the International Commission on Occupational Health (ICOH) to produce the estimates for ILO. The Coalition included also the Finnish Institute of Occupational Health (FIOH) and the European Agency for Safety and Health at Work (EU-OSHA). For this project, estimates of the occupational injuries were compiled using 2014 data for occupational injuries while the work-related illnesses were based on 2015 data and the baseline was mortality data from the World Health Organization (WHO) regions (International Labour Organisation et al 2017). Selected previously under-estimated work-related diseases, such as Chronic Obstructive Pulmonary Disease (COPD) and Asthma were better covered by revised attributable fractions (AF).

In addition, an elaborated method was developed to estimate in addition to fatal injuries and illnesses at work for each major group of diseases and injuries, but also related Years of Lost Life (YLL), Years Lived with Disease (YLD), and their sum Disability Adjusted Life Years (DALY). This method used the relationship between a fatal and non-fatal disease. Based on these variables one could make a rough estimate of the economic costs caused by poor occupational safety and health management. The value of economic costs as an indicator demonstrates the difference in applying the Vision Zero mindset and the reality.

Execution

Occupational injuries, fatal and non-fatal, caused by accidents were estimated using rates of injuries in selected economic sectors and in selected regions based on WHO classification. This is needed as data is poorly available from most countries in the world. However, ILOSTAT and EUROSTAT have shown that specific economic sectors have a characteristic injury rate, such as deaths/100,000 workers. Equally production methods are better comparable within WHO Regional Groups, e.g. in South East Asia, but much less comparable between WHO Regions. As a result one cannot apply rates/100,000 directly from one region to another. The High Income Group countries have much better reported rates but cannot be used as such for extrapolation e.g. Western Pacific Region. Selected best reporting country rates in selected economic sectors, however, are likely to produce more realistic estimations, for example, Malaysia manufacturing rates are close to those of the neighbouring countries.

For work-related diseases population attributable fractions (AF) established in scientific literature for a large number of diseases have been established, in particular, in developed countries. These were adjusted slightly to compensate for selected diseases more relevant in less developed countries. A fairly wide set of AF values were applied and used on the mortality data by WHO Regions obtained from WHO. Adjusted Values on YLDs were used from the Institute of Health Metrics and Evaluation project on Global Burden of Disease and Injury, GBD 2017 as adjusted.

Disability adjusted life years DALYs were used to estimate the society loss and economic costs. This was done by comparing the DALYs in the region or country to the optimal number of years that could have been used for work and production if no-one was killed, injured, or suffered from disease or disorder in the specific year. This percentage became the indicator of costs and lost production. It could be considered as comparing a Vision Zero level to the present real work environment and systems.

The two-tier method different to occupational accidents as compared to work-related diseases produces better estimates for both groups. A fatal injury caused by an occupational accident causes some 35 YLLs while occupational cancer manifests itself after long term exposure at later in life and the YLLs are about an average 15 years/death case. The YLD takes into account the non-fatal outcomes and covers diseases and disorders that do not necessarily cause a fatal outcome.

The mortality numbers and rates from ILOSTAT and EUROSTAT and establishment of proxy values for fatal and non-fatal injuries were taken from ILOSTAT by the ministry in Finland (STM). Mortality numbers by WHO Regions were obtained from WHO statistics and adjustment of attributable fractions were applied to various age and gender groups resulting in regional work-related disease numbers.

FIOH carried out detailed YLL, YLD and DALY calculations.

Findings

The global number of deaths caused by occupational risk factors came to 2.78 million. Asian continent including the South East Asian Region 808,000 deaths, and Western Pacific Region 734,000 deaths carry the heaviest burden (Takala J, Tan BK et al 2017). The European Union had 204,000 deaths which appears to be high if calculated by the size of the workforce. The major reason appears to be that the majority of work-related deaths are caused by long latency work-

related diseases, such as occupational cancer and occupational circulatory diseases that are prevalent in older age groups, such as in the EU.

Figure 1. Work-related mortality by WHO Regions in 2015.

	HIGH	AFRO	AMRO	EMRO	EURO	SEARO	WPRO	TOTAL
Communicable disease	10,435	84,948	8,152	19,396	4,373	87,511	15,168	229,983
Malignant neoplasms	225,939	37,198	50,038	29,036	56,277	110,662	233,085	742,235
Neuropsychiatric conditions	25,512	3,927	3,390	2,396	1,101	7,280	4,510	48,116
Circulatory diseases	103,863	60,151	48,580	50,597	129,992	246,885	223,105	863,173
Respiratory diseases	51,363	21,419	18,834	27,123	13,714	215,118	128,018	475,589
Digestive diseases	3,132	4,505	2,535	1,546	2,910	8,631	2,655	25,914
Genitourinary diseases	3,840	1,750	1,835	1,167	729	7,214	2,420	18,955
Occupational injuries	10,757	65,145	19,388	21,113	14,159	124,404	125,535	380,500
TOTAL	**434,840**	**279,042**	**152,754**	**152,375**	**223,253**	**807,705**	**734,497**	**2,784,465**

Figure 2. EU 28 Mortality Morbidity and Costs

EU-28 proportion (%) of the main causes for work-related mortality and morbidity from all occupational deaths (203,966) and DALYs (7,112,898)

https://osha.europa.eu/en/facts-and-figures/data-visualisation/economics-occupational-safety-and-health-value-osh-society
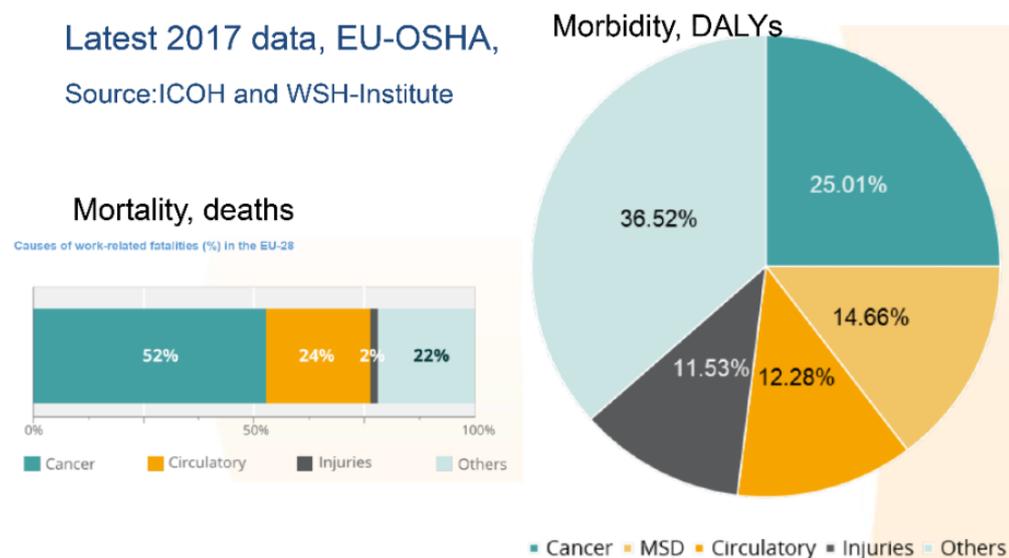
The division between various causes of deaths and DALYs is quite different. While cancer is the biggest killer and causes more than half of all deaths in EU, cancer is a smaller fraction of DALYs. Injuries on the other hand is a smaller cause of deaths but a much more significant reason for DALYs. This is again caused by the fact that injuries in average kill much younger people and the loss of years becomes a major factor. Furthermore, long term serious full or partial disabilities increase the number of YLLs and DALYs. These differences are varying considerably in different regions of the world (EU-OSHA 2017).

When looking at the country level and more carefully at the fatal cases and DALYs the countries that report well injuries – such as Germany and Finland according to both EUROSTAT and ILOSTAT– have a radically higher number of non-fatal injuries caused by accidents compared to

those in the EU that do not report equally well. Without such knowledge of less serious cases it is impossible to eliminate the fatal cases that are just on the top of the pyramid.

Sweden and Denmark report and compensate a much higher number of occupational diseases in the world than other countries and that is reflected also number of deaths and DALYs. In our study Sweden had 4,300 deaths per year, and country based economic costs amounting to 4.1% of the GDP, which appears to be much higher than the average 3.26% of GDP in the European Union. Swedish authorities recently released their own calculation of the number of deaths caused by work, which was 3200 – 5500, the higher number is taking into account less clear connections between risks and outcome. The relatively high numbers compared to some other countries does not necessarily mean that the circumstances are poor but rather that the picture is better and well recognised. Similarly the numbers - 2.78 million deaths - released by ILO may well be under-estimates.

The value estimates of 3.94% of the global GDP do not count the intangibles and are not based on Value of Statistical Life (VSL) or willingness to pay. Presenteeism, disability and reduced workability, and premature retirement, if these were covered, would multiply the lost social value. But the DALY based value matches perfectly to national comparable estimates (Zand et al. HSE/UK)

Conclusions

Vision Zero has been focussed largely on safety issues at work. In health issues, insufficient emphasis has been placed on preventive action. This is not usually considered as a key area of most health organisations, such as health centres, hospitals, and most health professionals. There is an immediate need to emphasize elimination of not only factors leading to fatal and other injuries at work, but all harmful consequences caused by or aggravated by work. A paradigm change is necessary to introduce Zero Harm at work.

Targets and objectives for future action include mapping of exposures. Cancer exposure registers are models for carcinogens e.g. in EU, Canada and elsewhere. Such knowledge requires continuous updating and expansion and to cover all significant risk factors including physical and psychosocial risk factors by sector, by occupation and jobs (Job Exposure Matrices). This means comprehensive and systematic data collection including modern methods.

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Vision Zero, Japan's Zero Accident Campaign and New Japan's OSHMS, having two functions of ISO 45001 and JIS 45100

Takeo Hayaki, Japan Industrial Safety and Health Association, Japan

Keywords: Vision Zero, Japan's Zero Accident Campaign, ISO 45001, JIS 45100

Abstract

"Japan's Zero Accident Campaign" has been succeeded to "Vision Zero". This was commenced by JISHA in 1973. This campaign" and its activities have become major and practical OSH activities among almost all Japanese industries, and contributed to a significant reduction of the work-related accidents in Japan. Currently, " Zero Accident Campaign" has become global movement and practical OSH activities, not only in Asia but also in Europe, America, by Japanese major companies, such as TOYOTA, HONDA, Panasonic, and other companies." Japan's Zero Accident Campaign " has been also succeeded to " New Japan's OSHMS, and also is expected to be more practical for further up-grading OSH level by executing ISO 4500. And JISHA will be a certification authority of both ISO 45001 and JIS 45100.

Introduction

1. "Vision Zero" and "Japan's Zero Accident Campaign"

ISSA previous Secretary General, Mr. Hans-Horst Konkolewsky declared at the conference in Tokyo 2018 that "Vision Zero" has been flowing from the birthplace of Japan's OSH's river. That is " Japan's Zero Accident Campaign", which was commenced by JISHA (Japan Industrial Safety and Health Association) in 1973. (see the Figure 1 : Japan's Zero Accident Campaign)

Figure 1: Japan's Zero Accident Campaign

The three (3) principles of " Japan's Zero Accident Campaign " are as follows:

1) " Leadership and Responsibility of Employer ".
2) " Establishment of OSH Organization and Management"
3) " Participation and Involvement of all for OSH activities "

According to the above-mentioned principles, and as previous ISSA Secretary General, Mr. Hans-Horst Konkolewsky declared, it is clearly understandable that " Japan's Zero Campaign " is succeeded to the Seven Golden Rules of " Vision Zero ".

Since " Japan's Zero Accident Campaign" started in 1973, the data of the number of work-related accidents in Japan, show that more than 6,000 of annual fatal accidents has been immediately and then gradually decreased to less than 1,000. Likewise, the data shows that the number of fatalities and absence of 4 days or more of the work-related accidents has been also decreased. The one of the most significant cause of the above-mentioned reduction is " Japan's Zero Accident Campaign ".

"Japan's Zero Accident Campaign " is not just a campaign, which is a movement from the top-management to worker's level and practical OSH activities, such as 5S (or 5C) activity, which is Clearing out, Clearing up, Cleaning, Cleanliness, and Controlled beha

Execution

Currently, "Japan's Zero Accident Campaign" and those activities have become major and practical OSH activities among almost all Japanese industries, from large to medium and small-size enterprises in Japan, and contributed to a significant reduction of the work-related accidents in Japan. Besides, nation-wide in Japan, " Zero Accident campaign" has become global movement and practical OSH activities, not only in Asia but also in Europe, America, by Japanese major companies, such as TOYOTA, HONDA, HITACHI, Panasonic, and other major Japanese companies. Those major Japanese companies adopted and familiarized " Zero Accident Campaign " in Japan and expanded globally.

2. ISO 45001 and JIS 45100, and New Japan's OSHMS

Japan's Zero Accident Campaign " has been succeeded to

1) " Vision Zero " as mentioned above, and
2) " New Japan's OSHMS (Occupational Safety and Health Management System), which has two functions of ISO 45001 and JIS 45100.

" New Japan's OSHMS " has started with ISO45001 and JIS 45100. ISO 45001 has been officially issued in March 2018, which is exactly translated into Japanese words as ISO(JIS) 45001 in Sep. 2018. And at the same time, JIS 45100 has been issued, as " New Japan's OSHMS ".

JIS 45100 covers both all of ISO 45001 and the original Japan's OSHMS, therefore JIS 45100 has two functions of ISO 45001 and the original Japan's OSHMS.

The features of the original Japan's OSHMS are as follows:

1) OSH management system, based on Labour Minister's OSHMS Guideline, which is a law and regulation of the Government of Japan, and,
2) Japan's original OSH activities, including "Japan Zero Accident Campaign" and the above-mentioned OSH activities, such as, KY activity, 5S (5C) activity, Hiyari-Hat activities, and etc.

As repeated again, " New Japan's OSHMS " has just started with ISO 45001 and JIS 45100.

Here are some features of " New Japan's OSHMS " as follows:

1) what is JIS 45100 ?
JIS 45100 has two functions that are an international aspect of ISO 45001, and Japan's original OSHMS.

2) what is the original Japan's OSHMS ?
The Japan's original OSHMS,as based on Labour Minister's OSHMS Guideline, has major features as follows:

(i) PDCA Cycle and Spiral up with management system.
(ii) OSH Risk Assessment.
(iii) Organizational role, responsibilities and authorities, which is top management's leadership and commitment.
(iv) Documented information of OSH.

The above-mentioned features mean that the original Japan's OSHMS has a same OSHMS's function of ISO 45001

Findings

On the other hand, what is a difference between the original Japan's OSHMS and ISO 45001?

As noted above, the original Japan's OSHMS has OSH activities born in Japan, such as Zero Accident Campaign, 5S (5C) activity, KY (Risk Prediction) activity, Hiyari-hat (Near-miss accidents) activity, etc,. According to the survey to enterprises in Japan, here is a list of effective activities for further upgrading OSH level.

(i) KY (Risk Prediction) activity effective 93 %
(ii) 5S (5C) activity effective 92 %
(iii) Hiyari-hat (Near-miss accidents) activity effective 88 %

Those above-mentioned activities are not in features of ISO 45001, because those activities were born in Japan.

Is the original Japan's OSHMS practically effective for upgrading OSH level ?

The data of work-related accident's rate of manufacturing companies certificated by JISHA, based on Labour Minister's Guideline show as follows.

(i) 1st certification work-related accident's rate per 1,000 workers & per 1 year is 1.00
(ii) 2nd 3 year-term renewal 0.81
(iii) 3rd 3 year-term renewal 0.64
(iv) 4th 3 year-term renewal 0.57
(v) 5th 3 year-term renewal 0.50

The average of work-related accident's rate in manufacturing companies in Japan is 2.2. Therefore, according to the data above, work-related accident's rate based on original Japan's OSHMS and Labour Minister's Guideline is quite lower than average 2.2 in Japan and obviously goes down by every 3 year-term renewal of JISHA's certification..

"Japan's Zero Accident Campaign " has been succeeded to " Vision Zero " as mentioned above, and also to " New Japan's OSHMS". " New Japan's OSHMS " is expected to be more practical on OSH by executing JIS 45100 for further up-graded OSH level. And, JISHA will be a certification authority of ISO 45001 and JIS 45100 shortly. (See the Figure 2 : JIS 45100 (New Japan's OSHMS)

Figure 2: JIS 45100 (Japan's New OSHMS)
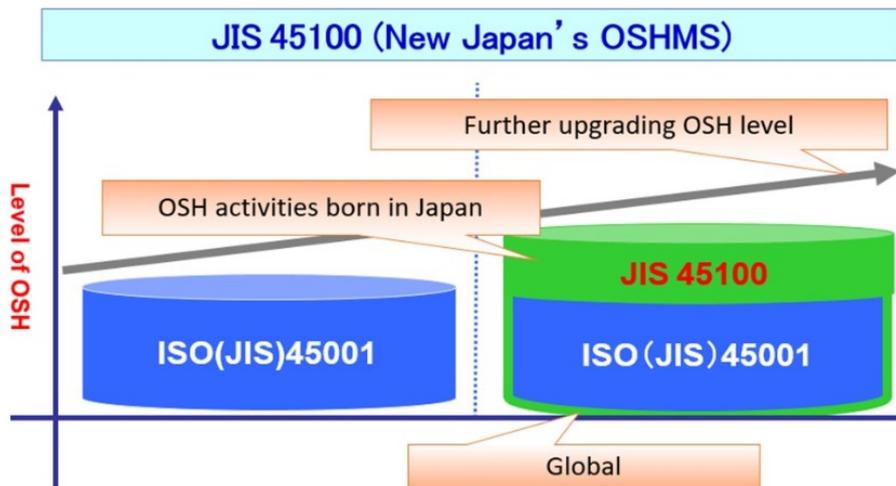
Conclusions

"Japan's Zero Accident Campaign" has been succeeded to "Vision Zero". "Japan's Zero Campaign" and its activities have become major and practical OSH activities among almost all Japanese industries, and contributed to a significant reduction of the work-related accidents in Japan. Currently, " Zero Accident Campaign" has become global movement and practical OSH activities, not only in Asia but also in Europe, America, by Japanese major companies, such as TOYOTA, HONDA, Panasonic, and other companies.

"Japan's Zero Accident Campaign " has been also succeeded to " New Japan's OSHMS, and also is expected to be more practical for further up-grading OSH level by executing ISO 4500.

And JISHA will be a certification authority of both ISO 45001 and JIS 45100.shortly.

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Return to Good Health & Work Programme
"A Case of the Workers' Compensation Fund Control Board-Zambia"

Chansa Kapema, Worker's Compensation Fund Control Board, Zambia

Abstract

The Workers' Compensation Fund Control Board (WCFCB) has in place a return to work (RTW) programme aimed at returning injured and diseased workers back to good health and eventually to work where possible. The programme is guided by the organisation's RTW policy. The return to good health and work program takes the form of provision rehabilitative treatment, counselling and retraining the injured or diseased workers in alternative skills that ultimately help them in getting absorbed into the labour market as productive citizens.

WCFCB has so far admitted a total of twenty seven (27) beneficiaries under RTW. Furthermore, WCFCB has employed one of its beneficiaries after completion of retraining in an alternative course.

RTW can be used as an economically viable tool to address disability, rehabilitation, unemployment, early pension and health. This document is anchored on two (Health & Wellbeing) out of three pillars of Vision Zero.

Introduction

The Workers' Compensation Fund Control Board is a social security institution established by Act No. 10 of 1999 of the Laws of Zambia, to provide for;

- The establishment and administration of the fund for the compensation of workers disabled by occupational accidents or diseases
- The payment of compensation to dependents of workers who die as a result of occupational accidents or diseases
- Levying assessments on employers for the purpose of establishing a fund out of which compensation are due
- Provide compensation to workers for disabilities suffered or diseases contracted during the course of employment
- Work Place Health & Safety Inspections
- Administer annual medical examinations for Ex-Miners
- Rehabilitation & Counseling Services

In responding to the modern norms of employment injury schemes, the WCFCB has introduced the Return to Good Health & Return to Work program aimed at;

- Returning the injured and diseased workers to as reasonable good health as possible
- Re-integrating injured and diseased workers back into the labor market
- Supplementing the inadequate pension
- Restoration of lost self esteem for both the injured worker and their immediate families

RTW programs can take many forms. These are as follows:

a. Short-term changes to work schedule and/or job to accommodate restrictions imposed by the employee's treating physician

b. Changes to the job that are based on the type of injury, the employees' present physical ability and limitations, skills and

c. Progressive return to full duty as such

The WCFCB has partnered with several health institutions across the country in the provision of the curative and rehabilitative services for its beneficiaries. The services range from physiotherapy, provision of the assistive mobility devices and orthopedic services. Where there is no local capacity to handle certain cases and conditions, the WCFCB, under recommendation of attendant Doctors, has executed foreign medical evacuations for specialist attention.

The RTW program is administered under the provisions of the Return to Work Policy which stipulates the eligibility criteria.

Execution

The Paper was prepared using already available data on WCFCB beneficiaries who have been recipients of RTW benefits. In addition, phone calls were also made to ascertain how many of those trained have absorbed back into the labor market. Interviews were also conducted with the rehabilitation team of WCFCB to ascertain the health condition of some the recipients of the RTW benefit. This was important because, before any beneficiary is engaged on the RTW, WCFCB embarks on the return to good health for all its beneficiaries in receipt of compensation.

It should be pointed out that some research also involved two organizations i.e. Ndola Lime Company and Mopani Copper Mines. As such, the results may not be considered as universally binding to all organizations. However, the research does provide a starting point for future work on the subject. Given enough resources, the research would have targeted more organizations compared to the two that were studied. Time was also a constraint, as most employees could not fill in the questionnaires in time. This meant the researcher following up the questionnaires personally from individual to individual. The researcher was also a full time employed worker thereby affecting the time available for a much larger sample size. Furthermore, literature on the Return-to-Work philosophy is limited as this a fairly new idea in Zambia.

The study aimed at understanding the awareness levels of the Return-to-Work program in Zambia being rolled out by WCFCB in relation to selected enterprises chosen for this study. In addition, the study aimed at discussing whether there is any relationship between voluntary payment of employment injury contributions by employers and the Return-to-Work initiatives.

The study also looked at the appreciation of the Return-to-Work program at Mopani Copper Mines (Nkana and Mufulira Mines) and Ndola Lime Company. Additionally, the study covered WCFCB rehabilitation unit's activities related to Return-to-Work.

In the modern approach, there is more to Return-to-Work than has been previously perceived. The idea to come up with such a concept in Zambia has come up by virtue of WCFCB being a member of the International Social Security Association where issues of Work Reintegration are top on the agenda as regards employment injury schemes.

Furthermore, a need does exist for programs aimed at reducing workers' compensation costs as well as the financial, psychological and physical toll placed on workers when a disabling injury occurs.

The Return-to-Work program as will be managed by the WCFCB will somehow depart from what obtains under similar programs as explained in most literature. Most RTW programs are proactive processes used by employers to help employees who have suffered work related injuries or illnesses return to their previous economic, social and vocational status. Conversely, instead of the employer driving this program, the WCFCB has taken the initiative of introducing the RTW with a view of showcasing the advantages of this concept. Thereafter, it is hoped that employers will buy in to this idea at individual enterprise level.

From both the Social security and employment point of view, little has been known about the concept of Return-to-Work in Zambia. Given the importance of the concept to the socio-economic well being of injured/diseased workers, it is only prudent that more time is devoted to issues of Work Reintegration.

This research therefore aims to contribute in finding effective means of rolling out the program in Zambia.

Findings

Much as literature and awareness could exist in developed countries regarding Return-to-Work initiatives, little is known and said about the concept in Zambia. The study also touched on two Zambian mining firms.

Injuries and disease at the workplace can result in financial loss to employers and physical, emotional and financial loss to employees. As the time off work due to disabling injury increases, injury- related costs such as indemnity payments, medical and legal expenses, and employee substitution costs rise.

Return-to-Work otherwise known as work reintegration has not been so formalized in Zambia. In the early 1960's and up until the 1990's, Zambia had several giant mining companies in the name of Nchanga Consolidated Copper Mines (NCCM) and Roan Consolidated Copper Mines (RCM). These two companies later evolved into what came to be known as Zambia Consolidated Copper Mines (ZCCM). During this period, injured or diseased workers were being redeployed into other departments which were often referred to as non scheduled areas. These were usually miners that suffered injury or other professional exposure diseases such as silicosis and tuberculosis.

Though this was in a way a form of work reintegration in a sense, it was not formalized and was not dependent on any scientific or rehabilitation considerations. It was more on humanitarian grounds to mitigate the economic impact of the injured employees and their families.

In the modern approach, there is more to "Return-to-Work" than has been previously perceived. The idea to come up with such a concept in Zambia has come up by virtue of WCFCB being a member of the International Social Security Association where issues of Work Reintegration are top on the agenda as regards employment injury schemes.

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The "Return-to-Work" program as will be managed by the WCFCB will somehow depart from what obtains under similar programs as explained in most literature. Most RTW programs are proactive processes used by employers to help employees who have suffered work related injuries or

illnesses return to their previous economic, social and vocational status. Conversely, instead of the employer driving this program, the WCFCB has taken the initiative of introducing the RTW with a view of showcasing the advantages of this concept. Thereafter, it is hoped that employers will buy in to this idea at individual enterprise level.

An early return to work reduces the chances that the employee will never return to the workplace.

The current cases of RTW that WCFCB is involved in mostly involve rehabilitation and re-training of injured ex-workers into other economic sustaining skills. The rationale involves affected workers applying to WCFCB for consideration of re-training where same job reintegration is not possible. These applications are studied on a case by case basis. Figure 1 shows one the modes WCFCB is reaching out to the public in terms of sensitization regarding the RTW program.

From both the Social security and employment point of view, little has been known about the concept of "Return-to-Work" in Zambia. Given the importance of the concept to the socio-economic well being of injured/diseased workers, it is only prudent that more time is devoted to issues of Work Reintegration. It should be noted that there is a strong relationship between disability and poverty.

Figure 1: Return to Work Campaign (Source: Zambia International Trade Fair, Ndola, Zambia, 2013)

Conclusions

The research on RTW drew the following;

1. There is exclusively no legislation that compels employers to manage a RTW program

2. Companies are not obliged to rehabilitate and eventually re-integrate injured into productive economic activity. However, under the Workers' Compensation Act No.10 of 1999 of the Laws of Zambia, WCFCB has this obligation

3. Informal and unstructured work re-integration initiatives are being done by some enterprises especially those that have historic links with the former state run ZCCM

4. Apart from the objective of paying out compensation to injured and disabled workers, very few employers know of the other benefits that WCFCB offers. This is so because most employers have not acquainted themselves with the Workers' Compensation Act

5. Most employers think that rehabilitation is s cost to the enterprise. The opposite is however true

6. Much as all workplaces are prone to risks, the most critical sector is the mining industry as it is the largest employer after the Government.

In addition, from the literature review point of view, the main drivers of disability are;

- Work-related conflict

- Aging workforce

- Fitness levels

- Changing culture

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How to support peer well-being and growth, when you don't have managers

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Keywords: self-leadership, well-being, coaching, agile

Abstract

Nitor is an information technology company with150 employees. The organization aims to maintain a hierarchy free environment and operates completely without middle management. The CEO is the direct supervisor of each employee. This type of structure requires progressive solutions in order to effectively support the well-being of employees. The Kamu support system was created to meet that need. Kamu is an employee that supports peer colleagues by coaching, mentoring, sparring, and listening. The idea is to help a colleague balance work and other aspects of life, and to provide support in professional and personal development. Kamu is not a superior, but is responsible for providing continuous support for a colleague.

Introduction

The purpose of this study was to understand how the employees Nitor view the Kamu peer support system. More specifically it was important to understand what the benefits or challenges of the Kamu system are, and what are the factors that prevent some employees from participating.

Trust was stated to be the most important element of the Kamu system. This was recognized by all respondent groups, and it is also included in the very top of Kamu system operating principles. Neuroscientific studies show that when people build social ties intentionally, the brain releases oxytocin in the brain, which in turn enables trust, and therefor improves performance. (Zak 2017.) This suggests that preserving the element of trust in all levels of Kamu system, is not only crucial for the success of the system but strategically sensible.

Regarding how the Kamu system is seen in general, another key finding is that the case company employees expect Kamus to have experience in coaching, mentoring, or working with people. More specifically, all respondent groups regard listening skills, ability to ask right questions, and facilitating structured discussions as important skills for a Kamu. The respondent groups have different perspectives on why these skills are important; Kamus want to perform well, Kaveris find that structured discussions are the most helpful kind, and those with neither role expect certain standards in order to have a credible system supporting the organization.

Execution

As Kamu system is designed to rely strongly on coaching methods and principles, it was noticeable that there is a lack of deeper understanding of those methods and principles in each respondent group. Most Kamus have an excellent command on coaching and are able to utilize coaching skills also in their core work. On the other hand, some Kamus either choose not to use coaching as basis of their Kamu work or are unable to do so, due to lack of skills or confidence. Although there is quite a lot of freedom to execute Kamu work in a manner that suits Kamu and Kaveri personally, it is clear that Kaveris would also benefit from more structured way of having discussions. It would also be beneficial to have clearer guidelines for Kamu meetings in general, for example the frequency of the meetings.

The main tool in Kamu work, NitorMindPlatter, is regarded as useful and as a good basis for discussions. It is simple to use, and it is not restricting the discussion. It also opens new and perhaps unexpected viewpoints for both Kamu and Kaveri. The biggest impact of NitorMindPlatter seems to be its effect on understanding the holistic approach to well- being, as it includes sections like "creativity time" and "non-connection time", not just the basics such as work, sleeping, and eating. Some suggestions to add new tools in Kamus repertoire were made, which could bring new energy in Kamu work. However, most find NitorMindPlatter sufficcient, and there are those who have yet to use its full potential, so continuing to use it seems reasonable. Providing new tools for more advanced Kamu- Kaveri pairs could be beneficial.

Based on the results, Kamu system promotes psychological health in two different ways; First, building successful Kamu relationships and thus having a strong community of trustworthy peers, creates a safer working environment. The second factor is the possibility to discuss both personal and professional issues with a peer, which is regarded psychologically safer than discussing them with a superior in hierarchy.

As Nitor relies strongly on self-leadership of the employees, the concept of motivation has an underlying presence in this research. It is beneficial to understand how motivation is built and how to lead intrinsic motivation. Since there is no middle management or an immediate relationship with the supervisor, it is crucial to be able to manage one's own work and find the motivation within that work. Kamu has potentially a significant role in helping find meaningful goals and also meet those goals. Based on this research, setting goals and following up on them is the most beneficial outcome of Kamu meetings for Kaveris. For Kamus the motivation was found in benevolence. By far, the most common answer from Kamus when asked about benefits was that they get satisfaction out of helping colleagues.

Findings

Another important element of the system is that it supports and helps maintain low hierarchy. Minimal hierarchy is a basic element of Nitor's way of working. The employees recognize the significance of the Kamu system for maintaining the organization flat. Kamus help carry the social burden of management by taking on the role of listener and supporter. However, annual supervisor face-to-faces are still considered important and irreplaceable. Support divided between Kamu and superior was seen as a wholesome solution.

Reflecting the JD-R model, Kamu system can be seen as resource offered by the employer. To ensure the quality of the system, emphasis and resources should be put in educating the Kamus. There are theory-based guidelines on how to build coaching and other relational learning programmes within workplaces. (Grant & Hartley 2013, 102-115.) Although the theory is based on the assumption that the coach is always the manager, there is no evidence that the same principles would not apply when coaching peers, as is the case in the Kamu program.It was considered important to keep the Kamu system voluntary, but it was also considered important to attract as many employees as possible to have a Kamu. Clearly identifiable reasons not to participate were lack of time and pressure in customer projects. Some just do not see how they could benefit from participating. Some considered the system too light weight to be able to be of any assistance. Some had the misconception that the system is solely meant for handling personal issues, and as they want to keep personal issues away from the workplace, they don't take part in the system. Some of the image and misconceptions could be improved and corrected

by focusing on educating Kamus, having clearer guidelines, and by improving internal communication about the system and its benefits.

Investigative question 4 was designed to find out what are the challenges that hinder or prevent Kamu work. Not surprisingly, the most common answer was lack of time. The pressure to perform in customer projects causes prioritizing customer work over Kamu work. This is also true in the case of Kaveri. It is difficult to find time to meet when both parties are tied up elsewhere. Lack of guidelines and uncertainty of what is expected of Kamu and outcomes of Kamu meetings, are also something that need to be paid attention to. However, they are easier challenges to tackle than the challenge of time.

Investigative question 3 stems from the fact the case company staff is multicultural and multilingual. The assumption was that when paired with Kamu/Kaveri with different mother tongue, issues regarding language may arise. However, when asked specifically about challenges within Kamu system, there were no comments regarding language. The case company staff has a very good command of English language, which probably explains the result in part.

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Vision Zero in Transportation: Possible or Imagination?

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Abstract

Transportation is one of the sectors with the highest fatal accident rates. The numbers indicate that there is still a lot to do to reach the goal of zero accidents.

The transportation sector shows some particular characteristics compared to other sectors, such as non-stationary individual work places and an extreme pressure to meet deadlines. How do these characteristics affect the success of Vision Zero? At the same time, the transportation sector offers some new technological solutions that are especially aimed at reducing risks. How can the sector make use of these solutions to the benefit of reaching the goal of zero accidents?

Understanding the interrelated aspects of Vision Zero is key, in order to successfully make work places in transportation safer and healthier.

Introduction

Transportation is one of the sectors with the highest fatal accident rates.

According to analysis of EU road safety data published by the European Transport Safety Council (ETSC) 25,670 lives were lost on the road in the European Union in 2016. A large proportion of those were victims of work-related road collisions. The exact number is unknown but, based on detailed analysis of data from across Europe, the authors estimate that up to 40% of all road deaths are work-related. [1]

The numbers indicate that there is still a lot to do to reach the goal of Zero Accidents. When it comes to implementing Vision Zero, the transportation sector shows some specific challenges and characteristics. For instance, non-stationary workplaces, with many individuals operating on their own, making it a lot more difficult to raise awareness on prevention and to improve a culture of safety. Also, the pressure of aggressive pricing and strict deadlines are particularly heavy in the transportation sector. In addition, digitalization and technological developments result in new challenges, for example, with respect to automated driving.

Vision Zero aims to reduce fatal and severe accidents to zero and promote a culture of safety, health and well-being at work. It claims that every accident is preventable and avoidable. It aims at a new effort to get prevention in the minds and hearts of company owners and employees. Not just as a project or something to take care of when the order situation is low, but as an integral part of doing business. It strives to regard the money spent on occupational safety and health as an investment; something that pays off, not just a cost factor. It is based on the assumption, that progressive technology is part of the solution and that culture is key. That more than rules, education and technical equipment, companies need to provide an environment of trust and openness in which everybody, regardless of rank or position, is entitled to address her or his staff, colleague or superior on matters of workplace safety and health.

How can the challenges of the transportation sector be met with the help of Vision Zero?

Execution

Accidents at work and occupational diseases are neither determined by fate nor unavoidable – they always have causes. By building a strong prevention culture, these causes can be eliminated and work related accidents, harm and occupational diseases be prevented. "Vision Zero" is a transformational approach to prevention that integrates the three dimensions of safety, health and well-being at all levels of work.[2]

Safe and healthy working conditions are not only a legal and moral obligation – they also pay off economically. Investments in safety and health at workplaces avoid human suffering and protect our most valuable asset – our health and our physical and psychological integrity. Importantly they also have a positive impact on the motivation of employees, on the quality of work and products, on the company's reputation, and on the satisfaction levels of employees, managers and customers and thus on economic success. International research on the return on investments in prevention prove that every dollar invested in safety and health generates a potential benefit of more than two dollars in positive economic effects. Healthy working conditions contribute to healthy business.

The roadmap towards Vision Zero is formed by "Seven Golden Rules" based on successful, practical management concepts.

1. Take leadership – demonstrate commitment
2. Identify hazards – control risks
3. Define targets – develop programmes
4. Ensure a safe and healthy system –be well-organized
5. Ensure safety and health in machines, equipment and workplaces
6. Improve qualifications – develop competence
7. 7.Invest in people – motivate by participation

All these rules are equally important in and of themselves. However, when it comes to the specific challenges for the transportation industry, as defined in the introduction, we need special attention to rules 1, 6 and 7 with regard to the human factors. Equally important is a special focus on rules 4 and 5 in order to integrate the new challenges of digitalization and automated driving into working safe and healthy.

Findings

In transportation, we are often dealing with non-stationary workplaces, with many individuals operating on their own. It is therefore extremely important that these individuals are aware of the risks they are facing in their work and that they are fully aware of their own responsibilities. They need a clear framework and the full support of their company management, whenever they need to interrupt their activities for safety purposes. This means, that simply teaching the employees about OSH measures is not enough. They have to be able to decide for themselves and apply the teachings to everyday situations. They need the courage and the conviction to interrupt their activities whenever they are at risk. They will need to be empowered to choose safety over meeting deadlines. This is truly the core of prevention culture: to always be able to choose safety and health first. Within this context, rule number 1 is key. The company management has to put OSH first on the agenda. In all aspects of doing business. Especially when there is a conflict between earning revenue or reducing costs on the one hand and improving safety on the other. Without the commitment of the management, there is no point in working on the other rules.

When it comes to applying new technologies, rule number 4 and 5 are important. Several technical solutions are available in vehicle nowadays, that improve the safety of the transportation workers.[3]

- Seatbelt reminder systems use sensors to detect occupants and their seatbelt use. Visual and audio warning remind unbelted occupants to buckle-up.
- Lane assist helps the driver to stay in their lane/on the road. It is activated if the vehicle is about to veer out of the lane/off the road. It can help steer the vehicle back into the lane or onto the road.
- Automated emergency braking (AEB) helps avoid collisions or mitigate their severity. It warns the driver and supports their braking and/or applies the brakes automatically.
- Intelligent speed assistance (ISA) helps drivers to comply with speed limits.
- Fatigue detection systems provide an alarm signal, when the driver shows signs of fatigue and has to take a break.
- Alcohol interlocks are connected to the ignition system. The driver must take a breath test in order to drive the vehicle. If the driver fails, the vehicle will not start.
- On board telematics units monitor speeding, compliance, location and driving style. The data can be used for driver training or collision investigation.

These solutions cost money and it is key, that the company management is willing and able to invest in these solutions. However, in-vehicle technologies are not a substitute for wider fleet safety. A work-related road risk management program should still be implemented. Staff should still be trained to drive safely and to apply all the available safety technology. Key risk factors like mobile phone use should still be targeted. Vehicles should still be regularly maintained.

Conclusions

Vision Zero in the transportation sector is possible, but only if company managers are willing to focus on safe and healthy work places in their totality. It is not only a matter of training. In addition, it is not just a matter of buying some drivers assistance tools. It is a matter of mindset and a matter of clear prioritizing. There are plenty of technical tools to assist the workers, but they will all become useless, as soon as the pressure to meet deadlines is bigger than the allowance to take the necessary time for safety measures. This demonstrates that all the aspects of occupational safety and health need to be regarded and treated in their interconnected context. Tools become useless without training, training is worthless if it comes without awareness and leadership, investments make no sense when they are not part of a bigger scheme. Understanding this interconnectedness is the first important step to Vision Zero.

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[3]Source: https://etsc.eu/wp-content/uploads/PRAISE-Info-3-In-Vehicle-Technologies.pdf

OSH literacy™: An Essential Life Skill Literacy

David Magee, OSH Literacy

Keywords: Occupational, Safety, Health, Literacy, Education

Abstract

Most Occupational Safety and Health (OSH) incidents happen within the first twelve months of employment. Numerous root-cause analysis studies have shown that poor communications and human factors figure in a significantly high number of these incidents. There are particularly at-risk groups. In this Information Age there are multiple, recognized literacies. Although OSH meets all the criteria for it to be classified as a specialized literacy, this has not happened, yet. As a result, globally, most young people leave school with no prior OSH literacy™ skills. This presentation aims to show the correlation between these facts and demonstrate how by recognising, teaching and raising awareness of OSH literacy as an essential life-skill literacy, we can make education-to-employment ecosystems, and workplace communications, safer and more cohesive and how this, in-turn, could aid us in achieving the long-term aim of Vision Zero.

Introduction

My name is David Magee. I am a teacher from Belfast, Northern Ireland. I am also an Occupational Safety and Health (OSH) and First-Aid trainer. My whole career has focused on helping people to safely and successfully transition into training, employment and independent living. I am also the founder of a small non-profit: OSH literacy™.org

- Most workplace incidents happen within the first twelve months of employment;
- Numerous root-causal analysis studies have identified poor communications and human factors as the underlying reason for a significantly high proportion of these incidents;
- Young people, migrants, females and persons with special educational needs and disabilities (SEND) are particularly at-risk groups;
- The communication system and competencies associated with OSH meet all the criteria for it to be classified as a literacy - comparable to other recognized key-skill literacies;
- This has not happened, yet
- Globally most young people leave school without any prior OSH literacy™ skills.

The aims of this presentation are:

- to show the correlation between these facts;
- to give you an understanding of Occupational Safety & Health (OSH) literacy;
- to demonstrate how by recognizing, teaching and raising awareness of OSH literacy as an essential life-skill literacy, we can make education-to-employment eco-systems, and workplace communications, safer and more cohesive;
- How this, in turn, could aid us considerably in achieving the long-term aim of Vision Zero.

Firstly, I shall present the 'execution' of my qualitative research, which is basically the observations made throughout my career on how our understanding and perception of literacy has changed and developed and why OSH literacy should be recognized and treated as an essential life-skill literacy for the Information Age. Then I shall present my 'findings' on the current effects of no OSH literacy awareness and the benefits that raised OSH literacy awareness can bring to already at-risk groups, employers and, also in relation to Vision Zero. Finally, I will present my conclusion.

Execution

Literacy has traditionally been defined as the ability to read, write and understand a language. However, this definition has expanded to refer to a level of competency in a specific field i.e. computer literacy.

Nowadays, there are multiple recognized literacies. Each comprises its own unique set of signifiers, terms, and competencies: ICT, finance, music, science, geography, health, media etc. A person must have the requisite literacy skills required for that subject area to be regarded as competent or 'literate' in that field. Some of these literacies have been identified as key to social and economic mobility and wellbeing and are taught in schools and colleges around the globe to better prepare young people for modern life.

OSH also use a unique communication system composed of different shapes, colors, symbols, pictograms and specialized terminology. These have all been agreed upon by international bodies such as the I.L.O. and the I.S.O. and are universally accepted and used. It is multidisciplinary with elements of language, numeracy, health and visual literacies embedded within it. OSH includes hard and soft skill competencies such as the ability to:

- use OSH equipment (PPE),
- identify hazards,
- assess risk,
- solve problems and behave appropriately (human factors).

It can become even more specialized depending on different industry sectors: agriculture, construction, energy etc.

As lifestyles and working habits change, it has become an important life-skill for safe, independent living. Examples of OSH information (and equipment) can also be found at home: for food, chemical and electrical products and in public places for: fire, evacuation, transport, electrical hazards and medical emergencies.

Ability levels can be mapped to competency matrixes from entry-level to advanced. It involves a continuum of life-long learning and the acquisition of these skills can enhance a person's long-term health, safety and wellbeing as well as their social and economic mobility prospects.
Although it fulfills all the criteria to be recognized and taught, as an important, life-skill literacy, this has not happened, yet. Globally, most young people, especially already vulnerable groups, continue to leave education and enter training, employment, and independent living without any of the functional OSH literacy skills needed to identify, access, evaluate, utilize or comply with any of the OSH information and services they are likely to encounter, or need. Nor do many of them possess any other, hard or soft, OSH competencies.
In addition to a lack of education and training, there are many other barriers which can restrict a person's ability to become OSH literate. These include cognitive, physical, linguistic, age, gender, social, ethnic, cultural, economic and even religious hurdles.

To compound the problem, many already at-risk people tend to find entry-level employment in high-risk industries such as: agriculture, manufacturing and construction. Furthermore, in this Information Age we are constantly bombarded with new terminologies and different shaped and colored signifiers offering a wide variety of information, products and services. Many people cannot differentiate and prioritize between these.

As the statistical-data shows, OSH literacy skills cannot be learned experientially. Unlike other literacies, if you make the slightest mistake due to poor OSH literacy, you rarely get a second chance to rectify it and the consequences can be fatal, life-changing and costly.

Findings

Workplaces are more diverse than ever. Increasingly stringent inclusion, equality and OSH legislation puts a burden of responsibility on employers to ensure their OSH information and training is accessible to ALL employees.

However, people with a responsibility for these communications seldom have any OSH literacy awareness or training either. Neither do they have the time nor skills needed to adapt their language and materials to make them accessible to everyone. Research, by the UK's HSE, and others, has shown that very often, levels of OSH communications far exceed the literacy and subject knowledge levels of employees. And, employers are often unaware of the range of learning difficulties which exist within their workforce.

Unfortunately, to comply with legislation and free themselves from liability, it is now common practice for overwhelmed employers to ask, or even coerce, new employees to sign documentation stating they: 'have had and understood OSH information and training'. There has also been an increase in unscrupulous 'training providers' who basically sell OSH certificates to anyone willing to pay or give them personal data. This has greatly decreased faith in many OSH qualifications. Furthermore, some new employees may not even realize they have OSH literacy issues, and if they do, they may not want to bring attention to it, especially when they have just started a new job.

A cliché used in OSH is: An organization is only as strong as its weakest link.

The current entry-level OSH communications and training chain is obviously archaic, incohesive and not fit for purpose. Data supports this. To truly achieve the goal of Vision Zero, this issue needs to be addressed.

Fortunately, there is no need to spend vast amounts of time and money 'reinventing the wheel' either. A possible, easy and cost-effective solution would be to simply follow the successful, holistic and collaborative model used with other recognized, life-skill literacies e.g.: English, ICT, finance and health:
- raise awareness of OSH literacy's existence and importance among policy makers, educators, employers and other stakeholders;
- give learners the basic skills related to it;
- build upon that foundation

OSH literacy.org has developed and delivered numerous resources and outreach projects, (for NGOs and private businesses in many countries) for people preparing for, and in, employment and training. Also, for managers and trainers. These have demonstrated that pre-teaching basic OSH literacy skills and making OSH communications more accessible, increases employee engagement and compliance with OSH information and training. Moreover, teaching and assessing it in the safety of a classroom allows for individuals, who may have issues with it, to be screened so that remedial actions can be taken.

OSH literacy can fit into junior, high-school, F.E. and H.E, curricula or into adult, special needs, vocational and workplace education and training programs. Lessons can be slotted into existing subjects such as English, numeracy, ICT, science and others or it can be taught as a stand-alone subject. People who have these skills can then cascade them within their families and communities. For many years business leaders have been asking policy makers to give young people skills more aligned to their needs. OSH literacy education better:

- prepares young people for employment;
- enables employers to meet their legal and moral OSH obligations;
- offers a practical solution to implement the 7 Golden Rules of Vision Zero.

Conclusions

With ageing populations, young people should be seen as a rare and valuable workplace commodity. Too many of them, and others, are having fatal, life-changing and costly accidents when they begin new employment. We have a duty-of-care responsibility to better prepare and protect them, and future generations, for life in the modern world. We cannot continue to simply assume, or hope, that everyone will somehow already possess OSH literacy skills without any prior education or training relating to it.

Through this short presentation I have tried to give you an understanding of OSH literacy, what it is and the issues relating to it. Recognizing, teaching and raising awareness of OSH literacy as an essential life-skill for the information-age, similarly to other key-skill literacies can:

- provide a simple, cost effective solution to an identified problem;
- make education-to-employment ecosystems, and OSH communications, safer and more cohesive;
- help employers to better fulfil their legal, moral and Vision Zero responsibilities;
- provide a tangible benefit to the lives of very many people;
- aid us considerably in achieving the long-term aim of Vision Zero.

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Application of Behavior Analysis to Safety Management - For a Quantitative Evaluation of Risk Assessment

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Keywords: Behavior Analysis, Behavior-Based Safety, reward, human factors

Abstract

There are novel structures of society such as Industry 4.0 and Connected Industries. Under the structures, a novel safety management system considering man-machine interaction is very important topic. Safety 2.0, a new safety control, is proposed from Japan. It seems that direct and quantitative validity of risk assessment and risk reduction measure such as reinforcement of safety behavior and/or reduction risks focusing on worker's behavior is necessary to make Vision Zero function better. We introduce to a principle of Behavior-Based Safety (BBS) which might be applicable to reduce residual riskof unsafe behavior is now not sufficiently accomplished. Some quantitative assessment for residual for safety of workers. BBS, focused on behavioral modification using principle of reinforcement,

Introduction

Now we are facing to era of industrial revolution, such as Connected Industries, Society 5.0 in Japan and/or Industry 4.0 in Europe. A novel safety management, which is available to these industry revolutions, is called safety revolution, has been proposed from Japan as the Safety 2.0. In Safety 2.0, it is very important that everybody have point of view of collaborative safety between human and machine, and a holistic safety under such situation. For achievement of Safety 2.0, the study which aimed to clarify human behavior is necessary.

We introduce "Behavior-Based Safety (BBS)" here. BBS is one group of Behavior Analysis which is belonged to Psychology. Behavior Analysis is defined as the science of behavior [1]. It aims to modify behavior using reinforcement procedure. Behavior-based safety is a kind of reinforcement to change existing unsafe behaviors in the workplace. It identifies the cause of unsafe behaviors and then applies research-based techniques to eliminate this behavior. Behavioral-based safety is a reinforcement action taken by an organization's management to identify the immediate and root causes of unsafe behavior and then apply corrective measures to reduce unsafe actions by employees [2]. Goals of BBS are 1) prediction and control, 2) analysis and quantitative evaluation, and 3) problem solution of behavior (not of human). Especially, behavior analyst thinks that reinforce safe behavior is more important than punish unsafe behavior. A way of thinking of a vision zero seems to strengthen having no accident from this viewpoint, but we think it is still not enough. If viewpoint of a behavior analysis would be added to the Vision Zero, then the world would become safer. We introduce an idea of fusion of Vision Zero and Behavior-Based Safety here.

Execution

About BBS – What is BBS?

Within BBS, behavior is expressed in terms of the ABC model (Figure 1). A, B and C mean Antecedent, Behavior and Consequence, respectively. Antecedent is a stimulus or an event that occurs before a behavior.

Figure 1:

ABC model

Antecedent → Behavior ↔ Consequence

Workplace   Cleaning machine

Thank you!
Work!

Increase	Decrease
Reward	Punishment
Verbal admiring	Reproach
Nodding	Pain
Eye contact	Ignorance
Graphic feedback	

Human factors の定量的評価に最適
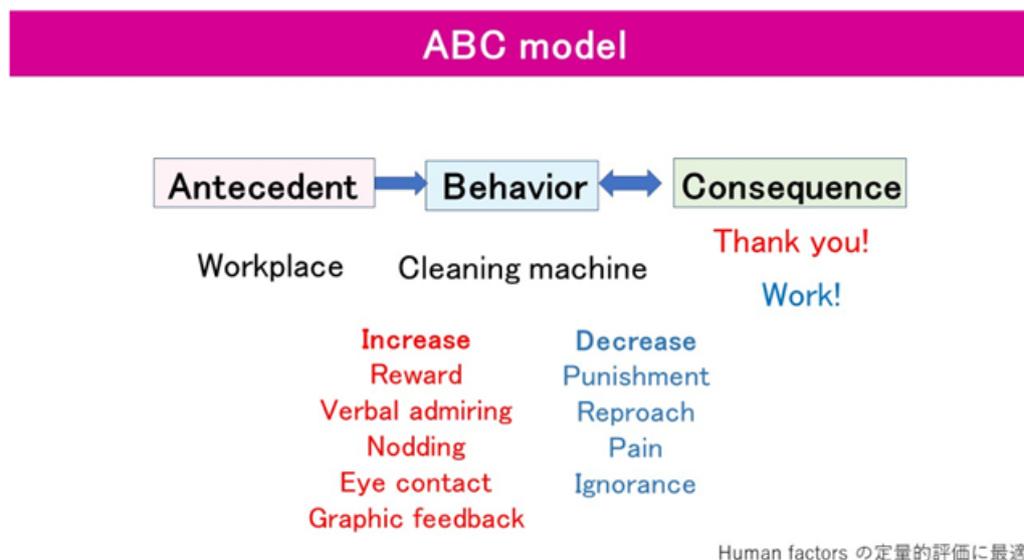
The stimulus or event may result in the behavior. We call it discriminative stimulus. Behavior is anything that we can see individual do or say. Even if something which we can't be directly seen such as mutter and/or thought of individual, those are sometimes defined behavior as "the internal verbal behavior". Consequence is a stimulus or an event that occurs after the behavior. This consequence increases or decreases the behavior in the future, depending on its reinforcing or punishing properties. We usually find the cause of the behavior in antecedents. For example, we express that I like movie, so I often go to watch movie. Even though we rely heavily on antecedents, it is consequences that have the greatest influence on behavior. An example of ABC model of BBS is indicated in Figure 1. If a worker cleaned a machine at workplace then the behavior was admired by a verbal admiring of his boss, the cleaning behavior of the worker would be increased (reinforced) by reward (verbal admiring). On the other hand, when it was warned by the boss "Work." even if the same worker did the same behavior, the behavior wouldn't appear anymore in the future. Factors for increase behavior are material reward such as money and/or presents, verbal admiring, nodding, eye contact, and graphic feedback. Also, punishment, reproach, pain and ignorance are factors of decrease behavior. However, these factors are different depending on individuals, so when using, we should be careful. We use reward more than punishment for safety. We should not try to change behavior directly. In BBS, we always try to change environment because all factors, ABC are surrounded by environment. Therefore, if environment is changed, behavior would be naturally changed. We do not support campaign, advertisement, verbal caution, and/or encouragement because those are not objective, quantitative, and direct methods for safety [3, 4].

Findings

A problem of Vision Zero

The way of thinking of a vision zero is reward-like from viewpoint of behavior analysis because days of no accidents are counted. We think the way of thinking is much better than counting the number of accidents. However, when an accident has occurred, it would be possible to become the punitive situation for the worker who has caused the accident. When the worker who has caused an accident reported the accident, a record on the days of no accidents are stopped (goes back to zero), and everyone is disappointed. There is also a possibility that the worker is blamed by the rest of workers. As a result, when an accident was not severe, the worker may hide it. These phenomena have been reported in a previous paper. In this paper, it has been indicated that more than 30 percent of accidents are hidden because of the reason.

Conclusions

For a perfect way of thinking of Vision Zero – Fusion of Vision Zero and Behavior-Based Safety

Here, we propose the idea of BBS for solving this issue. The behavior of reporting of the accident should be divided into two smaller behaviors, then the punitive situation should be eliminated. The behavior should be divided into the behavior which have caused an accident and the report behavior. The report behavior should be always reinforced by some reward. Doing that, it would be expected to increase the report behavior. On the other hand, the behavior which has caused an accident shouldn't be made responsibility of the worker who has caused an accident. It should be discussed to change the environment that the accident has been caused. Punitive circumstances are evaded by these changes (Figure 2). We think that safety becomes perfect by the contingencies of BBS and vision zero are employed concurrently.

Figure 2:
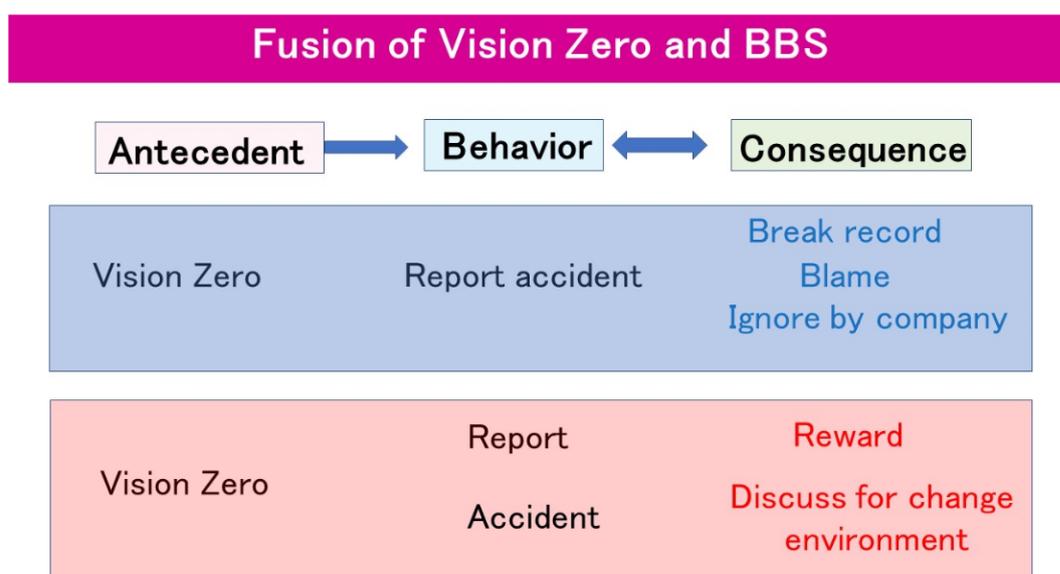
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Psychological Safety as an Asset in Work Teams - Comparative Case Study of Two Finnish Work Teams

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Abstract

Adjusting in today's constantly alternating work environment and complex assignments requires people and teams to learn constantly and be innovative. That is enabled by psychological safety, the shared belief that it is safe to take interpersonal risks in a team. Psychological safety has interested researchers for decades and the studies have revealed its vital role in the organizational life. In this paper, we introduce our comparative case study about the experienced level of psychological safety in two Finnish work teams. As a theoretical framework for our study, we used Amy C. Edmondson's model of antecedents and consequences of team psychological safety. Our findings support Edmondson's model. However, we succeeded to enrich the model and found three new antecedents for team psychological safety and one addition to team learning behaviors that are consequences of team's shared beliefs of team psychological safety.

Introduction

In today's volatile working life teams and projects alter and people work across team and organisational borders. Employees need to adopt and learn new work methods and environments and create quickly trusting interpersonal relationships with new colleagues. Adjusting in complex, constantly alternating environments, volatile work assignments and working in networks requires people to be constantly learning and being innovative together which is enabled by the shared belief of psychological safety. (Edmondson, 1999.) Psychological safety means the belief that it is safe to take interpersonal risks for example in a work team. This means the ability to voice one's opinions, concerns and ideas and ask for help and feedback without any fear of becoming humiliated, rejected or punished. In a psychologically safe team it is safe to take risks, make mistakes and speak up about errors. (Edmondson, 1999.) Psychological safety has been studied for several decades in various organizational contexts, in different fields and in several countries and cultures. These studies reveal its vital role in the organizational life. (Edmondson & Lei, 2014.) Also in its extensive Aristotle-project Google found out that psychological safety was the most important key factor for a work team to become a high-performing team (Rozovsky, 2015).

The theoretical framework of this research is the model of antecedents and consequences of team psychological safety introduced by Amy C. Edmondson (Figure 1). The model suggests that following organizational conditions; team leader behavior, informal group dynamics, trust and respect, use of practice fields and supportive organizational context influence in team's shared beliefs of team psychological safety. The shared beliefs, in turn, influence in team learning behaviors; help seeking, feedback seeking, speaking up about mistakes and concerns, innovation and boundary spanning. (Edmondson, 2003.) The most high-performing organizations are constantly learning and achieve high levels in psychological safety and also meet demanding goals (Edmondson, 2008).
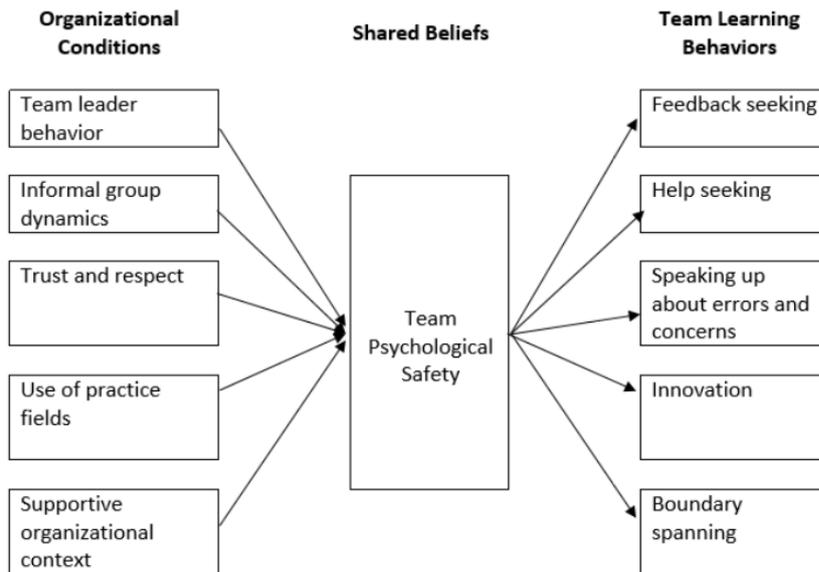
Figure 1. Model of antecedents and consequences of team psychological safety (Edmondson 2003).

Execution

The goal of our qualitative comparative case study (Lehtisaari & Ruokonen, 2019) was to study and compare the experienced condition and level of psychological safety in two Finnish work teams from different public sector organizations in Central Finland. The other work team, consisting of nine members, functions in the field of entrepreneurship education and the other work team with six members functions in customer service operations in municipal infrastructure. We chose these case teams for our study based on the fact that they fill the criteria of *a work team*. The leaders of both teams were willing to bring their teams as cases for our study.

This case study research material consists of pre-question form inquires, semi-structured theme interviews and observations gathered between 24 May – 8 November, 2018. There are altogether 17 individual interviews that were recorded and transcribed and three observation memos of case teams' ordinary activities. In our case study, we gathered material about the appearance of psychological safety in the case teams. Our analysis method was content analysis guided by theory and our research material alternately. During the analysis process, we grouped our study material in categories based on Edmondson's model. The organizational conditions based on the model were team leader behavior, informal group dynamics, trust and respect, use of practice fields and supportive organizational context and the team learning behaviors based on the model were help seeking, feedback seeking, speaking up about mistakes and concerns, innovation and boundary spanning. We grouped citations from the material to the above-mentioned categories. We also found and marked themes that did not match with the existing categories but were significant because of their frequency. So we ended up creating new categories for these findings: mutual care and recognition, relevance of physical facilities, fostering team spirit and culture of mutual thanksgiving and praise. The first three belong to organizational conditions and the latter features team learning behaviors.

Already during the interviews we found out that comparative study method was a relevant choice and while analysing the material this observation was confirmed even more. During the study process, it became clear that from the material, we would look for differences between the teams

and at the same time similarities and differences inside the teams. The more the teams had congruent citations internally that at the same time were different or even contrary to the other team, the more significant they were. We asked "why" questions to the material trying to find out why especially some members of the other case team experienced certain issues differently than others in that team or why some issues appear in the teams.

We presented our study results comparing the case study teams' stage of psychological safety, comparing the found antecedents and consequences of team psychological safety in both case study teams. We tested Edmondson's model in these two case study teams and presented the results category by category so that first we went through the results of organizational conditions that influence in team's shared beliefs of team psychological safety. Secondly, we went through the results of team learning behaviors that are consequences of team psychological safety. Our goal was to bring forth the personal voice of the studied team members and enrich Edmondson's model.

Findings

Our research results support Edmondson's model of antecedents and consequences of team psychological safety. Based on our research in these two Finnish work teams it is shown that organizational conditions influence in team's shared beliefs of team psychological safety, and in turn, these shared beliefs influence in teams' team learning behaviors.

The organizational conditions feed team psychological safety and by that, team learning. Team leader's coaching-oriented behavior and organization's strong support particularly had significant influence on team learning mediated by team's shared belief on its psychological safety. The lack or shortage of those conditions reflected unfavorable to the team. When studying the attributes of the team learning behavior it became obvious that the stronger the attributes were and the safer the team felt psychologically, the more the team was development-oriented and able to learn and ready to diversely improve its activities.

The role of a team leader is essential. When the team leader is coaching-oriented, inspirational, encouraging and dare show her/his vulnerability she/he enables the growth of psychological safety. Showing humanity doesn't concern only the team leader because members of the team foster psychological safety by accepting everybody's personality even if it's different from one's own and can see it as a resource for the team. Team leader encourages the members to utilize their personality, strengths and roles for the common good.

In a psychologically safe team, trust and respect as well as practising is in the team's culture. Team members are not afraid to make mistakes and find the opportunity to learn as a team. The team leader gives impulses to experiments and build the use of practice fields. Organization support is essential for team's psychological safety. The organization supports the team by giving the needed information and resources equally. The team leader has management's support and power to foster team's activities.

In addition, based on our research results we managed to enrich Edmondson's model (Figure 2.). As an addition to the organizational conditions we found significant first team members mutual care and recognition, meaning caring about each other and others' coping and wellbeing. Secondly, we found significant the relevance of the physical work space and premises and the feeling that they are functional for the job and the members of the team can affect spatial planning. Third finding was fostering team spirit. Members of the team think and speak "We" instead of "I"

and the team spirit is reflected in their behavior. Members of the team have shared belief of the meaning of team spirit.

In a psychological safe team it is safe to voice one's opinions, concerns and ideas, ask for help and feedback, develop ideas together and span boundaries without any fear of becoming humiliated, rejected or punished by other team members. In addition to Edmondson's model's consequences of team psychological safety, we found out that mutual thanksgiving and praise are also team learning behaviors that are consequences of team's shared beliefs of team psychological safety.
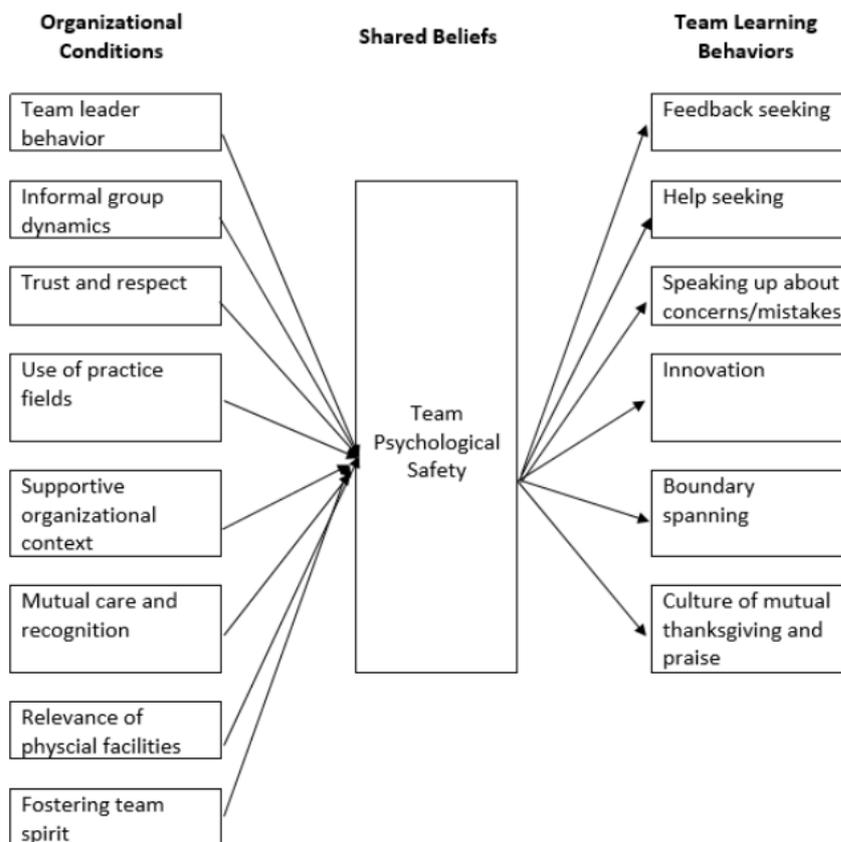
Figure 2. Enriched Edmondson's model on the basis of our study (Lehtisaari and Ruokonen 2019).

As a positive finding the study revealed that in the psychologically safe team there were mutual support and trust between team members. For the team members it was inspiring to work with such a team and at the same time social capital developed. That committed team members to the team goals and encouraged to exceed them.

Conclusions

The enriched model of antecedents and consequences of team psychological safety is a checklist for organizations' management and leaders on how teams could learn and perform better. A learning team understand and can utilize whole team's potential and this is understood by the whole organization. Without a shared belief of psychological safety the team can of course perform well but then the outcomes are more on a basic level without willingness or opportunities to develop and possibly on the cost of employee wellbeing.

Although we studied work teams in public organizations our research results can contribute and be applied to private organizations and any kind of work teams. We suggest that these research results can be applied also to startups and other entrepreneurial teams that are forming and growing rapidly. Based on our research results we advise team members and team leaders to take the concept of psychological safety into account in all stages of teams' lifecycle and in different organizational levels and contexts.

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Revisiting the Psychosocial Risk Assessment - Challenges, Hurdles, and Coping Strategies from Business Practice

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Keywords: Psychosocial factors, risk assessment, practical challenges, distress in the workplace, change management

Abstract

Since 2013 employers in Germany are obliged to assess psychosocial risk factors at the workplace and to take measures to reduce them. Many companies have fulfilled this obligation – with different experiences and outcomes. While some companies successfully implemented the process, others are still struggling with its initiation. Probably, one reason is that the legal obligation comes close to an obligation for organizational change – a fact some companies are not aware of when assessing psychosocial risk factors. Based on more than 40 conducted projects, typical challenges, hurdles but also coping strategies for different types of organizations and outline success factors will be exemplified. Further, proposals for a revision of the existing guidelines shall be discussed.

Introduction

Since 2013 German Occupational Safety Act requires employers to assess psychosocial risk factors at the workplace in accordance to DIN EN ISO 10075-1 as part of the risk assessment. The assessment of psychosocial risk factors is a particular challenge, due to the fact that other methodologies are needed than the existing approaches in measuring risks at workplace. Furthermore, they require a more extensive process communication and active involvement of different players in the company. And finally, the psychosocial risk assessment involves wider implications since they focus on psychosocial risk factors arising out of work task, work organisation and work environment as well as of social relationships at the workplace (BAUA, 2014; GDA; 2018), so it often also affects issues of corporate culture.

Which factors are crucial that companies can benefit from the opportunities of psychosocial risk assessment? Which are the major challenges and how to meet them? Based on practical experience, challenges, risks, and opportunities in conducting the psychosocial risk assessment are presented.

Execution

The EO Institut has conducted the psychosocial risk assessment in more than 40 organisations, among them small and large companies as well as public sector organisations. Based on these practical experiences we systematically identified internal organisational hurdles and success factors, that affect the success of the process. For a better understanding of the results, we first sketch out our process for implementing the psychosocial risk assessment in organisations:

Before analysis: In preparation for the analysis a steering group consisting of companies' representatives is built. Usually, it consists of a member of the management, a works council representative, representatives of the departments HSE and HR and (in large companies) the company doctor. The steering group makes the decisions for the process design of psychosocial risk assessment. Issues that needed to be addressed in this phase: the determination of methods for conducting the psychosocial risk assessment, responsibilities, communication process,

reporting lines and the effectiveness check. The next important step before conducting the analysis is to inform employees and managers about the pending process. Usually, various channels for information are used, like information events for employees and managers, flyer or information on intranet.

Conducting the psychosocial risk assessment: Suitable tools for analysing psychosocial risk factors are employee surveys, workshops, and interviews. In our process, we use all three approaches, depending on the company's framework conditions. Usually, two methods are combined, especially the combination of employee survey and subsequent workshops is often carried out. In some projects, Workshops take place in every work unit to analyse causes of the survey's findings and to develop solutions together with employees. In other cases, only if critical survey results occur workshops take place.

Developing measures: Results of analyses are reviewed with managers. On this basis, managers develop measurements to reduce psychosocial risk factors. If no detailed analysis in the form of workshops or interviews took place, managers will be enabled to constructively discuss their department's results with their employees and to derive measurements to reduce psychosocial risk factors. Responsibilities and deadlines will be defined for all determined measures to ensure their realisation.

After analysis: In accordance to the fixed deadlines, an effectiveness check will be conducted. In this phase, again the steering group is closely involved to check the realisation of measures. If measures are not implemented as planned, the steering group supports managers to overcome hurdles or to find alternative solutions to reduce the identified psychosocial risk factors. In the following, the psychosocial risk assessment will be repeated after a defined period, e.g. after two years.

Findings

The psychosocial risk assessment is associated with challenges in the different project phases. It is essential for the sustainable reduction of psychosocial risk factors to meet these challenges in a proactive way. Therefore, the following measures are crucial for a successful process:

Ensure the commitment of the management board before beginning:

Before the process begins, the management board needs to be positive about of the purpose and benefits of the psychosocial risk assessment. The attitude "We just see the psychosocial risk assessment as a legal obligation" is not enough.

Establish a steering group and define roles and responsibilities of the members of the steering group:

It is important that all members of the steering group act continuously in a proactive way. It has to be ensured, that members of the steering group understand their role and responsibility in the process. If not, it can happen that only few persons are loaded with an immense work and that these persons become overstrained.

Choose a level of analyse which ensures specificity and anonymity of the results:

When using a survey as method of collecting data, a profound discussion of the level of analyse is required. If the analyzation level is too superficial, the results are not specific enough and cannot be traced back to certain work units. In consequence, measures based on these results are

possibly not specific enough. In contrary, if the analyzation levels are divided into too small sections, anonymity is endangered, or no results are obtained at all. Ensuring anonymity is crucial. The recommendation is to report results for a single work unit only if at least five employees from the unit have participated in the survey.

Be proactive in the communication with managers on all management levels:

Managers are often sceptical because they don't see the purpose of the psychosocial risk assessment. Often, they shun the needed time and effort. Furthermore, they fear that critical results lead to disadvantages for themselves. A roadshow only for managers helps to resolve fears and reservations and to enable openness and commitment.

Ensure a transparent flow of information during the whole process:

A roadshow combined with different information materials (e.g. flyer, video, FAQs) is recommended. Additionally, there should be contact persons for employees. Employees should be informed after every step of the process.

Ensure the fit of assessment method and organisational culture:

The employees are tired of countless online surveys? Choose another method for the psychosocial risk assessment: standardised workshops or personal interviews. In general, it should be ensured that the instruments are understandable to all employees.

Don't forget the effectiveness check:

It helps to already respect the effectiveness check in the time schedule. Focus should be on effectiveness of measures, difficulties in implementation and adjustment of measures.

Conclusions

The Psychosocial Risk Assessment is a useful instrument that effectively helps to reduce psychosocial risk factors at work and therefore to foster a company's success. Success and sustainability of the process are affected by attitude and activity of the company's players, by a well-structured process and a comprehensive process communication. A process that is adapted to the company's framework conditions is more expedient than a too complex and complicated set of instruments. From the beginning the players should take a proactive part to drive the process forward. Low-threshold measures are often more successful and more likely to get enduring implemented than too sophisticated ones, which threaten to fail in practical implementation.

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Team resilience: Smart routines as prevention strategy for the age of new work?

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Keywords

Abstract

In the age of new work, employees are challenged by new factors of mental and physical stress. Since many stress factors affect entire teams and are related to the work environment, 'team resilience' is needed. Team resilience is not the sum of many resilient individuals but derives from smart team routines. Routines helping to anticipate and preventively minimize stress factors, routines helping to manage stress factors by means of team resources, and routines supporting team learning and improvement from prior stressful situations.

Based on the extant literature and a case study with more than 700 employees a special team resilience training was developed and tested with seven teams from a pilot company. Results indicate that team resilience might be an appropriate prevention strategy.

Introduction

At the modern workplace, employees face digitalization, flexibilization, and other challenges. In consequence, work has become the major source of negative stress for Germans due to high workloads, time pressure, permanent interruptions, information overload and unprecise tasks (Techniker Krankenkasse, 2016). Flexible and mobile work structures increase and provide chances as well as risks (Hammermann & Stettes, 2017), and might eventually affect employees' well-being and health. Thus, the mental illness related absence rate of German employees increased by nearly 80 percent within the last decade (Meyer et al., 2017).

Employers are increasingly attracted by the idea to simply provide their workforce with resilience trainings to cope with work-related stress factors. An idea that has been promoted since the 1990s when the concept of resilience gained popularity through a broad landscape of advice and self-help literature and training offers (Sonnenmoser, 2018). Originally, resilience factors were identified through research on children who were exposed to unusual high levels of stress and difficult circumstances (Werner, 1984). However, stressing individual resilience at the workplace shifts responsibility for coping with today's workplace challenges to the individual. This seems inappropriate for different reasons:

First, many trainings on individual resilience do not include real stressors, are not repeated as a matter of sustainability and lack effectiveness controls (Forbes & Fikretoglu, 2018). Second, at the workplace, it is often the team and not the individual who is challenged, so that resilience has rather to be trained at the team level (Alliger, Cerasoli, Tannenbaum, & Vessey, 2015). Then, the focus is more on team resilience than individual resilience.

Execution

Based on a literature review of (organizational/group-level) resilience and stress management studies, industry specific approaches to stress management (aviation, special forces, surgery, etc.) and data from a case study with more than 700 employees of an organization undergoing

organizational change, a specific team resilience training was developed. The training itself was then tested with seven teams from a pilot company.

The extant literature stressed that team resilience is not the sum of many highly resilient individuals but derives from a number of smart team routines. Routines helping to anticipate and preventively minimize stress factors, routines helping to manage stress factors by means of team resources, and routines supporting team learning and improvement from prior stressful situations. These routines enable the team to effectively cope with stress factors before, during and after a high-pressure or load situation (Alliger et al., 2015; Tirpitz, 2019). Thus, team resilience can be considered as dynamic capability at the sub-organizational level (e. g., Teece & Pisano, 1994; Teece, Pisano, & Shuen, 1997). Dynamic capabilities are usually defined as a set of organizational routines which enable organizations to adapt to their environments, cope with challenges, and stay competitive (Teece, 2007). Team resilience is then made up by a set of interdependent team routines which help teams to anticipate, manage and learn from highly stressful work situations (Alliger et al., 2015; Eisenhardt & Martin, 2000).

Especially professionals in high-risk environments do heavily rely on team routines since their daily work is characterized by high levels of uncertainty and low levels of predictability (e. g. special forces, firefighters, surgery teams, flight and space shuttle crews, etc.). These teams are regularly exposed to high levels of physical and mental stress but need to function, anyway. Therefore, these teams stick to certain routines. As a whole, these routines build the foundation of their team resilience.

Drawing on the swiss cheese model (Reason, Broadbent, Baddeley, & Reason, 1990) these routines should ideally be designed in an interlinked fashion and they should mutually support each other. Further, smart team routines should be based on or at least foster open team communication and role clarity.

Seven different teams received the developed team resilience training. The training started with short theoretical inputs on individual resilience, specific stress factors in teams, the notion of open team communication and role clarity within teams, and finally the concept of team resilience. Then, based on the concept of Alliger et al. (2015) teams were guided to develop simple routines at three levels: Minimize, manage, and mend. In order to test these routines and adjust them, teams were finally exposed to stress factors by means of a complex team task under time pressure.

Findings

Minimize: Routines to anticipate and minimize future stress factors' impact. By anticipating stress factors, these routines help to make use of team members strengths and compensate weaknesses at the same time. In one of our pilot groups the routine of a team-written travel guide was developed since the self-responsible organization of frequent business trips put stress on team members. Team members documented their experiences with hotels, restaurants and recreation places. This did effectively reduce searching and planning efforts and the related perceived stress.

However, for most teams it turned out to be rather difficult to think of potential minimize-routines. Instead of an abstract discussion about potential load situations it helped to analyze real past situations and then derive routines that could have helped in advance.

Manage: Routines to actively manage acute load situations as a team. Therefore, team members must be able to identify, and name actually stress factors and take countermeasures. At the same time, the team needs to make sure that standard working procedures are maintained. The development of checklists and standard operation procedures are appropriate approaches.

In our pilot groups all teams integrated an individual-level „workload traffic light"-routine in their regular team meetings. Thus, team meetings did not focus on detailed project reports but on the individual load situation of each team member. Every single team member reported his or her load situation according to the traffic light principle. In consequence, a highly cooperative reallocation process was initiated among team members. Team members with lower workloads took tasks from members with an overload. Thus, the traffic light routine ensures team performance as a whole.

However, even though all teams adopted the traffic light routine, especially younger team members seemed more willing to transparently discuss their individual workload situation. Some elder team members expressed concerns about the high transparency created by that routine.

Mend: Routines to recover from the actual load situation and to prepare for future challenges. Therefore, the team needs to openly address fears, mistakes and emotions from previous situations and discuss necessary adaptations. At the same time, success factors must be named, team performance and in-group support should openly be acknowledged.

Originating from the military domain, debriefings are a useful routine all pilot teams adopted. Thus, the whole team systematically reviews team performance after completion of a project or any other high stress situation. Lessons learned are elaborated and improvements for future work are derived.

However, questions all pilot teams faced were the following: When does a debriefing take place? What shall the debriefing exactly deal with (questionnaire)? And how to ensure that the results of the debriefing enable team or even organizational learning and development?

Conclusions

Establishing team routines to build team resilience seems a promising prevention strategy for the age of new work. Besides the above-mentioned example routines many other helpful routines are imaginable. However, it is essential that these routines are developed by and within the team itself. If this is given, teams are able to develop resilience at the group-level. Then, these team possess a group-level capability of anticipating stress factors early and start up appropriate coping strategies. The pilot groups which received the team resilience trainings made effectively use of the "workload traffic light"-routine. With this simple routine as core of their revised cooperation approach they were able to reduce perceived pressure and complete projects less stressful. Thus, they could recover quicker and started more powerful into new projects what made team resilience routines a positive self-reinforcing mechanism for them.

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Vision Zero: Integrating workplace safety, health and well-being into business strategies

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Abstract

This paper elaborates on two Vision Zero topics: 1) Research based on our surveys, interviews and workshops with 27 companies in seven European countries, show that the Vision Zero strategy for occupational safety builds on the traditional strategy by focussing more on commitment and investment, the processes of creating safe work, safety leadership and integrating safety in business. 2) In an ongoing project with the International Social Security Association, we are developing 14 'leading indicators and fact-sheets' for their Vision Zero strategy for occupational safety, health and wellbeing, which may facilitate companies in proactively gauging progress, benchmarking with others in their sector, and in establishing key performance indicators.

Introduction

The concept of a 'zero' strategy has been around for many decades and is applied to many aspects of modern life, business and national and global politics. Today we see environmental and health goals (UN sustainable development goals), food and drink (zero sugar and fat), patient, fire and traffic safety, zero tolerance for terror, violence and bullying, and zero defects and zero downtime in production and processes. In occupational safety, companies have been applying 'zero' approaches like zero harm and zero accidents, but there has been little research into what they are doing, and whether it differs from traditional strategies, or how these strategies can be supported or improved (Zwetsloot et al. 2013).

Companies predominantly rely on reactive indicators such as accident frequencies and sickness absence statistics, in order to gauge progress, or benchmark with others in their sector. However, it is well-known that zero targets and accountabilities can have a counterproductive impact, such as underreporting of incidents. Defining target zero is different from Vision Zero. It is an expression of traditional 'management' thinking, whereas Vision Zero focuses on 'leadership' and 'commitment'. There is therefore a great need to investigate what proactive and leading indicators could be of practical use and value to companies pursuing Vision Zero.

The objectives of this paper are threefold:

1) To explore how a Vision Zero strategy differs from a traditional occupational safety and health strategy

2) To describe an international ongoing project to develop 'leading indicators and associated fact-sheets' for occupational safety, health and wellbeing

3) To share some of our broader understandings of Vision Zero.

Execution

For the first objective, safety researchers from Belgium (Prevent), Denmark (NFA), Finland (FIOH), Germany (IFA), Netherlands (TNO), Poland (CIOP) and the United Kingdom (HSL) collaborated under the Partnership for European Research on Occupational Safety and Health (PEROSH). A total of 27 companies, 3-4 in each country, were included, with predominantly manufacturing (n=13) and construction companies (n=7). The companies took part in a survey (8819 respondents: 1/3 leaders, 2/3 workers), interviews (3-5 per company) and national workshops, with the main focus being on vision zero commitment, communication, culture and learning (Zwetsloot et al. 2017b). Funding for the project, which ran from 2013-2015, was primarily from the German Social Accident Insurance (DGUV), and secondarily from the participating institutes. A DGUV advisory board for the project was established collaborating with the research team in conceiving, recruiting, interpreting and communicating the results (Zwetsloot et al., 2017a & b).

The second objective arose as an offspring of the first study, with collaboration of researchers from Denmark, Ireland and the Netherlands. Funding for this ongoing project (2019-2020) was received from the International Social Security Association (ISSA). The project is meant to support ISSA's Vision Zero Strategy, as well as its global Vision Zero campaign (visionzero.global). At the time of writing (of this article), a draft set of seven indicators has been defined and described in fact sheets. These are currently being shared with Vision Zero and other interested companies and intermediary organizations, and feedback is requested via an on-line survey. The preliminary results thereof will be presented at the Vision Zero Summit in Helsinki, November 2019.

Literature from scientific databases were reviewed, other literature were added from the researchers' own databases, reports found on the internet or received otherwise. Input from industrial practices was obtained through the networks of ISSA and the research team. In this way, input from 30 organisations from 13 countries was obtained.

Findings

Objective 1

The main findings as to how companies with a Vision Zero strategy for safety differ and build on a traditional occupational safety strategy are shown in Table 1. The companies' Vision Zero for safety strategy can be characterized as a commitment strategy. It is to the commitment of all through policies, procedures and practice, that all accidents and injury are preventable. This is attained through investing and creating safety (in design), in safety leadership, and learning from incidents and through networking.

Table 1. Traditional versus Vision Zero occupational safety, health and wellbeing (SHW) strategy (adapted from Zwetsloot et al., 2017a)

Traditional occupational SHW strategy	Vision Zero occupational SHW strategy
SHW control strategy (we have to)	Commitment strategy (we want to)
SHW is a goal	SHW is a process
SHW management	SHW leadership
SHW programs	SHW integrated in business
SHW is a cost	SHW is an investment
SHW owned by few	SHW owned by all
SHW is preventing accident	Creating SHW
Incidents are failures	SHW incidents are opportunities for learning
SHW is desirable	SHW is the norm
Local sector-specific networking	Multi-sectoral national networking
SHW benchmarks on lagging indicators	SHW benchmarks on leading indicators and good practice
S, H and W are different silos in the company	Synergies between SHW are generated

Good practices across the 27 companies included integrating SHW training and on-boarding, with some companies ensuring that commitment to Vision Zero was a topic in job interviews. Many of the companies where still looking for new and effective leading 'process' indicators for use in benchmarking and as KPIs, not only for safety, but also for health and wellbeing. Finland provided a good example of a multi-sectoral national Vision Zero network, whereby over 300 (over 400 in 2019) companies and organizations meet annually to share and discuss good practice.

Objective 2

A total of 64 leading indicators were identified in the literature and 72 were submitted by industry – with the majority dealing with safety, whereas indicators for health and wellbeing were scarce.

The indicators were then categorized according to one of the ISSA Vision Zero campaign's seven golden rules. The research team identified a key leading indicator for reach rule – and developed a fact sheet on the indicator. The fact sheets are limited to one page, and follow the template of: Title, key concepts, aim, how to measure (frequency or percent), limitations and five associated good practices. The preliminary topics deal with integrating SHW in on-boarding, training, pre-work SHW briefings, risk assessments evaluations, and innovations in the design stage.

Objective 3

The research questions in both projects were triggered by demands from organisations. Collaboration between researchers, companies, organisations and advisory boards in both projects are conducive to knowledge-transfer and exchange (Van Eerd, 2019). The scientific paper on Vision Zero for safety, health and wellbeing, clarifying the innovative aspects of Vision Zero and the synergies between safety, health and wellbeing (Zwetsloot et al., 2017c), had great impact in being inspirational for ISSA's 2017 launch of a global Vision Zero campaign (visionzero.global). This campaign then led to many Vision Zero companies requesting relevant proactive indicators for safety, health and wellbeing.

Conclusions

The Vision Zero strategy for occupational safety, health and wellbeing differs from traditional occupational safety and health strategies by requiring commitment to a sustainable process from all in an organisation, through policies, procedures and practice, that all accidents, injury and work-related diseases are preventable. This is attained through investing and creating SHW (in design), in SHW leadership, and learning from SHW incidents. Synergies between the three aspects SHW is thereby increasingly important. Vision Zero companies utilise leading indicators for benchmarking and KPIs, but there is no general agreement on what indicators to use. A draft version of seven leading indicators has been proposed and is currently being evaluated by industry. Knowledge-transfer and exchange has played an important role in generating further interest and evidence for the Vision Zero strategy.

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Vision Zero Fund: Shared Responsibility for Safer Supply Chains

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Abstract

The Vision Zero Fund (VZF), an initiative of the Group of Seven (G7) countries, and endorsed by the G20, aims to contribute to the achievement of zero severe fatal work-related accidents, injuries and diseases in global supply chains (GSCs). By the end of 2019, VZF will be operating in seven countries (Mexico, Colombia, Honduras, Madagascar, Myanmar, Lao PDR, and Ethiopia) and in two GSCs, namely garment and agriculture. The VZF embraces the model of shared responsibility, which recignises that to address the root causes of the most serious and entrenched violations of labour rights requires a new paradigm – one that involves the collective action, influence and resources of all major stakeholders in global supply chains.

Introduction

About 60 per cent of global trade today is organized within so-called GSCs. While the contribution of GSCs to global economic growth and job opportunities is evident, their impact on the living and working conditions and the safety and health of workers in developing countries raises important concerns. Paradoxically, however, evidence also suggests that supply chain relations can create opportunities to ameliorate these effects and contribute to supporting improvements in arrangements and outcomes for safety and health for workers.

Many companies have adopted codes of conduct and monitoring programmes aimed at improving labour conditions (including OSH) in their primary suppliers. Others have focused on capacity-building initiatives to improve suppliers' technical expertise and internal management systems, which would enable suppliers to enforce labour standards and improve working conditions on their own.

While these approaches have undoubtedly yielded "episodic improvements", they have failed to address the most persistent governance gaps. Even at their most successful, these private initiatives have created "islands of compliance", where the rights of workers depend on the strength and commitment of the companies involved.

While private compliance initiatives should no doubt continue to play a role in improving labour standards among primary suppliers in each multinational company's operations, it has become clear that to address the root causes of the most serious and entrenched violations of labour rights requires a new paradigm – one that involves the collective action, influence and resources of all major stakeholders in global supply chains.

Execution

1.Shared responsibility

Recognising that a new approach is necessary to address the root causes of the most serious OSH deficits in GSCs, VZF adopted the model of shared responsibility, which acknowledges that in order to address the root causes of the most serious OSH deficits in GSCs, the collective action

of all major stakeholders, including global companies, national-level suppliers, governments, workers and trade unions, international financial institutions, civil society, private philanthropy, and development agencies is required. The model facilitates the development of industry-wide, systemic approaches that involve key public and private stakeholders.

In order to promote such industry-wide approaches, the full scope and complexity of OSH challenges in each industry's entire supply chain must be given greater visibilty. This must be followed by an honest assessment of the real costs and commitments required to address the identified (OSH) risks and problems. Finally, all stakeholders, private and public, need to assume equitable responsibility for preventing and combating such challenges. For example, while global brands and retailers do have some role to play in meeting risk mitigation and remediation costs, they cannot be expected to do so alone. Others, especially home and host governments, as well as local suppliers, international financial institutions and private foundations, must shareresponsibilities for these costs.

VZF uses its convening power (as part of the ILO) to bring together stakeholders at both country and global level in pursuance of this model.

2. VZF objectives

VZF activities at country level is focused on both the private and public spheres. In the private sphere, the VZF implements targeted interventions with the goal of achieving sustainable practices to support safe and healthy working conditions at sector and workplace level. Specific activities include the creation of workplace safety and health committees with worker participation, awareness raising and training, and establishment or strengthening of occupational health services, among many others.

In the public sphere, the Fund works in three distinct, but interrelated areas: (i) strengthening the national OSH system, including the legislative and regulatory framework; (ii) improving the capacity of the regulatory authorities, including the labour inspectorate; and (iii) supporting the development of robust and effective compensation schemes.

3. VZF approach

VZF acknowledges that each supply chain is different, requiring customized public and private interventions to achieve effective OSH compliance. To this end, the VZF has adopted a systematic approach. It starts in each VZF partner country with an inception phase, during which specific value chains are targeted and comprehensively assessed to inform the design of intervention models that are implemented during subsequent project phases.

Findings

4. VZF focus

The focus of VZFs current sectoral work is on the garment- and agriculture GSCs. The largely formal nature of the garment sector and informal nature of the agriculture sector provide unique opportunities for VZF to test approaches, methodologies and tools in different settings, and explore opportunities for their replication and scale.

The garment industry provides formal employment to over 60 million workers worldwide, predominantly female, typically between the ages of 18-35, the majority of whom have migrated

from rural areas for their first formal employment. In some countries, garment production represents 70 per cent or more of total exports.

Despite its importance as a source of employment in the VZF project countries, the garment sector does not necessarily warrant prioritization based on the level of risk to workers. However, the presence of reputation-conscious global brands with technical and financial capacity to support improvement together with the relatively high level of formalization and unionization (compared to other sectors in the countries) offer unique opportunities for improvement. VZF will be able to test its approach, tools, and methodologies in workplaces with strong links to the institutions that are the focus of VZF's work in the public sphere (namely the labour inspectorate and social insurance system) and with direct links to global buyers, who have incentives to improve working conditions.

An estimated 1.3 billion people worldwide work in the agriculture sector, women accounting for almost half of these workers. Most workers work on family operated farms. Farms are often in rural and remote areas and agricultural workers are often migrants engaged on a seasonal, temporary or even daily basis. Agriculture is one of the most hazardous sectors of activity worldwide. In several countries the fatal accident rate in agriculture is double the average for all other industries. A wide range of workplace hazards are associated with the agriculture sector, including but not limited to those from hazardous machinery, chemicals, other toxic or carcinogenic agents, transmissible or infectious diseases, dust exposure, ergonomic hazards, and hazards associated with confined spaces, noise and vibration. Pesticide poisoning, often attributable to excessive and inappropriate use, application that results in excessive exposure, failure to substitute for less toxic alternatives, lack of understanding of hazards, and a lack or improper use of personal protective equipment, are common.

The focus on these two sectors allow VZF to develop valuable sector-specific experience and expertise that could be replicated in other countries and extended to other agricultural commodities. However, it does not preclude the Fund from considering other (high risk) supply chains for interventions, provided that meet specific sector criteria, including evidence that the proposed sector is part of employment-intensive GSCs.

Conclusions

A number of unique characteristics sets the VZF apart from other global initiatives aimed at improving labour conditions in GSCs. In addition to the model of shared responsibility, which represents a new paradigm for improving respect for labour rights in global supply chains, other distinguishing features include the following:

- VZF is endorsed by the G7 and the G20, which provides it with unparalleled political support, and unique access to multinational companies and brands headquartered in G7 and G20 countries;
- VZF's focus on improving OSH outcomes, the benefits of which are generally acknowledged by governments, workers and employers, provides it with a unique entry-point for improving social dialogue on other conditions of employment, including wages and collective bargaining;
- VZF's focus on both prevention (captured in its vision of a world without accidents, injuries and diseases) and compensation (improved employment injury insurance) is another unique feature.

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From "Vision Zero" rethinking to OSH Management System development: The experience at large potash mining company PJSC "URALKALI"

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Abstract

The brilliant idea of the "Vision Zero" as an international campaign for all working people and operating enterprises rushed into the occupational safety and health (OSH) world with its specific. The main character of OSH is formality, legality and its requirements and operations are very strongly mandatory. Moreover, concrete legislation of every country has national character and OSH Management System has corporate character too. We called procedure of transition from the main ideas, principles and indicators of the "Vision Zero" to elements and procedures of a corporate OSH Management System as "incidence matrix" design. After designing the incidence matrix we applied this approach in the practice of a large potash mining and chemical producing Russian company PJSC "Uralkali".

Introduction

The "Vision Zero» principles make high sense, but their application success will be provided only with realness of the used methods. The principles "Vision Zero" have international character and they arose applicable in traffic safety where the main actors are drivers. A situation with the "Vision Zero" in OHS is other. OHS has national character, and activity employers and their workers is strictly regulated by national labour legislation. All this demands special approaches at implementation of the principles "Vision Zero" in practice.

The central task of OHS is to maintain the safety and health of the workers. And the main tool for ensuring OHS is the OHS Management System at the employer's level. To specify it, we will use ILO-OHS 2001 and GOST interstate standards of CIS countries. Moreover, in our opinion ISO 45001 is not yet sufficiently implemented in general practice. Repeat, the idea of "Vision Zero" about seeking Zero Accidents is very good, but is implemented through 7 Golden Rules only. In practice, as shown in this study, these 7 golden rules are implemented in the form of specific corporate OHS Management System requirements. Then, according to our ideas, each golden rule can be brought into line by forming a special "incidence matrix", a provision of national legislation or standards and its implementation in the form of an appropriate requirement or organization of work of the corporate OHS Management System. Note that most large industrial enterprises at the same time with OHS Management System use a major accident prevention management system ("industrial safety management System" in Russian).

Execution

The conversion from seven golden rules of the "Vision Zero" to requirements of OHS Management System (in version of the ILO-OSH 2001) looks like this. Realization of first golden

rule "Take leadership – demonstrate commitment" needs to use paragraphs of the ILO-OSH 2001: 3.1 Occupational safety and health policy, 3.2

Worker participation and 3.3 Responsibility and accountability. Realization of second golden rule "Identify hazards – control risks" needs to use paragraphs: 3.7 Initial review, 3.8 System planning, development and implementation, 3.10 Hazard prevention, 3.11 Performance monitoring and measurement, 3.13 Audit and 3.14 Management review.

Realization of third golden rule "Define targets – develop programmes" needs to use paragraphs: 3.5 Occupational safety and health management system documentation, 3.6 Communication, 3.8 System planning, development and implementation, and 3.9 Occupational safety and health objectives. Realization of forth golden rule "Ensure a safe and healthy system – be well-organized" needs to use all paragraphs of the ILO-OSH 2001 and requirements and tools of national legislation. Realization of fifth golden rule "Ensure safety and health in machines, equipment and workplaces" needs to use paragraph 3.10 Hazard prevention: 3.10.1 Prevention and control measures, 3.10.2 Management of change, 3.10.3 Emergency prevention, preparedness and response, 3.10.4 Procurement and 3.10.5 Contracting.R ealization of sixth golden rule "Improve qualifications – develop competence" needs to use paragraph 3.4 Competence and training. Realization of seventh golden rule "Invest in people – motivate by participation" needs to use paragraphs: 3.2 Worker participation and 3.6 Communication. The main option described above is one in which some requirements come to the fore and others become ancillary. But in principle, all requirements of the ILO-OSH 2001 and all requirements of national legislation are used. It is interesting that the huge variety of dangers and risks of their impact on an organism of the working person is accompanied by only several concrete measures of protection which we know and which we use. The very first step and the most cardinal measure of protection from dangers and risks – change of technology with primary elimination of hazards, first of all hand manual work. The following step – universal application of collective protection equipment. The next important step is broad use of personal protective equipment. Having exhausted technical and hygienic means and methods of protection against dangers and risks, we start organizational measures of protection: training of workers in safe methods of work, availability of OSH instructions, operation schedules and, indeed, corporate OHS Management System. Let's emphasize that all measures and actions are carried out by people and begins to play a so-called "human factor". And therefore it is necessary to create the system of stimulation and motivation.

Findings

The Russian traditions of unification and standardization demand that these approaches were recorded in official documentation. It was made by us in a cluster of interstate standards. All of them have been approved as interstate standards for member countries of the Eurasian Council for standardization. Now these standards are put into operation in the Russian Federation. These interstate standards are GOST 12.0.002-2014 (it contains 165 key Russian and English terms on safety and health at work), GOST 12.0.003-2015 (it contains detailed classification of dangerous and harmful factors and agents), GOST 12.0.004-2015 (it recommends good order and programs for OSH training and instructions), GOST 12.0.230.1-2015 (on implementation of OSH MS), GOST 12.0.0230.2-2015 (on assessment of conformity), GOST 12.0.230.3-2016 (it contains criteria, indicators and methods for estimation of effectiveness and efficiency), GOST 12.0.230.4-2018 (it contains methods of hazard identification), GOST 12.0.230.5-2018 (it contains methods of risk

assessment), GOST 12.0.230.6-2018 (it contains methods for combination of various management systems with OHS MS).

After application of all above receptions it is possible to construct performance indicators "Vision Zero". For example, the statement for policy in the field of labor protection is made, all necessary structures of management are created, duties, obligations and employer's liability in the form of duties of workers are distributed, necessary resources under all tasks are allocated and procedures of checks and self-regulation are established.

Sets of such indicators of performance "Vision Zero" have to be established and described in the OHS Management System of company according to each golden rule of "Vision Zero". It gives the chance to completely introduce the ideas "Vision Zero" in practice of daily work on prevention of accidents and to elimination of occupational risks.

Our methods were the implementation of OSH Management System for large potash company PJSC "Uralkali". Now the company carries out the whole complex of measures on the prevention of accidents - as a result, over the last few years their number has significantly declined. For example, over the last 5 years the number of accidents, including fatal, have decreased more than 2 times compared to the previous five-year period. It is very good result.

Conclusions

Main objectives and tasks "Vision Zero" can be reached within OHS Management System which is guided by the national legislation system and the best practices. In fact any good OSH Management System allows the management of the enterprise to show the qualities of the leader, to involve all workers in process of their protection against dangers and risks, to increase their competence of all questions, necessary for safe and productive work, to create the system of actions for realization of the ideas "Vision Zero", including hazard identification, risk assessment and risk management in workplaces. The implementation of such approach in the large mining potash company Uralkali shows good legitimacy and efficiency.

Acknowledgements

Aiming for Zero Harm at Construction - Aligning Safety and Health Strategy and Operations

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Abstract

In 2015 Skanska Group published new strategy aiming at injury free workplace and working environment. Skanska Finland and its occupational health care provider Terveystalo joined their specialists to review current health performance.

Measures preventing ill health were shadowed by strong focus on accident prevention. Safety action plans took little attention to physical load, noise, vibration and chemical exposures.

Since occupational health care services were governed elsewhere, co-operation was disintegrated and coordination in many matters, including yearly action planning was mostly lacking.

In 2016 action plan was created to close gaps between H&S policy aspirations and operations. Co-operation committees between safety organization, HR and occupational health care were

Introduction

Skanska Finland, as part of Skanska Group construction and development company, has 2100 employees and 2500 subcontractor workers on its approximately hundred on-going projects.

Company has moved substantially forward with is H&S performance since launch of its first Group Safety Strategy in 2004. Focused preventative work, H&S specialist network development, raise of local H&S standards, leveraging new IT solutions (incl. eLearning and digital observation tools), lean tools implementation for production processes and comprehensive follow-up and reporting has reduced its lost time accident rate by over 90%. The attention has been keenly on accident prevention (Leino, A., Elfving, J. & Ballard, G. 2010).

In 2015 Skanska Group published new strategy aiming at injury free workplace and working environment, pushing harm caused by workplace accidents and exposures towards zero, by promoting health, well-being and safety at work. Group Safety Policy document was replaced with Health and Safety Policy.

Skanska Finland and its occupational health care provider Terveystalo joined their specialists to review current health performance in 2015. Questions were set:

1. What kind of a gap is there between health and safety aspirations and operations?
2. How can gap be closed? What existing practices are already in order? What preventative safety management processes can be extended to cover also health aspects? What kind of new competences are needed and trained to safety specialists?

Execution

Measures preventing ill health were shadowed by strong focus on accident prevention. Safety action plans took little attention to physical load, noise, vibration and chemical exposures. As an

exception, dust exposure prevention had picked up speed when construction safety regulations were altered 2009 in Finland (VnA 205/2009).

Work ability and occupational health care were managed by another function, Human resources (HR), separate to safety function. Since occupational health care services were governed elsewhere, co-operation was disintegrated and coordination in many matters, including yearly action planning was mostly lacking.

Lack of planning processes had as well resulted in neglecting development of safety specialists' ill health prevention competencies. Therefore, their scope of work was to be reformulated.

Safety information management system had been set up to effectively disseminate lessons learned (Leino, A. & Helfenstein, S. 2012). System had lots of potential for health promotion. However, it was never defined what topics and content could be utilized, referring also to privacy of certain health data. An example of inefficiency concerned numerous job health analyses (työpaikkaselvitys) that were yearly carried out by occupational health care provider. Valuable health information was extracted from operations, but not really systematically utilized. Other findings included: health information was not affecting operational decision-making, safety tool-box talks, workshops and elearning did not cover health issues and reporting routines between health and safety did not match with each other.

Findings

In 2016 action plan was created to close gaps between H&S policy aspirations and operations. Co-operation committees between safety organization, HR and occupational health care were established both on strategical and operational levels. Alignment has resulted in several new ways of working:

- Scheme for right-timely health action planning was set at different levels: Business unit and regions use now extended yearly planning tool called Health and Safety Road Map. Respectively, at site-level Safety plans now include health issues. New tools have been developed also on task-specific planning such as ergonomics reviews. All necessary health information is escalated through safety leadership team, e.g. decision-making in policies on construction site lifts and their investments.
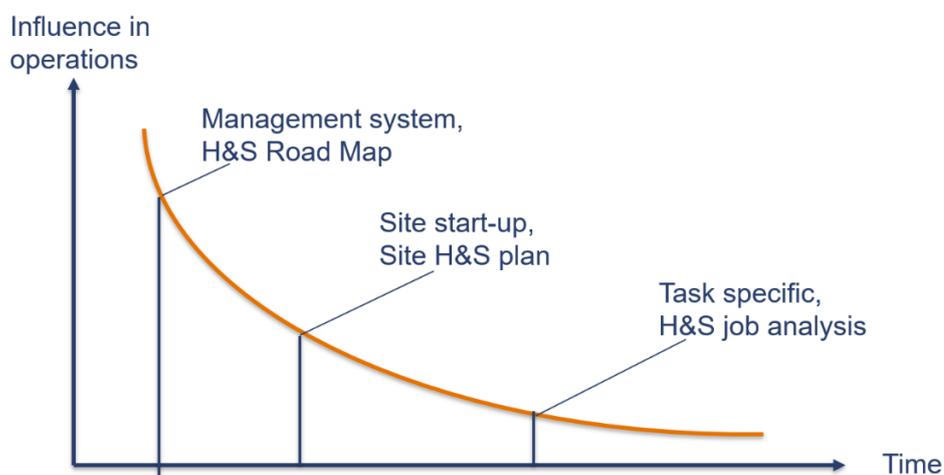

Figure 1. Preventative planning for health and safety

- Safety Information System has been augmented to include Health information, e.g. Task-specific health data sheets on A3 format based on job health analyses. A3's are disseminated across the organization to help incorporate health aspects in safe job analysis (task risk assesment). Findings are also dealt in regional safety committees, safety manager's meetings and as well as needed in the safety leadership team meetings.
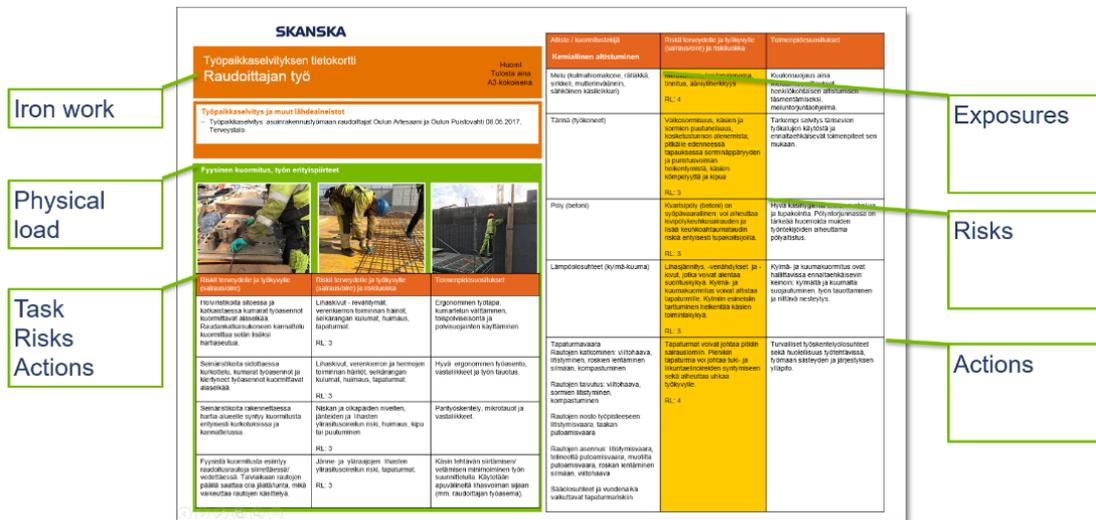
Figure 2. Job health analysis findings modified into A3 report, example iron work

- Safety specialist competence matrix was updated. Trainings have been delivered on ill health prevention topics such as asbestos, vibration, respiratory and hearing protection. Accordingly, safety organization is capable of delivering tool-box talks.
- Site ill health prevention workshops and eLearning modules have been published. Workshops include occupational health care provider's specialist presentations covering such topics as hearing protection, vibration control, physical load and stress management.

Conclusions

Policy renewal, redefined co-operation between specialists (HR, occupational health care provider and safety organization) and joint action planning have helped organization to take steps towards zero harm vision. Balanced approach between health and safety targets has been received well amongst personnel. Integrated approach supports holistic safety culture improvement, business objectives and productivity of H&S work. In 2020 organisation will be assessed against ISO 45001 requirements stressing health aspects. Recent actions have matured personnel at all level of organisation to start more open discussion on workplace stress management and work-life balance.

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Safety Guide Book – Introductory book to disseminate new safety concept

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Keywords: machinery safety, safety at the manufacturing site, Zero Accident

Abstract

Nippon Electric Control Equipment Industries Association (NECA) had started actions to disseminate and promote the concept of "machinery safety" in Japanese society in 2000.

One of NECA's representative activities is publication of "Safety Guide Book" which advocate the importance of ensuring safety systematically based on the international safety standards. The book introduces machine safety basics by explanation using manga (cartoons). Since first publication in 2001, it has revised according to revision of safety standards and changing of the environment surrounding manufacturing industry. Through the effort, NECA succeed to popularise the idea of machinery safety in Japan.

This paper reports on NECA's past actions and future challenges for safety at the manufacturing site.

Introduction

NECA is established in 1964 for promoting the growth of the electric control equipment market in Japan. As one of its activities, NECA conducts activities to contribute to ensuring safety at the manufacturing site where machines equipped with control equipment are used.

Traditionally, safety at workplaces in Japan has been focused on education and training to foster the workers' ability of avoidance dangerous situation by their awareness. This method is still used in various industries and have shown a certain effect in preventing accidents.

However, environmental changes at the manufacturing site occurred that require additional safety measures not only dependent on the education. For example, with the evolution of technology, high-speed and complex machines have been introduced. The employment environment has also changed, and opportunities to hire short-time workers with limited skills and experience are increasing. Under such circumstances, the idea of "machinery safety" has been attracting attention.

Machinery safety is the concept of achieving the safety of the machinery itself from the design stage. The idea is shown in international standards such as ISO 12100: 2010.

The concept of machinery safety began to be introduced in around 2000 in Japanese industrial field. One of the reasons for this is a technical report ISO TR 12100-1: 1992 translated into Japanese in 1999, which was the basis of current ISO 12100. Another is that, "Guidelines for the Comprehensive Safety Standards of Machinery" was issued in 2001 as a complementary document for the Japanese Industrial Safety and Health Act.

In response to these movements, NECA established the Control and Safety Committee in 2000 and started actions to disseminate and promote the concept of machinery safety.

Execution

NECA has conducted two typical activities for safety so far. One is the establishment of "Safety Assessor Qualification System", an effort to develop human resource for safety. This will be announced by Dr. Fujita, NECA Vice Chairman, in Session 2C "Safety by training". The other is the publication of the "Safety Guide Book" described in this paper.

The Safety Guide Book is an introductory book created to communicating the concept of safety in an easy-to-understand and effective manner. To ensure safety at the manufacturing site, it is necessary for a wide range of people such as machine designers, engineers, operators, manufacturing site supervisors and safety specialists, to have a common understanding of safety. However, most of the books that describe ideas and technical methods for achieving safety were specialised for safety experts. As a result, many non-experts felt a difficulty to learn safety. This book was created on the assumption that designers, engineers, and on-site machine operators who do not have enough knowledge of safety can learn safety in with plain explanation.

In order to make it easier to understand, we made two efforts. This Safety Guide Book uses the words "every person makes a mistake" and "every machine will be broken" as easy-to-remember keywords that convey the concept of machine safety. No matter how educated and trained you are, you may make mistakes in your work. Any high-performance machine can break down. For this reason, you must use a machine that is designed so that it does not cause a dangerous situation if you make a mistake or break the machine. This concept is perfectly aligned with the machine safety concept described in ISO 12100: 2010.

Another point is using manga (cartoon). The explanation using manga is a technique widely used in Japanese education and business scene. This is said to be effective for non-professionals to visually understand the overview in a short time. It is because that our target readers of this Safety Guide Book are every person who handle the machine at the manufacturing site, we decided to create a manga using characters from machine manufacturers and users and convey the concept. For the points that are particularly important in conveying the concept of safety, we adopted a 4-frame manga having storyline that can convey those points.

These are the example of the 4-frame manga showing the importance of the concepts "every person makes a mistake" and "every machine will be broken" as basic concepts for ensuring safety.
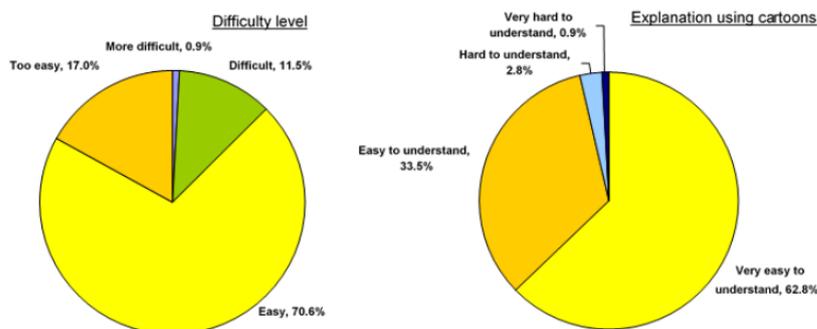
Findings

We conducted a questionnaire for readers of the guidebook. To confirm that the book makes easier for readers' safety learning process, the questionnaire asked the learning effect of the Safety Guide Book.
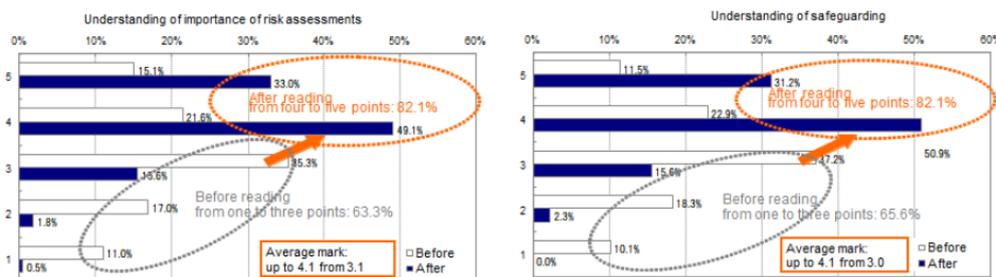
Graph 1 shows the results of questions about difficulty of the entire contents explained in this book and about explanation using manga. It shows that the contents easily explained because most of the key contents described by manga.

Graph 2 shows the results of a question about understanding the safety concept before and after reading this book. In the questionnaire, understanding level of important items for realizing safety systematically were confirmed with a five-point score from "very easy to understand" to "not understandable" before and after reading this book. As a result, it should be noted that before reading this book, more than 60% of people gave a score of 1-3, but after reading more than 80% of people gave a score of 4-5. This indicates that the level of understanding of the reader has improved. The questions introduced here are comprehensions about "importance of risk assessment" and "safeguarding", but it was observed that many other questions have similar trends.

<Graph1: Results from questionnaires concerning effects of Manga(cartoons)>

Difficulty level
More difficult, 0.9%
Too easy, 17.0%
Difficult, 11.5%
Easy, 70.6%

Explanation using cartoons
Very hard to understand, 0.9%
Hard to understand, 2.8%
Easy to understand, 33.5%
Very easy to understand, 62.8%

<Graph2:Result of questionnaires concerning effects on understanding level after reading>

Understanding of importance of risk assessments
5: 15.1% / 33.0%
4: 21.6% / 49.1%
3: 35.6% / 35.3%
2: 1.8% / 17.0%
1: 0.5% / 11.0%
After reading from four to five points: 82.1%
Before reading from one to three points: 63.3%
Average mark: up to 4.1 from 3.1

Understanding of safeguarding
5: 11.5% / 31.2%
4: 22.9% / 50.9%
3: 15.6% / 27.2%
2: 2.3% / 18.3%
1: 0.0% / 10.1%
After reading from four to five points: 82.1%
Before reading from one to three points: 65.6%
Average mark: up to 4.1 from 3.0

Through the questionnaire we got a lot of positive feedback on this book; for example, "Manga-based explanations are easy to understand and effective as reference books." "Can be used effectively to promote understanding of machine safety and new safety technologies in the company." "It contributes to improving awareness for safety."

NECA conclude that the book is quite useful for expanding basic safety knowledge, technology for elementary level of engineers who have a will to learn safety knowledge of machinery. In addition, the book gives awareness for wide range of readers.

Since first publication of this book in 2001, we have revised it 6 times in accordance with revisions of international standards and changes of manufacturing environment. NECA have also created several guidebooks based on this successful experience in the fields of machinery safety. It publishes two new books that are explosion-proof safety and electrical safety of DC power supply systems. As a result, the total number of series issued so far has exceeded 130,000.

We started to discuss the way of further contribution to realize safety for much greater number of workplaces. One improvement is reconstruction of distribution method. The book has only been distributed through NECA and their member companies by printed style.

For those reasons, NECA decided to make it public on the website so that more people can reach useful information of machinery safety on this year. At the end of November, every person who has interest about safety will be able to view latest 7th edition Safety Guide Book will be available on the NECA's website. We believe that this will make a further contribution to the realization of safety in various industries.

Conclusions

As mentioned above, NECA conduct activities to contribute to ensuring safety at the manufacturing site where machines equipped with control equipment are used. Under the changing environment at the manufacturing site, we published "Safety Guide Book" as an introductory book to disseminate and promote the concept of machinery safety. The way we created in an easy-to-understand manner using manga was quite useful to expand understanding of importance of basics of safety. We revised it since its first publication in 2001, we will release the latest 7th edition in November.

In 2017, NECA sets "Zero Accident" as a keyword to continue activities to disseminate safety concepts which needed in society according to environmental and technological changes such as widely known as the 4th industrial evolution or smart manufacturing. We will continue updating this book for spreading safety concept effectively under this new word.

Acknowledgements

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Do investments in gender equality create a safer workplace?
A case study within the construction sector

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Abstract

The construction sector is heavily male dominated and is often characterized by a strong macho culture, which includes factors such as status, risk taking and showing physical strength. To create a safer and healthier work place, and move away from this kind of culture, a large construction company in Sweden employed 16 female apprentices. This study utilized the Nordic Safety Climate Questionnaire (NOSACQ-50), which was distributed to personnel at five sites within the company, to analyze the safety climate. The preliminary results (13 women and 53 men) show that the women tended to have rated lower scores in the dimensions safety justice and safety systems' efficacy. These results indicate that in order to improve the safety at construction sites, just to employ women is not enough.

Introduction

Construction industry is one of the most dangerous industries when considered occupational safety (OS). In Sweden, construction ranks as one of the most accident-prone industries (Berglund et al., 2019). In addition to being accident-prone industry, construction sector is one of the most gender-segregated sectors. It is heavily male dominated and is often characterized by a strong macho culture, which includes factors such as status, risk taking and showing physical strength in order to be included in the social community (Connell et al., 2005). Women have in this culture not been accepted as professional employees (Arditi et al., 2013).

As Regis et al. (2019) stated, female employees seem to feel less comfortable than males, indicating difficulties, lack of respect and safety during work. In order to manage, women need to be very good at their work, or as Dainty et al. (2000) pointed out that they have three choices: 1) act like men, 2) lower their goals and assume secondary positions, or 3) surrender and move to work elsewhere. However, having gender diversity is noticed to be beneficial; gender diversity improves decision making and problem solving, reduces workplace conflicts and alleviate skills shortage within the industry. Furthermore, it increases productivity, improves corporate social responsibility and improves financial performance (Campbell & Mínguez-Vera, 2008; Soares et al., 2011). The aim of this study was to contribute to this gender discussion by providing an analysis of a Swedish construction company's safety climate and answering following research questions (RQ):

- RQ1: What may the level of safety climate be in a large construction company?
- RQ2: What kind of differences on the safety climate views may be identified between men and women?

Execution

Data

The Nordic Safety Climate Questionnaire (NOSACQ-50), consisting of 50 items assessed on a 4-point Likert scale across seven dimensions related to respondent's perceptions of management and workgroup safety, was used to evaluate the safety climate of the construction company's sites (Kines et al., 2011). The questionnaire was distributed to five of the company's sites in Stockholm and in Malmö. The company hires their own carpenters and works actively with their company values.

Material

All together 74 answered to the questionnaire. The distribution between Stockholm and Malmö was quite even since 39 (52.7%) of the respondents were from Stockholm and 35 (47.3%) were from Malmö. Most of the respondents were men, 55 (74.3%), while 18 (24.3%) were women. In Stockholm, there were 23 (31.1%) men and 15 (20.3%) women, while in Malmö there were 32 (43.2%) men and 3 (4.1%) women. One respondent from Stockholm did not indicate his or her gender. The average age of the respondents was 38.3 years (SD = 10.9). Most of the respondents, 50 (67.6%), were blue collar workers, while 22 (29.7%) were in leader position. Two of the respondents did not indicate their position.

Data analysis

This study is based on a questionnaire with Likert scale and its nature is quantitative. In analyzing the NOSACQ-50 questionnaire the reversed formulated items were taken into account to evaluate the safety climate (Kines et al., 2011). The seven dimensions were analyzed and interpreted as recommended by the authors of NOSACQ-50:

- A score of more than 3.30 indicates a good level allowing for maintaining and continuing developments
- A score of 3.00 to 3.30 points to a fairly good level with slight need of improvement
- A score of 2.70 to 2.99 shows a fairly low level with need of improvement
- A score below 2.70 indicates a low level with great need of improvement

The non-parametric Mann-Whitney test was conducted in IBM SPSS 25 to study if there were significance differences between genders in the dimensions. The answer that did not contain gender information was ignored. The level of statistical significance was defined as $p < 0.05$. In these analyses Stockholm women were compared with Stockholm and Malmö men. No comparisons were made between Malmö women and Malmö and Stockholm men since the number of Malmö women was too low.

Findings

Safety climate in the company (RQ1)

From Figure 1 can be seen that the safety climate was in a fairly good level or in a good level overall in all sites. In addition, Figure 1 shows that Stockholm and Malmö men had fairly good level or good level in every dimension, while Stockholm women had fairly low level in dimension five.

Figure 1. NOSACQ-50 results
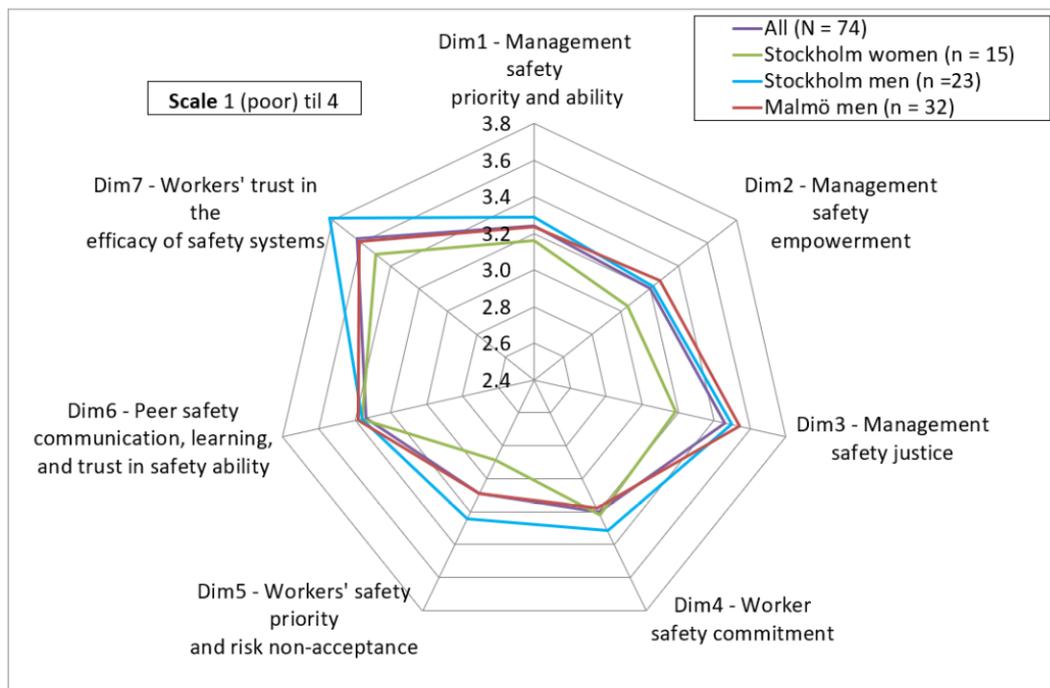
Differences between gender (RQ2)

According to Table 1, there were significance differences between the genders only in dimension seven between Stockholm men and women (p = 0.035) and in dimension three between Malmö men and Stockholm women (p = 0.031).

Table 1. Comparison between Stockholm women and men and between Stockholm women and Malmö men.

	Stockholm women (n = 15)	Stockholm men (n = 23)	p
Dimension 1	3.16	3.29	0.504
Dimension 2	3.05	3.22	0.345
Dimension 3	3.18	3.5	0.112
Dimension 4	3.22	3.31	0.606
Dimension 5	2.89	3.25	0.072
Dimension 6	3.36	3.36	0.938
Dimension 7	3.50	3.82	0.035
	Stockholm women (n = 15)	Malmö men (n = 32)	p
Dimension 1	3.16	3.24	0.805
Dimension 2	3.05	3.27	0.160
Dimension 3	3.18	3.54	0.031
Dimension 4	3.22	3.18	0.795
Dimension 5	2.89	3.09	0.204
Dimension 6	3.36	3.38	0.569
Dimension 7	3.50	3.61	0.507

The second column shows women's responses and the third column shows men's responses in each dimension, and the last column presents the p -values.

Conclusions

This study showed that the safety climate in the concerned company is fairly good to good. The study also indicates that the participating women rated lower NOSACQ-50 scores than the men. The women had weaker trust (significant differences) in the dimensions safety justice and safety systems' efficacy. Even though in literature the male dominated construction sector is described in terms of macho culture and risk-taking behavior, in this study men had "better" scores in the safety climate questionnaire than women. It could be discussed if these results are due to the fact that the women are in minority with negative experiences and are apprentices, or if they are taking on a macho behavior as a coping strategy. These results indicate that in order to improve the gender equality and safety at construction sites, just to employ women is not enough, in-depth measures also need to be taken.

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From Zero Accidents to Vision Zero – A Story of Evolution

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Keywords: Vision Zero Forum, network

Introduction

The Finnish Zero Accident Forum – now Finnish Vision Zero Forum - was founded in 2003 to support workplaces in promoting safety and health. The Forum is a voluntary network and it is open to any workplace, regardless of its size, economic sector or level of occupational safety. Shared commitment to vision zero is the key to Forum membership. A total of 440 workplaces belong to the Zero Accident Forum (October 2019). These workplaces employ 450,000 people, which is more than 16% of the Finnish working population.

Member workplaces of the Forum share the common vision of becoming leaders in OSH and are willing to share their experiences for the benefit of other members. The Forum provides examples of experiences and good practices from workplaces, spreads success stories, creates opportunities for networking and learning from others, and motivates and encourages workplaces to strive for a high level of OSH. The Forum also promotes vision zero by organizing national and regional events and providing materials and tools for workplaces.

Execution

In May 2019 Vision Zero forum conducted a member survey to find out member workplaces' thoughts on current issues in occupational safety, health and well-being. Approximately 25 % of the workplace representatives responded to the survey.

Findings

Finnish Vision Zero Forum started out as Finnish Zero Accident forum and its' focus was on avoiding occupational accidents and advancing safety promotion. During the its' 15 years of existence there has been a shift in focus. Safety promotion is still the overarching idea, but in many workplaces risk of an accident is not the major issue and there is need to address also other topics, such as inappropriate work-behavior or workplace bullying. In some workplaces progress in occupational safety has been made to the extent that it is possible to focus more on well-being at work. Through these and many other experiences in Vision Zero Forum we have come to notice that there is a need to broaden the perspective and include also issues that threaten work ability and well-being at work in our Vision zero. Thus, we have developed our own "set of zeros" that in addition to zero accidents include zero tolerance of workplace bullying, zero sickness absences due to work, zero supervisors and employees unaware of occupational safety, zero cases of job burnout, and zero no-flow working days.

In the member questionnaire respondents were asked to choose the most topical "zero theme" in their workplace. 77 % of the respondents chose "Zero accidents". Second most popular was "Zero supervisors and employees unaware of occupational safety" with 62 % and third "Zero sickness absences due to work" with 52 %. The respondents could also give alternative options. Some of the alternatives proposed were zero harm, zero indifference to safety & health, zero incidents, zero occupational diseases, zero unresolved incidents of violence and harassment, and zero leisure-time accidents.

When asked about current issues and needs for development in order to advance on their path of safety and well-being at work the workplaces' key area of development were supervisors' knowledge and expertise in occupational safety and developing a shared safety mindset where OSH is a part of everyday work for everyone. In addition, safety in shared workplaces and with contractors, and psychosocial risks were mentioned as topical themes the member workplaces need to concentrate on in the future.

Conclusions

The Finnish Vision Zero Forum team has identified 3 different levels of development within the member workplaces:

1) Workplaces that need to develop and exploit the basic OSH good practices

2) Advanced workplaces that need help with moving to the next level in OSH and

3) Front runners who are willing to learn from the most recent research and innovations.

In the future we aim to develop Vision Zero Forum together with the member workplaces, utilizing service design way of thinking. Through different services and networking we want to be able to support all different member workplaces regardless of their level of development.

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Results of Finnish Vision Zero Forum member questionnaire, May 2019. (unpublished)

The German Campaign kommmitmensch – an effective tool to realize Vision Zero

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Keywords: Culture of prevention, Vision Zero, Campaign, Campaign kommmitmensch, Tool

Abstract

The number of workplace accidents and fatal accidents at work in Germany has not dropped significantly in recent years. To realize the goal of Vision Zero, a world without accidents at work and occupational diseases, we need a holistic approach. On the way to Vision Zero, the DGUV and its members launched the kommmitmensch campaign at the end of 2017 with the aim of creating a culture of prevention in companies and educational institutions. The campaign will run for ten years. The concept focuses on six fields of action: "Leadership", "Communication", "Participation", "Error Culture", "Social Climate" and "Safety and Health". The initial aim is that safety and health should become firmly established values within both individuals and organizations and part of every-day decisions. Therefore the German accident insurance institutions support companies and public organizations by offering a comprehensive bundle of measures and tools.

Introduction

The number of workplace accidents and fatal accidents at work in Germany have dropped substantially over the last 100 years; however, by now, the numbers are retracting at a much slower pace. The approaches taken to prevention may not be sufficient for the achievement of effective further progress towards the goal of Vision Zero. To move effectively towards the goal of Vision Zero we need a culture of prevention. We need an integrated, fundamental understanding of prevention, which focuses on the human being in all his stages of life. A culture of prevention is an integral part of the overall corporate culture. Successful prevention approaches show that a stronger focus on individual employees can further reduce the risk of accidents and illnesses. The goal of the campaign kommmitmensch is therefore not only to highlight safety and health as values for every individual, organization and society as a whole but also to integrate them into all thoughts and actions. The concept focuses on six fields of action: "Leadership", "Communication", "Participation", "Error Culture", "Social Climate" and "Safety and Health". Activities in all these fields improve the safety and health of employees in all organizations and strengthen employee loyalty. They also have a positive impact on other areas of life.The initial aim is not only to inform and sensitize but to sustainably change the attitudes and behavior of every man and every woman in the intended way. And even more: safety and health should become firmly established values within both individuals and organizations. They should become part of everyday business and every-day decision-making. The prevention campaign consists of a joint umbrella campaign involving all participating German social accident insurance institutions as well as industry-specific institutional campaigns run by the various social accident insurance institutions.

During the entire duration of the campaign evaluations will take place. The results will be used to control the design of the different phases of the campaign, to adapt measures to specific target groups, monitor trends, devise new measures and improve existing measures.

Execution

We use all kind of relevant media channels to reach our target groups. We coordinate the most suitable media mixes on a case-by-case basis and separately for each topic. Therefore, specific tools and aids are offered for the different target groups like press and media work, commercials, corporate events, video clips, good practice examples, brochures. We offer brochures to each topic with recommendations how to address these topics in a company or organization.

The communication work for the campaign places a strong focus on social media. The campaign has a presence across almost all social media channels. Videos are a major component. Short video clips have been made or are being made for each of the six action areas. These entertaining clips show everyday work situations where people unfortunately don't behave like kommmitmensch people because they think they know better

Annother focal point of the communication work is the use of storytelling, which introduces various people in their real workplaces and shows how they think and implement safety and health there.

A decisive factor in the development of a culture of prevention is the qualification of both one's own staff like labour inspectors, as well as managers and occupational safety experts from companies and educational institutions.

Introduction of two essential campaign tools:

a)   KulturCheck

The KulturCheck is an analysis tool for free for taking stock and further developing the culture of prevention in companies and institutions with a minimum size of 50 employees. In it, the circumstances are viewed from a holistic perspective: The management style, communication within the company, dealing with mistakes, the extent to which employees are involved and last but not least the working atmosphere - all these areas shape the culture within the company and influence safety and health.

The BG responsible for the foodstuffs and catering industry (BGN) for example offers therefore a self-check for safety and health at work as an APP. Immediately after processing, the company will receive offers and measures from BGN to improve health and safety at their workplace.

The culture quick-check uses six short questions to give companies and institutions a first impression of the fields in which they can become active. They could be the starting point for working out the status quo of OSH especially in SME, means what's working well and where there's room for improvement.

b)   Kommmitmensch dialogs

The aim of this instrument is to reflect on what the culture of prevention currently looks like in the company and how to improve it. The kommmitmensch dialogues invite to reflection on the six fields of action. The employees will talk about their working experiences and their proposals to improve safety and health at work. They decide about which topic they would like to talk about. The benefit is
- to discuss a common understanding within the team
- to identify potential risks and the need for action- to formulate goals as well as
- to develop first relevant measures.

The dialogues are easy to understand and can be done with just a little preparation and without knowing a lot about the culture of prevention. They are primarily designed for small and micro-sized enterprises but can also be used in larger companies and institutions with smaller units.

The 'kommmitmensch dialogues' were also reworked so that the content matches the target groups of day-care centers and schools as part of the just started educational campaign.

Findings

The campaign started first with a focus on businesses. Since spring 2019, it will now also support educational institutions in establishing a prevention culture. Studies from education and health research show that safety and health are prerequisites for successful work, learning and education. Conversely, education is a prerequisite for safety and health.

Against this background, safety and health measures should be geared to the educational missions of the institutions and promote their educational quality. In this way, a culture of prevention can be created in the long term. For this to succeed, safety and health must be fundamental components of an institution - both in its processes and structures and in the actions, decisions and values of its employees, children and young people. The DGUV prevention campaign kommmitmensch pursues this goal of good integrative health and educational quality.

The umbrella campaign has resulted in numerous media, tools and comprehensive approaches, that support a systematic cultural development process to the next ship. Even if the start of the individual campaigns of some accident insurance institutions has been hesitant at first, many of them have launched their concepts and entered into concrete implementation with the target groups.

Numerous qualification measures for the prevention experts and contact persons of the accident insurance institutions were developed as well as seminars for managers and OSH experts from companies offered by the individual accident insurance institutions.

The evaluation of the campaign is essential for its further development and campaign management and takes place at different campaign levels. The results will be used to control the design of the different phases of the campaign, to adapt measures to specific target groups, monitor trends, devise new measures and improve existing measures. As such, evaluation delivers structured, prompt information on the state of the campaign and its measures and can be used as a basis for decisions on the continuation of the campaign.

After the first evaluation in 2019 the campaign kommmitmensch will focus above all on the topics that are responsible for the most serious and fatal consequences of accidents. For business, we will concentrate on the vision Zero areas of accidents involving falls from height and road accidents involving vehicles. In the field of education we will focus on school sports accidents and swimming accidents. The aim is to use measures in the six fields of action to reduce the accident black spots and to integrate safety and health as values guiding action into the practical actions, decisions and behaviour of the players in the facilities.

Conclusions

The development of a culture of prevention is a continuous process which needs time. The focus and content of our campaign kommmitmensch must therefore be constantly reflected, reviewed and readjusted. We want to encourage companies and organizations to reflect and continuously improve their own culture of prevention at all levels with all employees to realize Vision Zero.

The umbrella campaign kommmitmensch will therefore continue to support the accident insurance institutions in their prevention work in educational institutions in thinking and promoting safety and health together with educational quality and in companies together with the corporate culture. Only in this way prevention measures can be integrated holistically and effectively and the prevention culture in the institutions and companies be promoted.

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An Approach toward Safety by a Japanese Company—Vision Zero Activity, ISO 45001 Certification, and Effort toward Ensuring the Safety of Machineries and Developing Human Resources with Safety Expertise

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Keywords: ISO 45001, Safety DNA, ANSHIN, safety qualification systems, Safety Evangelist

Abstract

IDEC Corporation is a Japanese control equipment manufacturer, and conducts business activities based on the motto "Lead the world with safety and ANSHIN." The main safety-related activities are the following four points;

1) Joining the Visio Zero Campaign as the first Japanese company

2) Obtained ISO 45001 certification for the first time in the Japanese electronics industry

3) Developing the human resources with safety expertise by effectively utilizing the safety qualification systems

4) Having been conducting safety awareness activities such as safety seminars and workshops for over 20 years by safety experts, so called Safety Evangelists

In this paper, we present safety management practices and a benchmark study on the safety, health and wellbeing at workplaces.

Introduction

Celebrating its 75th anniversary in 2020, IDEC Corporation developed "Safety box: SB type metal switching box," which had an interlocking mechanism to protect workers from electrical hazards, as its first control device in 1950. As a result, the company has been pursuing the realization of "SAVE ALL" for more than 70 years in manufacturing, and has continued to develop safety technologies that reflect the needs of the era, namely intrinsic safety, control safety, explosion-proof safety, machine safety, and functional safety. IDEC is a company with "Safety DNA" that has a history of multifaceted development unparalleled in the world. Now, in the fourth industrial revolution where IoT, artificial intelligence, and robots are penetrating into society, there are global trends of concept such as safety and ANSHIN and management framework. In this situation IDEC aims to be the company based on the motto "Lead the world with safety and ANSHIN." The word ANSHIN is a Japanese word which means "feel-safe," a sense of trust and assurance without any fear or stress).

In this article, we report according to three important aspects of building safety and ANSHIN: (A) management, (B) human resource development, and (C) technology. Specifically Vision Zero activity and ISO 45001 certification as (A), human resources development by utilizing the safety qualification systems as (B), and collaborative safety, so called Safety 2.0, technology development and its demonstration in our own production line as (C) are reported in order.

Execution

First, (A) management aspects will be described. Manufacturing management has various issues such as quality, cost, delivery time, environmental considerations, safety, etc. which must be solved simultaneously. To that end, occupational safety, health, and wellbeing are the most fundamental. Therefore, IDEC joined the Vision Zero Campaign, registered in January 2018 as the first company from in Japan, and has promoted the Vision Zero activity. The activity led to the acquisition of ISO 45001 certification at the Takino plant in March 2019. This is the fourth acquisition of ISO 45001 certification in Japan certified by the Japan Industrial Safety and Health Association (JISHA) after NGK INSULATORS, LTD., NTN Corporation, and Meiji Co., Ltd., and the first acquisition in the Japanese electrical industry.

Through this activity, four good changes occurred within the company. First, health and safety activities can be improved continuously. Second, appropriate risk assessments have been implemented. Third, safety and health promotion activities can be incorporated into business management. And fourthly, documentation has been established customarily so that continuous improvement activities have become possible.

In addition, when managers and field managers were checked for achievement based on Vision Zero's 7 Golden Rules before and after achieving ISO 45001 certification, as shown in Fig. 1, the managers improved 22 points and field managers improved 29 points respectively. In addition, it was confirmed that the difference in scores between managers and field managers was halved that means the recognition gap was decreased.[1]

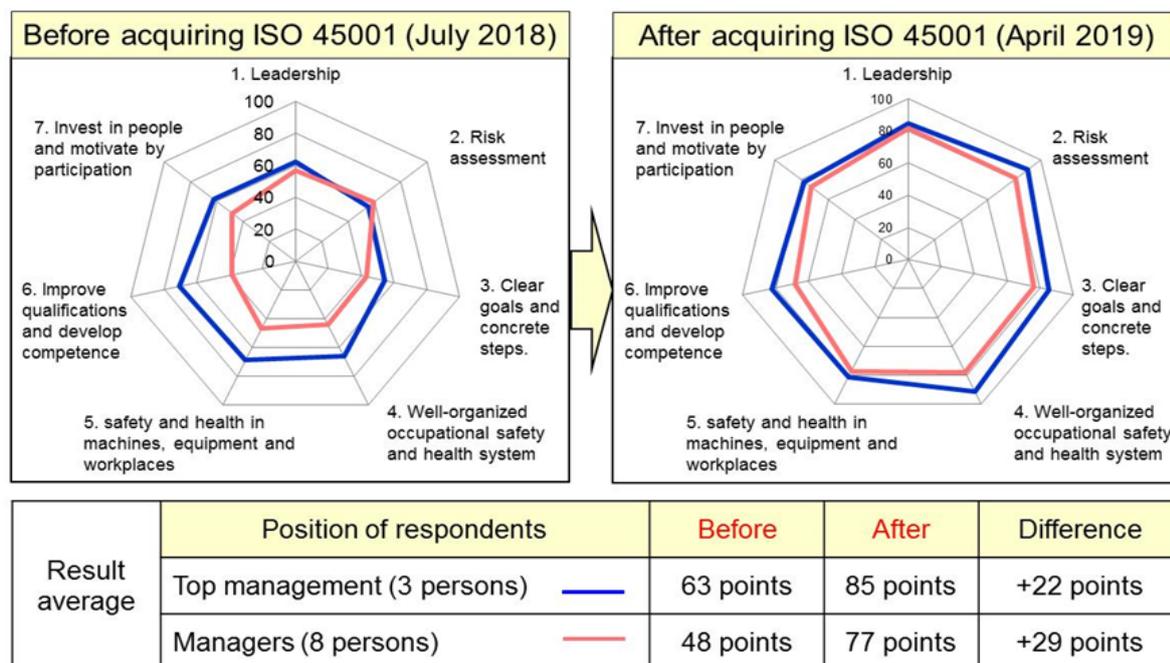| Result average	Position of respondents		Before	After	Difference
	Top management (3 persons)	———	63 points	85 points	+22 points
	Managers (8 persons)	———	48 points	77 points	+29 points

Fig. 1 Self-check results of Vision Zero 7 golden rules

Next, (B) Human resource development is described. Vision Zero's 7 Golden Rules include "No. 6 Improve qualifications – develop competence" and "No. 7 Invest in people – motivate by participation." The safety assessor qualification systems[2] are utilized actively in IDEC which have not only improved the level of personnel in charge of conducting risk assessments at production lines. Higher-level qualifiers are promoted as Safety Evangelists who instruct safety seminars with 20 years of experience for customers.

In addition, the Safety Officer (SO) Qualification System for managers and top management is now promoted. In fact, the trial exam of SO Qualification System was conducted and there were a great deal of positive feedbacks from examinees such as re-acknowledging requirements for managers, increasing the value of enterprises in pursuit of safety and making efforts toward declining industrial accidents. The SO qualification is an effective tool for occupational safety activities based on Vision Zero and ISO 45001, which emphasize top commitment, and will be actively used.

Findings

As mentioned above, (A) management and (B) human resource development are important as the basis of occupational safety and health. Furthermore, as a new trend in the aspect of (C) technology, Collaborative Safety (Safety 2.0) is gaining worldwide attention. Safety depending on only human attention (Safety 0.0) and safety by separating humans and machines (Safety 1.0) should be defined, and as a new trend, humans and machines should build safety in collaborative manner. It is the basic concept of Collaborative Safety (Safety 2.0). [3] IDEC pioneered Safety 2.0 technology development and at the same time practiced in its own production lines. Fig. 2 shows an example of a coexistent working environment of a person and a collaborative robot.

This production system incorporates the concept of Safety 2.0, in which people, machines and the environment collaborates. Protective fences around the robot are partly removed and when the operator approaches the robot, its operation speed slows down. When the operator moves toward the robot until he touches it, it pauses. After the operator leaves, the operation resumes at a low speed, and when the operator further moves to the safe area, the operation returns to a high speed. While ensuring the safety of workers and giving a sense of ANSHIN, robotic production is continuously carried out, realizing both safety and productivity.

In IDEC, the safety level of coexisting environments of humans and machines is defined as Collaborative Safety Level (CSL), and is categorized as CSL1, CSL2, CSL3, and CSL4. In the example of Fig.2 it is constructed as the CSL3 system. There is a background we have introduced the concept of cooperative safety as a new relationship between human and machines, and has newly established such cooperative safety level CSL. Originally, IDEC has utilized the 3-position enable switch developed in 1997 for its robot control cell production, and promoted the development with repeated verification in its own plant. Since then, the 3-position enable switch has been internationally standardized in IEC and ISO as a robot safety device, resulting in a 90% global market share.

Based on experiences of implementing and developing these 3-position enable switches, which are indispensable for Safety 1.0 and Safety 2.0, in our own production facilities, we consider that CSL is very useful as a new safety index for cooperative safety where humans and machines coexist.[4]
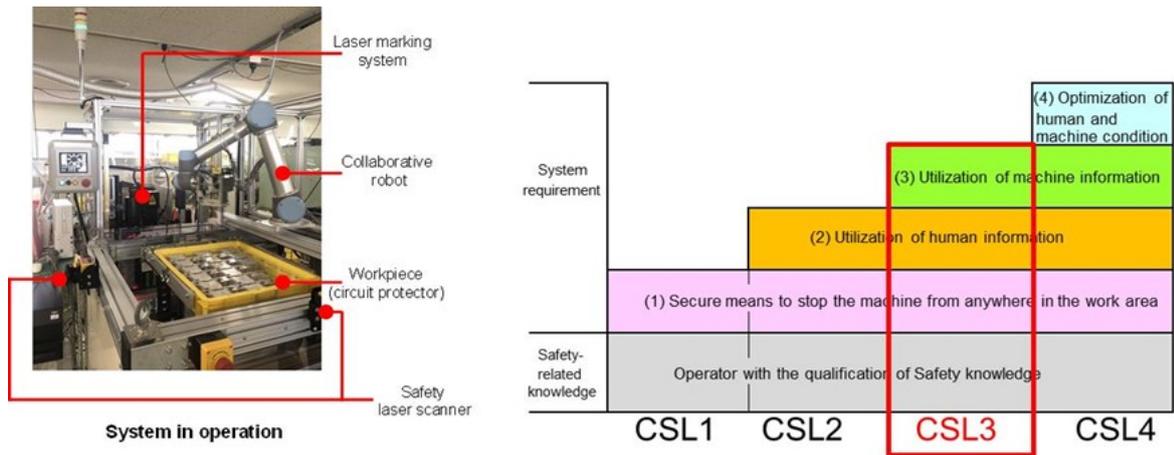
Fig. 2 Robot production system with Safety2.0-CSL3 (Cooperative safety level 3) using a collaborative robot

Conclusion

Focusing on three important aspects in building safety and ANSHIN, management, human resource development, and technology, participation in Vision Zero, utilization of ISO 45001, utilization of safety assessor qualification system, Safety2.0 technology development and practices were reported. In order to "Lead the world with safety and ANSHIN.", IDEC aims to further evolve safety and security technology, which is an important core competence, to develop human resources, and to advance manufacturing, including innovations in management systems such as Vision Zero.

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Developing safety through LIFE – I Care culture program

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Keywords

safety, culture, commitment, program

Abstract

Construction and development company Skanska Group strives to provide an injury free workplace and working environment which supports well-being for everyone.

In 2016 Skanska Finland started new cultural based safety program called LIFE – I care. Goal of the LIFE -program is that everybody takes responsibility in caring of themselves and each other.

Telling and dictating may create right behaviour but it's not affecting mindset, attitudes and values. LIFE-program takes a coaching approach that helps people realize themselves that they are responsible for their own safety.

Feedback has been very positive. Change in the culture takes time and results are to be more closely evaluated over the coming years.

Introduction

Construction company Skanska Group, in its Health and Safety Policy, aims to be a leader in health and safety. Consistent with its "Care for Life" value, Skanska strives to provide an injury free workplace and working environment which supports well-being for everyone.

Skanska Finland is part of the Skanska Group. It has 2100 employees and a similar amount of workforce through contractors, engaged in 100 simultaneously on-going projects.

Skanska has improved its safety performance substantially since the publication of its first Safety Strategy in 2004. Improvements have turned Skanska Finland from a reactive organisation to an organisation that proactively prevents injuries and accidents. However, after introducing traditional safety engineering measures accidents are still happening in the operations. Question remains how to go forward.

Execution

In 2016 Skanska Finland started to address what caring culture means, how it should realise and how it can be strengthened systematically. New cultural based safety program called LIFE – I care was created.

Goal of the LIFE -program is that everybody takes responsibility in caring of themselves and each other. Everybody should stop and make active choices that increase safety. Skanska wants that:

1. everybody makes personal commitment to safety.

2. people talk more about safety at work whenever there is need to stop and think.

3. people realize that they have power to influence the safety.
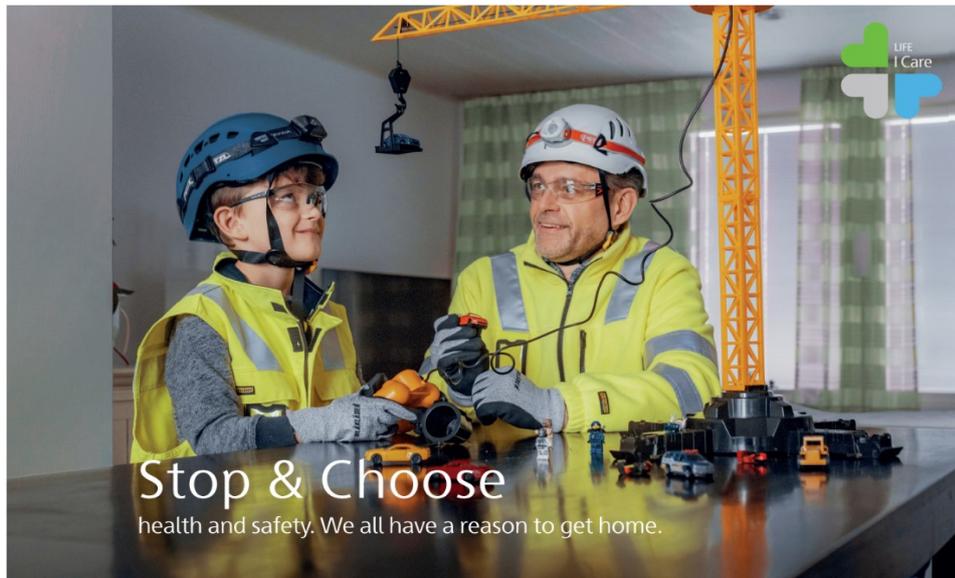
4. safe choices are made also at leisure time.

Figure 1. Stop and Choose health and safety. Example LIFE-poster

Presumption is that it is not possible to force anybody to commit to health and safety. Telling and dictating may create right behaviour but its not affecting mindset, attitudes and values. LIFE-program takes a coaching approach that helps people realize themselves that they are responsible for their own safety. Over hundred workshops have been arranged where people are given opportunity to think and discuss about their personal view to safety. The aim is to touch participants' emotions, feelings and build on that process.

Findings

LIFE-program has introduced an alternative way to influence people's behaviour. Traditional fact and teaching based safety training has not been replaced rather focus has been extended to cover questions such as "why should I choose to work safely?" and "who are the people that are dependent on my safety?".

Skanska Finland has carried out LIFE-program now three years and feedback received has been very positive. Results of the program has been measured through yearly personnel survey and traditional leading and lagging safety metrics.LIFE-program does not introduce any new health and safety systems, procedures or documents. The main expected outcome from it is more thorough usage of existing tools in the management system.

Conclusions

Reasoning behind the LIFE-program is that it advances Skanska Care for Life -value. Thereby living the value in everyday work is not more difficult than complying with organisation's safety management procedures. After LIFE participation one should better understand why it is important for everyone to educate themselves to safety rules and to follow them. Strength of the culture is measured "when no-one is seeing".Change in the culture takes time and results are to be more closely evaluated over the coming years. There is a trend in the safety statistics which indicates that Skanska workers have been less involved in potential fatal incidents. From 2018 to 2019 the reduction is 15-%-points.

"Italia Loves Sicurezza" A movement of citizens and professionals that made a revolution in the way H&S is communicated and perceived

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Abstract

A network of people united by the same passion for health and safety, committed to revolutionizing how these values are perceived in Italy by using non-conventional communication based on emotional involvement.

This is Italia Loves Sicurezza (ILS), a social movement open to anyone who shares these values and coordinated by the Leadership in Health & Safety Foundation, a non-profit organization created by Saipem to raise the safety culture in both industry and society. Its members, called "Ambassadors", contribute every day through their influence and leadership to spread a new health and safety vision and are called every year to organize in their cities or organizations non-conventional events to celebrate April 28th (World Day for Health and Safety at Work).

Introduction

Italia Loves Sicurezza is a network of people united by the same passion for health and safety, committed to revolutionizing how these values are perceived in Italy by using non-conventional communication based on emotional involvement. It is a totally free social movement, open to anyone who shares the same values and vision: to encourage safer behaviours and reduce the number of deaths and accidents - at work, at home, on the roads - by changing the safety culture of the whole country. Italia Loves Sicurezza is coordinated by the Leadership in Health & Safety Foundation, a non-profit organization created by Saipem to raise the safety culture in both industry and society.

Execution

Italia Loves Sicurezza's members, called "Ambassadors", contribute every day through their influence and leadership to spread a new health and safety vision in Italy. As part of the movement, they are called every year, on the occasion of the World Day on Safety and Health at Work (April 28th), to organize in their cities or organizations non-conventional events focusing on the topic of health and safety. These events are characterized by the use of innovative communication languages such as cinema, theatre, workshops, visual art, literature and music. Adults are not the only public involved: many of these events target school students, in the belief that a profound cultural change must look to the future and invest in the training of younger minds. In order to engage people into the movement, LHS Foundation organizes each year networking events, where Ambassadors can interact and share innovative ideas of which everyone can take advantage. Also, LHS Foundation develops tools, initiatives and campaigns aimed at promoting a health and safety culture in society, that are freely shared with all the Italia Loves Sicurezza's community.

Findings

Born in 2015, ILS has incredibly grown year after year, with 1700 events organized from 2016 to 2019 involving around one million people - children, students, workers and ordinary citizens. Today, ILS gathers institutions, organizations and citizens, counting more than 300 active Ambassadors and 10 "Hubs" - groups of Ambassadors organized at local level with the aim of spreading information and ideas in order to enhance cultural change in the local areas. The interest about this movement and its methods is huge, if we consider that more than 1100 people attended last December in Rome the third Safety Leadership Event, the biggest H&S 1-day event with a single stage ever organized in Europe, sponsored by the LHS Foundation and open to all ILS Ambassadors. But there is an even greater achievement: not only Italia Loves Sicurezza keeps growing, but it is really designing the new way in which health and safety are communicated in Italy. In fact, speaking about safety using emotional and involving communication methods is not a rarity anymore, on the contrary, it is slowly becoming the new trend. And it's Italia Loves Sicurezza who opened this path.

Conclusions

Being part of Italia Loves Sicurezza means joining a group of people expressing a love for life and bringing this unique value to local areas and networks. This experiment is designed and coordinated by LHS Foundation, but its success is only made possible by the synergy of a network of people, united by the same principles and determined to achieve an extraordinary target: an accident free country, where Health & Safety are both rights and values to safeguard and promote. Changing mentality, habits, attitudes is a long way challenge, but possible, especially with such a number of motivated and enthusiastic people, willing to share ideas, resources and vision to achieve the goal of zero harm.

Mainstreaming OSH into Education

Lester Claravall, Oklahoma, USA

Abstract

It is important to look at recommendations from past global conferences where nations came together to discuss ways to prevent serious injuries among youth workers. Over the years, there have been productive sessions allowing researchers and practitioners to discuss ideas, share information, and draft solutions. Based on the international exchanges, it is possible for nations to change the youth culture into one of injury prevention through curriculum policy, the whole school approach, educational outreach, and partnerships. Through the school system, it is possible for children to be educated on the core competencies of workplace safety before they transition into the workforce. Mainstreaming OSH into education will help reduce serious injuries on the job.

Introduction

Throughout the decades, there have been worldwide efforts to bring nations together to address the universal problems involving young worker injuries and fatalities. According to the International Labour Organization (ILO), working children suffer 12 million occupational accidents that result in an estimated 12,000 cases being fatal.

It is important to look at recommendations from past global conferences where nations came together to discuss ways to prevent serious injuries among youth workers. Over the years in different parts of the world, there have been various events and productive sessions allowing researchers and practitioners to discuss ideas, share information and material, and come up with solutions.

Execution

The two events that have produced a nice blueprint to success include the 2011 Creating Safe Futures held in Washington, D.C. and the 2012 Mainstreaming OSH into Education: Towards a Culture of Prevention held in Turin, Italy. The 2011 international event in Washington, D.C., brought together 25 nations and was hosted by the United States Department of Labor, National Institute for Occupational Safety and Health (NIOSH), World Health Organization, and ILO. The 2012 international event in Turin, Italy, brought together 27 nations at the ILO International Training Centre and was hosted by the European Network Education and Training in Occupational Safety and Health (ENETOSH), ILO, International Social Security Administration, and NIOSH.

The lessons learned from both workshops shared the importance of bringing the world of work, the world of education, and the world of community together. Safety is everyone's responsibility! In efforts to create a safe future, the researchers and practitioners agreed that mainstreaming OSH into education from pre-K to 12 grade and beyond is the key to reducing young worker injuries in the workplace.

The following is a compilation of the recommendations that will help nations to keep young workers safe:

- Identify and compile existing curricula and other tools, as well as innovative approaches (i.e. the whole school approach), for sensitizing children of different ages to safety concepts and preparing them for their future role as workers.
- Start teaching injury prevention education in the earlier years. Start at pre-K and elementary grades and continue into 12 grade and beyond (i.e. the whole school approach).
- Organize workshops to share practical experience in using tools and approaches to create cross-global partnerships on implementing these tools and approaches. This would include exploring mainstreaming collaborations to allow different organizations to work together and put together international workshops.
- Create a package to be adapted to different countries and different environments. This would include providing global resources into different educational levels for life-long learning through forums, online learning, and virtual classrooms.

Conclusions

Through curriculum policy, the whole school approach, educational outreach, and partnerships, nations will be able to change the youth culture into one of injury prevention. Through the school system, it is possible for children to be educated on the core competencies of workplace safety before they transition into the workforce. Through education, children will start having the safety mind to think safety while at work. Mainstreaming OSH into education will help reduce serious injuries on the job.

Acknowledgements

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ILO

ENETOSH

NIOSH

Vision Zero Journey of Indo-German Focal Point (2017 to till date)

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Abstract

Being the basic Prevention strategy of the ISSA, VISION ZERO is the vision of a world without occupational accidents and work-related diseases. Its highest priority is to prevent fatal and serious work accidents and occupational diseases. VISION ZERO is the goal of comprehensive culture of prevention.

VISION ZERO is about nothing less than our life and health- our most valuable asset. But only that: it is also about the success of enterprises, efficient productions and motivated, productive employees. Although it is sometimes also called a Vision Zero philosophy, VISION ZERO is in fact a strategy for more efficient prevention that is based on results and characterized by values.

[Source: Vision Zero Guide, ISSA Sections]

Introduction

Accident at work and occupational diseases are neither determined by fate or unavoidable- they always have causes. By introducing the VISION ZERO strategy at workplaces, these causes can be eliminated and work related accidents, harm and occupational diseases can be prevented. Seven golden rules have been developed to establish this strategy successfully at workplaces.

The ISSA's Vision Zero strategy is flexible and can be adjusted to the specific safety, health or well-being priorities for prevention in any given context. Thanks to this flexibility, VISION ZERO is beneficial to any workplace, enterprise or industry in all regions of the world. [Source: Vision Zero Guide, ISSA Sections]

➤ Indo-German Focal Point is unique in bringing the Campaign "7S"
    Securing, Safety , social security & skill development starts with self (7S)

Empowering Workers & Entrepreneurs on Safety, Social Security & Skill Development by Educating Women & Children that "Zero Accident & Diseases at Workplace is Possible."

Execution

By following 7 Golden Rules for VISION ZERO

1. Take Leadership-Demonstrate Commitment
   Be a leader-wave the flag! Your conduct as a leader is decisive for the success or failure of Occupational Safety and Health-OSH.
2. Identify Hazards- Control Risks
   Risk assessment serves as the essential tool for the timely, systematic identification of hazards and risks and to implement preventive actions. Accidents, injuries and near misses should be evaluated as well.
3. Define Targets- Develop Programs
   Success in occupational safety and health does not come on its own. It requires clear goals and concrete steps for implementation, which should be established in a program.

4. Ensure Safe and Healthy System- Be well organized
    Systematically organizing occupational safety and health in your operation is a good recommendation. It pays off and is not all that difficult.
5. Use a safe and Healthy Machines and Equipment
    The Classic: Safe Production facilities, machines and also workplaces are essential for working without accidents. Health effects have to be considered as well.
6. Improve Qualification-Develop Competence
    Invest in the training and skills of your employees, and make sure that the required knowledge is available at every workplace.
7. Invest in People- Motivate by participation
    Motivate your staff by involving your employees in all matters related to safety and health in the operation! This investment pays off.

Findings

Vision Zero has come to occupy as an agenda item in Review meeting conducted by departmental heads in public and private industries including by Labour departments in India.

1. To bring on board Highest Level who are involved in Implementation of Vision Zero- Political Head, Labour Minister & Bureaucratic Head, Labour Secretary of Each Country
2. To Translate Vision Zero Materials including Strategy & Golden Rules in Regional Languages of Country, beyond English, Spanish & French Languages.
3. Extending Vision Zero Concept to informal contract workers who constitute 93% of total workforce in Developing Countries like India.
4. By Educating Children & Families that " Zero Accident & Disease @ Workplace is Possible ".
5. Using Transgender available in the Countries like India to Promote Vision Zero Concept through their Sign Language as done in Few States in India.
6. By taking the Participants of First Vision Zero Trainer Program @ Berlin as " Focal Point in Their Countries to Carry Forward ISSA"s Vision ".

Conclusions

Vision Zero Campaign by Indo-German Focal Point with support of DGUV/BGBAU and ISSA Sections

1. Conducting Awareness Programs [National and International]
2. Through Street Play & Drawing Competition
3. Through Indian safety Song & Video Contest 2019
4. MOU signed between BGBAU, BGETEM, KIIT and Indo-German Focal Point for establishment of Center of Excellence at KIIT, Bhubaneswar.
5. Through publications of Indo-German Focal Point-Pocket size Booklet, Safety & Health are Human Rights and Poster etc.

Acknowledgements

IGFP recognised as a Trainer on vision Zero
http://visionzero.global/trainers

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VISION ZERO GUIDE, ISSA Sections

Necessity of Qualified Human Resources in Safety in the Fourth Industrial Revolution Period: Japanese Approach and Current Status of Safety Assessor Qualification System and Its Expansion into the Fields of Robotics, Corporate Management and Collaborative Safety

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5 Japan Certification Corporation (JC), Japan
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Abstract

In the era of the Fourth Industrial Revolution, new holistic safety approaches such as Vision Zero and Collaborative Safety "Safety2.0" are emerging, and there is an urgent need to develop skilled personnel who possess not only the latest safety knowledges based on ISO/IEC safety standards, but also safety management knowledge. To foster safety personnel, as also required by Vision Zero, various qualification systems have been established in Japan: Safety Assessor (SA) in 2004, Robot Safety Assessor (R-SA) in 2018 and the Safety Officer (SO) Qualification System in 2019. This paper reports the status of safety human resource development and how international standardization of Certification of Personnel Competence (CoPC), promoted by NECA, is developing in IECEE [1].

Introduction

In this age of the Fourth Industrial Revolution, new innovative technologies such as IoT, AI, and Big Data are coming into practical use at a dramatic speed across society. In Japan, the Robot Revolution is in progress and many robot manufacturers have developed collaborative robots that are becoming common across various industries and service sectors. What has driven these developments is the industrial and service sectors' growing awareness that they need to rely on robots to make up for labor shortages, and this trend is spreading further. These changes have caused various paradigm shifts. How important safety is and how it should be ensured must be understood by not only engineers but also managers of plants and business offices, and top management, so that safety can be pursued in a top-down approach [2]. This idea matches Vision Zero's 7 Golden Rules, especially Rule 6, which stresses the importance of improving qualifications and developing competence. ISO45001, an ISO standard for management systems of occupational health and safety published in March 2018, can be an effective tool to drive the vision and concept of Vision Zero.

This paper reports that, under these circumstances, the Safety Assessor (SA) Qualification System was established in Japan in 2004 to foster human resources reflecting the universal knowledge of

machinery safety. It also reports the Robot Safety Assessor (R-SA) Qualification System developed in 2018 as an evolved version of the SA Qualification System, and the Safety Officer (SO) Qualification System that aims to certify mangers' safety management capability, developed in 2019. The status of the international standardization for competence required for these qualifications is also covered, on which the IECEE has started working [3].

Execution

The Safety Assessor (SA) Qualification System introduced in 2004 and the Safety Basic Assessor (SBA) Qualification System in 2009 were designed to train knowledgeable safety personnel. The Nippon Electric Control Equipment Industries Association (NECA) plays a role as the scheme owner with assistance from the Ministry of Economy, Trade and Industry (METI) of Japan.

The overview of these systems was presented at the SIAS conferences* as part of the reports on how the systems of SA and SBA had evolved and been adopted by companies, and how common they had become across Asia [4-5].

* Held in the United States in 2005, Tokyo in 2007, Finland in 2009, Canada in 2012, Germany in 2015 and France in 2018.

The total number of SAs and SBAs has increased to more than 20,000 and the number of companies having adopted the systems, as shown in Figure 1, has risen to about 1,300 over the last 15 years. AGC Inc. in Japan is a successful case. The global manufacturer of glass, electronics, chemicals, and ceramics introduced the SA system in 2006, and reduced the number of accidents owing to the President's commitment to the safety, and various safety measures.
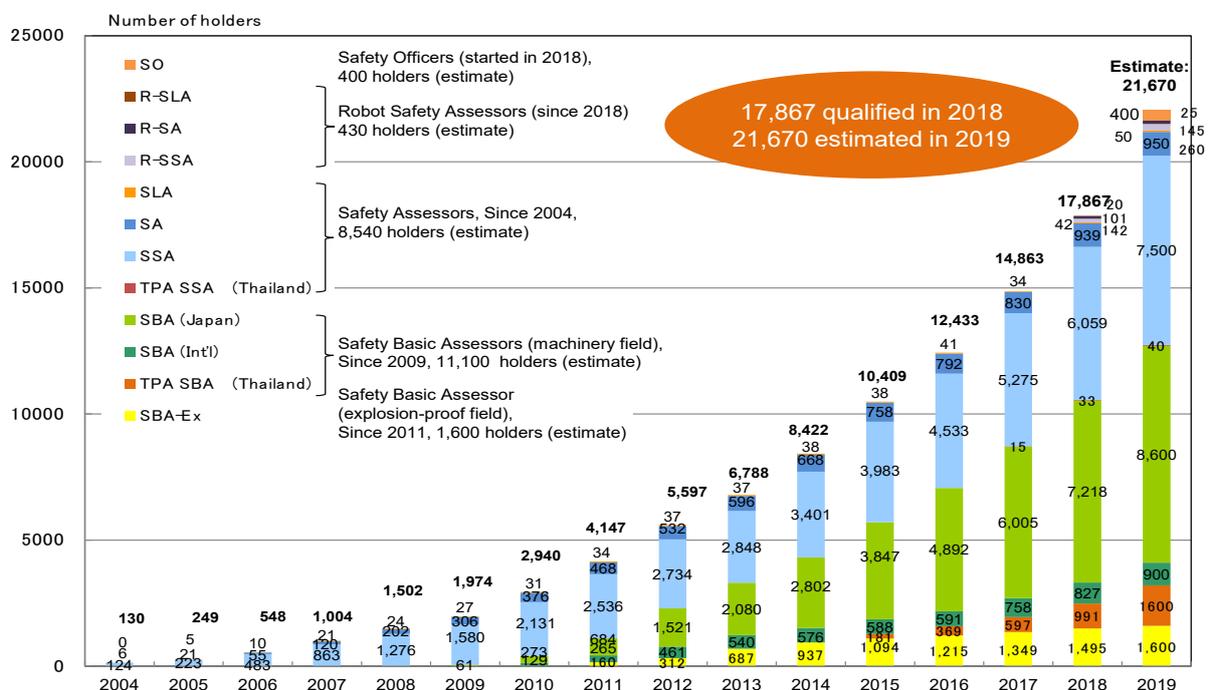

Figure 1. Number of holders of Safety Assessor, Safety Basic Assessor, Robot Assessor, and Safety Officer.

In 2014, the Ministry of Health, Labour and Welfare of Japan issued a notification that described these systems as valuable, and advised companies to adopt them, which helped to increase the

number of certified SAs and SBAs. Moreover, seven other Asian countries adopted the SBA system. The Japanese government transferred the SBA system to Thailand, which it acknowledged as a model country for the system, through an ODA (Official Development Assistance) project. The SBA and SA holders have increased to over 1,000 since its introduction in 2015. If such qualification systems become an international standard, it could contribute to a reduction in accidents globally. The details discussed in IECEE are described later. As the numbers of certified Safety Assessors were steadily on the rise in Japan and overseas, the training of robot system integrators with an understanding of robot safety standards became more important. In July 2018, the Robot Safety Assessor (R-SA) Qualification System was officially launched, and 263 people have been qualified as R-SA holders as of July 2019. This R-SA system is expected to serve as a tool to develop human resources who understand the importance of risk assessment and risk reduction so that certified assessors' knowledge will be leveraged to achieve advanced robot applications in Japan.

Above all, the upcoming age of robots and humans coexisting and collaborating will require collaborative safety "Safety 2.0". Given these factors, a new safety personnel training system which assesses personnel's understanding of collaborative safety "Safety2.0," coupled with top management's understanding of workplace safety, has become necessary. Steady efforts toward these will eventually lead to a future safety vision that adopts new technologies, and to society that will achieve Vision Zero.

Findings

Figure 2 shows the qualifications on safety standards which will be necessary in the new age of Vision Zero and collaborative safety "Safety2.0." As explained above, the SA Qualification System (I) launched with METI's support and the new Robot SA (R-SA) Qualification System (II) are intended for engineers. Below the gold-silver-bronze systems, the Safety Basics Assessor (SBA) Qualification System (aluminium) was set up in 2009 for on-site workers who need machinery-safety/explosion- protection. The efforts to ensure workplace safety part of overall plant management have continued for the last 15 years.
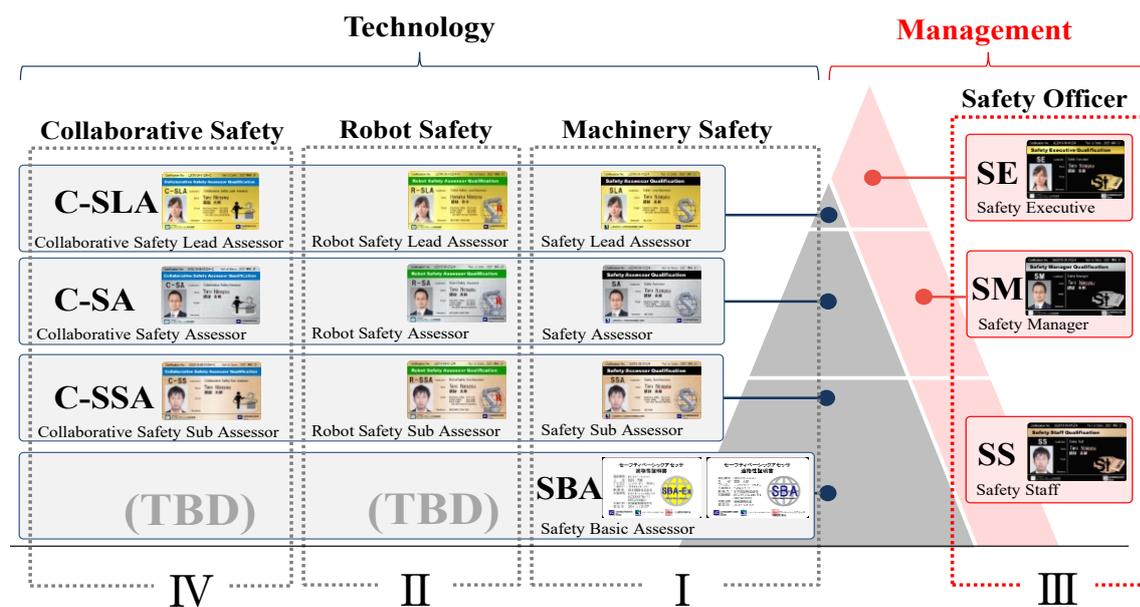
Figure 2. Success case of Safety Assessor Qualification (I), and evolution to Robot Safety Assessor (II), Safety Officer (III), and Collaborative Safety Assessor (IV).

Safety qualification systems for engineers and on-site workers are important, and the great response to the newly-established R-SA Qualification System seems to herald the growth of the system as an educational program that suits society's needs. However, no safety learning or training programs for top management and managers (e.g., corporate executives and plant managers) are available in Japan. Their lack of safety knowledge has led to the reality where safety awareness is not shared across a company, no matter how hard engineers make efforts. Because such situation must be changed, in addition to the machine safety qualification systems for engineers (I) (II), the Safety Officer (SO) Qualification System (III) for managers and top management is now promoted. The trial exam of SO Qualification System was conducted and there were a great deal of positive feedbacks from examinees such as re-acknowledging requirements for managers, enhancing the value of enterprises in pursuit of safety and making efforts toward reducing accidents. Also, since the new collaborative safety "Safety2.0" will spread into the society, the establishment of Collaborative Safety Assessor (C-SA) Qualification System (IV) is expected in a few years [6].

As a global qualification system for safety human resource development, the IEC (IECEE) established a new TF CoPC (Certification of Personnel Competence Task Force) in 2017. At the IECEE Certification Management Committee (CMC) meeting held in France in June 2018, the SA System was presented with its achievements and the meeting officially decided to start developing personnel competency certification systems in the machine safety field. At the CMC meeting in Chile in June 2019, its effectiveness and the possibility of expanding to other fields (robots, collaborative safety, etc.) were recognized and the promotion from the Task Force (TF) to the Working Group (WG) was approved. In addition to the technical knowledge/skill requirements for designers, operators, and workers, it is also expected to expand to personnel competency certification systems for managers such as corporate executives and business owners who play an important role to ensure safety. The personnel competency is also regarded as necessary in IEC MSB's White Paper "Safety in the Future" to be published in 2020, which describes the next-generation safety.

Conclusions

The SA Qualification System launched by NECA in 2004 with help from METI has been internationally recognized to make a big contribution to workplace safety. Consequently, it has been adopted in and outside Japan, and the IEC now considers standardizing the system internationally. This paper reported that the R-SA Qualification System was launched under the circumstances that collaborative robots are being developed and put into use in society across the world. Furthermore, the overview of the SO Qualification System for managers and top management along with the new Collaborative Safety Assessor Qualification System were reported.

As Vision Zero, the Future Safety Concept and collaborative safety will be pursued around the world and corporate governance will be highlighted in relation to corporate social responsibility (CSR), realizing safety is essential to enhance corporate value. Hence, the importance of holistic approach to safety will be accelerated further in the coming years.

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Immersifying workplace safety with virtual reality

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Abstract

Virtual reality enables crafting safety training content for personal experience, which allows training for procedures, operating machinery, and making safety observations. It provides a way of accessing work environments -- even high-risk or hazardous in nature -- in a safe, virtual way, without the need to enter the real environments in person.

We introduce Virtuario™, our in-house-developed immersive virtual reality platform for safety training, and results on the usability and acceptability of the system. We also report preliminary results on the MoSaC study comparing virtual reality safety training with traditional lecture-based training for construction workers. Our results show that VR training can provide high quality learning environment and beneficial outcomes on safety competencies of employees.

Introduction

Virtual Reality (VR) aims to immerse the user in a computer generated environment, replacing real surroundings with virtual sensations. VR technologies are maturing, and credible virtual experiences can be catered through consumer devices. The VR market as a whole is forecasted for a compound annual growth rate of 33.5% for the next four years (M&M report on the Virtual reality market, code SE 3528; retrieved from marketsandmarkets.com) and VR is expected to become a major driver in both consumer and professional use. While VR training has been adopted in various fields e.g. medical and health-care, military, and hazardous environments such as mining, its advancement has been partly limited by expensive, specialized, or hard-to-operate equipment.

Here, we briefly present our in-house-developed virtual reality training solution, report results of related usability and acceptability studies, and deliver preliminary results for the MoSaC project (Nykänen et al. 2019A), where we compared the efficacy of virtual reality safety training to the more traditional approach of lecture-based learning.

Previous studies have shown that individual-level safety factors such as skills and abilities are positively associated with safety performance at workplaces (see Christian et al. 2009). However, there is a lack of studies that examine the effects and impact of VR safety training on individual-level safety competencies. In our study, we explore VR safety training effects on individual-level safety competencies using a randomized-controlled research design. A key psychological outcome in our evaluation framework is safety-related self-efficacy (see Bandura, 1997), referring to the degree of confidence in one's ability to perform successfully in essential safety-related scenarios, such as identifying hazards and preventing accidents. It's a key factor in safety education as self-efficacy has been shown to have a positive impact on the effort and persistence of an individual's safety related behavior. (Burke et al., 2007; Nykänen et al. 2019B).

Execution

We have developed Virtuario™ (www.ttl.fi/virtuario) as an immersive virtual platform for providing effective safety training experiences. Virtuario™ offers an expanding library of VR training content, each built around a central safety theme. Virtuario™ aims to guide the learner through the training with visual and auditory cues in a simplified visual environment emphasizing the learning objectives, and simple storylines for effective training performance. The first version of Virtuario™ was implemented on the HTC Vive platform (HTC Corp., TW), and the current version runs on Oculus Quest devices (Facebook Technologies LLC, USA).

The usability and acceptability of Virtuario™ was evaluated with a general-audience study with people from various backgrounds completing a training course on general safety observations on the Oculus device (n=16, 69% F, median age 42.4), and with a customer's workers completing a training course with a safety check up and dealing with a small fire, running on the Vive platform (Mirka Ltd.; n=67, 37% F, median age 37.7). The first group participated in a questionnaire and an interview, and the latter group filled out a questionnaire.

In the MoSaC project (https://www.ttl.fi/en/research-and-development-projects/mosac/) we implemented a randomized-controlled trial in eight construction sector organizations during 2019 with 119 construction sector workers as participants, randomly allocated into intervention and comparison groups. The intervention group participated in VR-based safety training on the Virtuario™ platform running on the HTC Vive. The comparison group participated in lecture-based safety training containing the same informational content and learning topics as the VR safety training. The study had three measurement points (baseline, short-term follow-up, and one-month follow-up). We used generalized linear mixed models to examine safety training outcomes among the study groups: VR-based safety training vs. lecture-based safety training.

Findings

Virtuario™ is already in use in training for various scenarios ranging from using protective equipment, making safety observations to operating machinery and equipment, reacting to hazards and emergencies, and preparing properly for work in various environments, and has proven to provide a flexible platform for delivering safety training in various industries.

The usability and acceptability results for Virtuario™ safety training are encouraging. With a rating scale maximum of 5, users in both test groups (Oculus; HTC Vive) felt immersed in the VR environment (4.4; 4.3), were highly concentrated on the learning matter (4.5; 4.3), and reported themselves being eager to receive more VR training (4.7; 4.1). They evaluated the training as being useful (4.5; 4.2), the training method as supporting and focusing their learning (4.1; 4.2), and experienced having learnt new things about safety (3.0; 3.5).

There were no reports of adverse effects for using the VR training (average of negative dimensions related to nausea or displease: 0.6; 0.2), and felt no need to end the training midway. These findings are key to considering the use of VR as a training solution for a large worker base as an effective tool for providing immersive training, as cybersickness is negatively related to the feeling of "presence" or immersion (Weech et al., 2019).

For the RCT trial comparing VR safety training to lecture-based safety training, preliminary results show that VR-based safety training had a stronger impact on safety self-efficacy. Specifically, virtual-reality based safety training showed a significant improvement in the study participants'

ability to identify factors affecting safety and ability to anticipate safety related issues, even when compared to the lecture group. The positive effect was detected both at short-term follow-up and at one-month follow-up, indicating that the VR training produced a lasting effect on the safety-related self-efficacy of the trainees. Furthermore, these participants also perceived that the training greatly increased their safety skills and that the training was inspiring.

Conclusions

In our study comparing lecture-based and VR-based safety training, we found that the VR-based safety training produced a significantly more effective impact on the safety self-efficacy of the study participants. Similar findings were reported by Lawson et al. (2019): in their study, VR training was more effective than lecture training in memory retainment, behavioral and motivational aspects. Sacks et al. (2013) have also found that VR training was more effective than low-engagement lecture training in their study concentrating on construction workers.

Fully immersive VR, such as our Virtuario™ solution, enables motivational, gamified, immersive, memorizable and effective training for the safety field. A key issue in widespread use of VR however is designing and configuring the training so that VR sickness and nausea are minimized. Our users reported no such issues; on the contrary, they reported being eager to receive more VR training. As workers' safety behavior is modulated by their ability to identify and assess risks, which improve mainly through experience, we strongly recommend incorporating VR into the safety training regimen.

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Case Logisafe: Digital feedback and learning systems for in-house logistics – New opportunities for safety promotion, lessons learned

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Abstract

Logistics involve the risk of occupational accidents. As work life is changing, forklift drivers are encountering new technology in their work. In order to assess whether new technologies can improve the safety of in-house logistic workers, we conducted a three-year intervention study. We gathered our study material from six workplaces using mixed methods.

The new technologies we studied were a fleet management system and a video-based learning game. The focus group of the study were forklift truck drivers.

The empirical findings of our study concerned the importance of communicating the safety perspectives of new methods and practices, and support for their implementation. These bases for safety communication create good prerequisites for using new technology to work towards vision zero.

Introduction

Logistics is often evaluated from the perspective of efficiency and productivity (Hameri & Lehtonen 2001; Jeschonowski, Schmitz, Wallenburg & Weber, 2009; Koskinen 2009). Logistics involve the risk of occupational accidents. In Finland, material transfers cause one quarter of all fatal occupational accidents (Perttula & Salminen 2012). Overall, occupational accidents related to material transfers also cause longer disabilities than other occupational accidents (Perttula, Kiurula, Merjama & Laitinen, 2003). Material transfer-related accidents occur in in-house logistics (Perttula 2013); and in warehouses, occupational accidents often involve forklift trucks (de Koster, Stam & Balk, 2011).

Occupational accidents in in-house logistics have often been studied from the accident prevention perspective. Studies promoting occupational safety in warehouses have highlighted some risk factors such as physical strain in both manual and mechanical material transfers (Denis, St-Vincent, Imbeau & Trudeau, 2006; Lanoie & Trottier, 1998), as well as risks caused by the transferred material itself (St-Vincent, Denis, Imbeau & Laberge, 2005). Ergonomic studies (Roman-Liu 2010; Mack, Haslegrave & Gray, 1995) have promoted the prevention of physical strain. In addition to the traditional background factors of occupational accidents, some studies in the warehouse sector have also focused on psychological and behavioural factors (de Koster et al, 2011).

Although warehouse work has been a target for new technology, the effect of this technology on occupational safety has not been a central focus of recent studies. Our study concentrates on the use of new technologies in in-house logistics, which still involve a high risk of accidents regardless of traditional preventive actions.

Execution

The study project was a three-year intervention study. We assessed two interventions to determine whether they provided opportunities to improve safety. The study was conducted at six workplaces that carried out in-house logistics operations. The effects of the two interventions were assessed by analysing changes in safety climate and safety operations. We assessed safety level through questionnaires at the beginning and the end of the study.

The two interventions were a fleet management system and a video-based learning game. The fleet management system provides driver-based information on any impacts that forklifts have suffered. The purpose of the video-based learning game was to improve the forklift drivers' ability to recognize and predict hazards while driving.

The research method followed a mixed methods approach in which quantitative and qualitative methods are combined. We assessed the success of the interventions in two different ways:

1) The use of the fleet management system for improving occupational safety was assessed by comparing actual operations to a determined ideal process. The comparative data were collected through semi-structured interviews.
2) The learning game intervention was assessed by intervention criteria created by the researchers. The participants were also asked about their experiences of the intervention via a questionnaire.

The assessment of the effectiveness of the interventions was also related to the analysis of safety operations. This analysis was conducted at different phases of the study:

a) Present state analysis was conducted at the beginning of the study. This analysis included information on the target companies' practices concerning disturbances, near-miss cases and occupational accidents. The data were collected using a survey and interviews. The survey consisted of five sections (background information, flow of and disruptions in work, safety at work, safety climate at the workplace and experiences of IT solutions).
b) Mid-term evaluation included semi-structured interviews on the safety operations conducted at the target companies.
c) Final state analysis included a follow-up survey and interviews.

Findings

Conducting the intervention study for safety research proved to be challenging: collecting the data from different targets and using mixed methods was difficult in a real work environment. In-house logistics operators in their real-life dynamic workplaces began the interventions at different phases to those planned, which caused re-arrangements of the study set.

The survey from the present state analysis and final state analysis revealed that forklift drivers' most common disturbances and load factors were related to time pressure, visibility and in-house traffic arrangements. The survey results also revealed that the safety climate remained the same between the surveys' time periods. The survey responses showed that managers saw the safety climate as more positive than employees.

According to our study, the fleet management system was not utilized for safety promotion. The system's existence was recognized on some level in the target companies but its data were not systematically utilized for planning safety improvements. The reason for commissioning the fleet

management system was mainly technical, and its purpose was to increase efficiency rather than safety. Figure 1 shows examples of the intervention criteria gathered during this study.
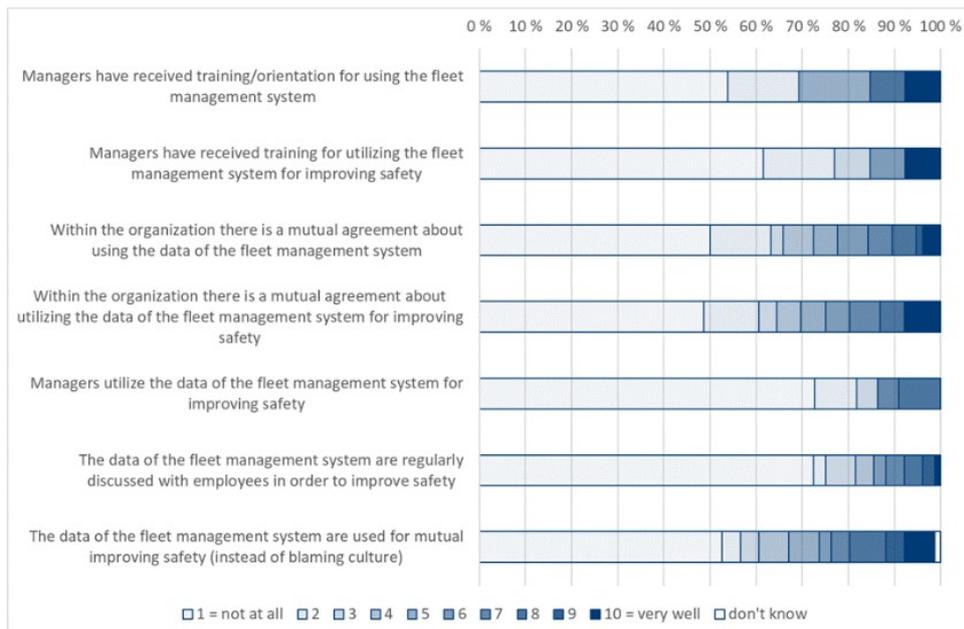

Figure 1. Examples of assessment criteria: success of fleet management system intervention for improving safety.

Even though there were improvements in the participants' learning game results, we consider these to be mostly related to the increased understanding of the game's logic. For this reason, we see no clear connection between the game and the identification of hazards at work. Figure 2 shows the variation in the success of the different intervention criteria in the target workplaces and how this varied between the workplaces.
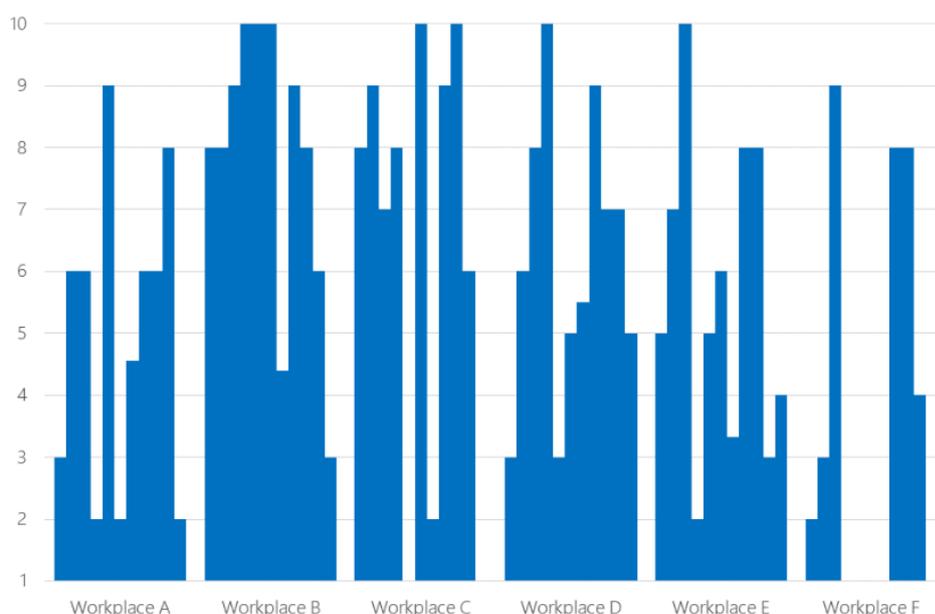

Figure 2. Assessment criteria at target workplaces. The graphs show single criteria and the scale is 110 (1=not realized..10=realized extremely well)

Although the game arrangements set at the target workplaces was strictly planned, production pressures caused some delays and interruptions during the intervention. Some difficulties also arose with practical arrangements: for example, providing an appropriate computer for participants during the game period. The intervention period was several months and there was also some turnover among participants as they changed workplaces.

During this interesting study set, some challenges arose due to the turnover of contact persons at the target companies. Every change revealed how it was difficult to transform the information of this study and to retain commitment at the original level. This presented challenges for us in terms of study information, but we see this as a common overall challenge at workplaces as they face continuous changes.

Even though the general attitude of the respondents to IT solutions was positive, our study still revealed that positive attitude is not enough if commissioning is not planned and operated well.

Conclusions

Conducting intervention studies in safety research is challenging. Our study project determined whether occupational safety can be improved by digital feedback and learning solutions. Our survey showed that forklift truck drivers regarded new technology and IT systems as positive for improving safety and the flow of work. We suggest that even though the employees had a positive attitude to new solutions, this is not enough if these solutions are not properly introduced.

The findings of our study concerned the importance of communicating the safety perspectives of new methods and practices. As regards organizational learning, a common understanding should be created before taking new technology into use. Mutual understanding regarding the usefulness of safety operations requires commitment at all organization levels and continuous common discussion on safety issues. This basis for safety communication creates good prerequisites for using new technology to work towards vision zero.

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Promotion of the Future Safety Concept in Japan

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Keywords: Future Safety Concept, ICT technology, Safety2.0, collaborative safety, ANSHIN

Abstract

The ICT has been developing rapidly in recent years, and the new technology that utilizes the ICT to fulfill the necessary safety functions is called "Safety2.0." The new approach to achieve safety, by way of sharing information between technology, human, organization/environment in a comprehensive and holistic manner, is called "collaborative safety." Safety2.0 is making it possible to achieve collaborative safety, and with Safety2.0 and collaborative safety in mind, I hereby present Future Safety Concept to propose the way how we should lead the safety in the future, for the future society which the world trends help us predict how it will be.

Introduction

There are four major currents that are currently transforming our world. The first two are related to technology: digital transformation attributed to the ICT development such as IoT, AI, and Big Data, and the Fourth Industrial Revolution that rooted in digital transformation and production revolution in factories. The remaining two currents are related to the economy and the sense of values: the rise of circular economy, and the United Nation's SDGs that aim to solve the unsolved global-scale challenges to achieve sustainable development, with which the sense of values in societies are transforming dramatically [1]. The trend is changing toward placing emphasis on safety, health, and wellbeing, totally consistent with the goals of Vision Zero.

Harnessing the new ICT technologies to exercise safety functions is making it possible to achieve highly sophisticated and flexible safety, which is called Safety2.0 [2]. Safety cannot, by any means, be achieved solely by technology, or by human efforts only, or by merely depending on regulations or organizations. Safety needs to be realized by way of sharing information among technology, human, and organization/environment in a comprehensive and holistic manner. Such a new approach towards safety is called collaborative safety [2]. Safety2.0 is making it possible to achieve collaborative safety. Safety forms the basis of human's health and wellbeing. In the following chapters, I present the Future Safety Concept [3] to show the way towards which safety should be directed.

Execution

Taking a look at the history of what has played the role to ensure safety in situations where machines and humans coexist, there was the age when humans played the major role to exercise safety function, by paying attention to dangerous machines. This age is called Safety0.0 as shown in Figure 1 (a), and the basic principle is "mind your own business." Next is the age where

machines and systems are first provided with safety measures, and people pay attention to these machines and systems. The role of safety function in this model is mainly played by technology, and is called Safety1.0 as shown in Figure 1 (b), whose basic principle is "safety based on isolation and stop" to isolate the operating machine from human and to stop the machine when the machine and human coexist. We are now in the age of Safety1.0.

The emergence and development of IoT, AI, image processing, Big Data and other ICT technologies have brought about safety functions that were not possible before. This new-age safety technology is Safety2.0 as shown in Figure 1 (c), in which machines are given the intelligence to attain flexible operation such as slow-speed motion in case the workers are inexperienced; or stopping machines in case of danger, by attaching wearable devices such as RFID on workers to give machines the workers' data such as physical condition, experience/career, qualification, and capability.
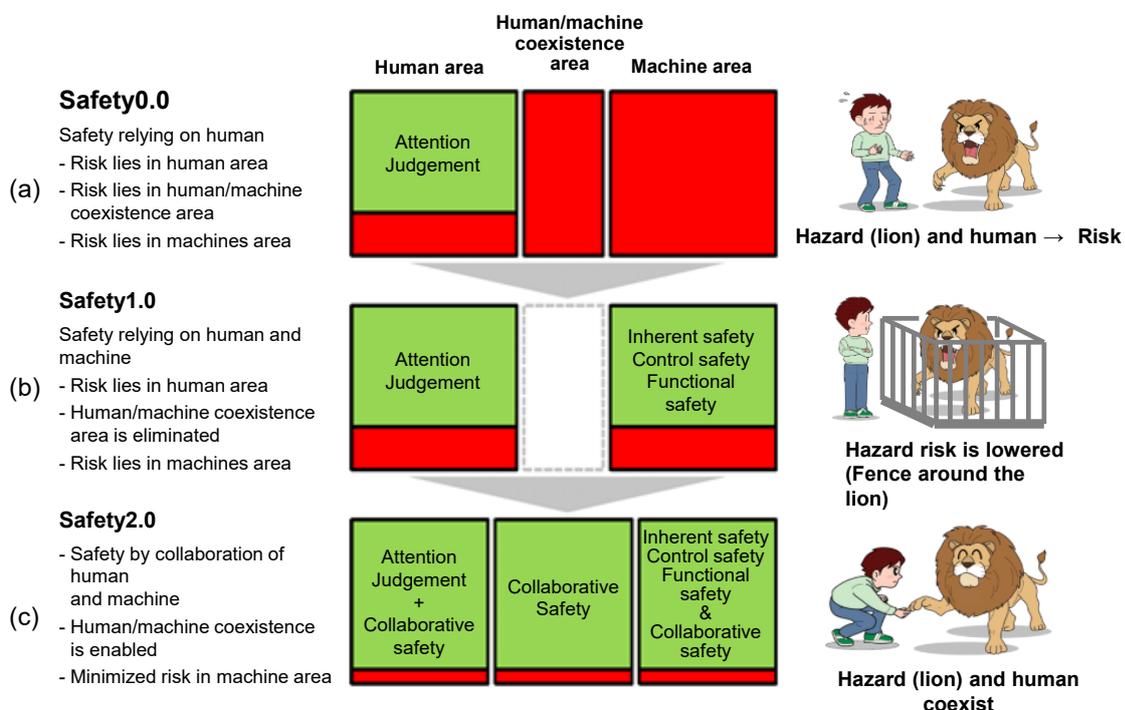

Figure 1: Evolution of safety from Safety0.0 to Safety2.0

Collaborative safety is a new safety concept that achieves safety in which human, machine, and environment share digital information, communicate and collaborate based on the new safety technology Safety2.0. In this context, environment refers to social environment including physical environments, organizations, systems, data bases, standards, regulations and rules. Collaborative safety, unlike Safety1.0, places the same level of importance on the human capability as technology and organization, and human capability, satisfaction and the sense of worthiness that workers receive from work, health, and wellbeing are valued. The role of comprehensive management is critical in Safety2.0 to achieve safety by collaboration of human, technology and environment.

With the new technology Safety2.0, which is expected to lead the safety in the future society, how specifically the safety concept "Collaborative Safety" will be brought to realization? It should not

be determined by necessity only, but has to be established proactively with our sense of values. To this end, we, before anything else, must give careful thought to how to build the safety in the future society.

In 2017, IGSAP unveiled, in a backcasting perspective, the Future Safety Concept to set the safety targets that must be accomplished through Safety2.0 and collaborative safety [3]. Figure 2 shows the eight guidelines of Future Safety Concept. The fact that these guidelines have similarity to the forecasting Vision Zero's seven golden rules is not an coincidence, but shows that we are heading towards the same direction.

Future Safety Concept
Safety as an Extra Value

1. Promote safety from both top-down and bottom-up.
2. Safety is not a cost but an investment.
3. People are both the key of, and the beneficiaries of, health and safety.
4. Pursue state-of-the-art safety technologies.
5. Zero risk does not exist.
6. Safety must be established by country, companies, and individuals as a whole.
7. Safety must be managed holistically by technologies, organizations and humans.
8. Accident data must be shared in society

Figure 2: Future Safety Concept, the guidelines for ensuring safety in the future by achieving safety, health and happiness for the people of the entire world

Findings

The followings are the brief explanation of the Future Safety Concept.

First, companies need to "Promote safety from both top-down and bottom-up." Safety has more value in the future society. Companies need to create a culture that encourages all concerned—from top to bottom—to achieve safety, health and wellbeing.

Second, "Safety is not a cost but an investment." Safety is the foundation of business operation, and the money for safety is not a cost to be cut but a prior investment that proves to be effective in the long run, essential for the sustainable growth. The more machines and humans work collaboratively, the more there will be risk. Companies need to invest in safety to protect lives.

Third, "People are both the key of, and the beneficiaries of, health and safety." Safety is ensured by humans for their safety. Safety workers provide more value, and companies make an effort to train safety workers and value their achievements. They need to foster a safety culture and climate for all employees including safety workers to enhance safety, health and wellbeing. Top executives also need to develop career at safety and health department.

Fourth, companies need to "Pursue state-of-the-art safety technologies." The future society based on digital technologies requires safety technologies based on digital technologies as well.

While maintaining Safety0.0 (safety ensured by human beings) and Safety1.0 (safety ensured by machines), companies need to pursue Safety2.0 collaborative safety where digital technologies are used to ensure safety through collaboration between humans and machines.

Fifth, companies must remember that "Zero risk does not exist." In reality, a tolerable risk is a basic requirement, and both the providers and users of need to be aware of the risk level. In the future where circular economy will be the mainstream, companies need to be more aware of risk, for example due to the longer product life.

Sixth, "Safety must be established by country, companies, and individuals as a whole." Safety can be achieved when the providers, users, and regulators fulfill their duties. Things will tend to be owned by the society than by individuals. The roles for the government/ companies/individuals must be clearly defined, and safety mechanisms must be devised by the society.

Seventh, "Safety must be managed holistically by technologies, organizations and humans." As required by collaborative safety, safety must be viewed holistically from the triple angles of technology, organizations and humans, and the total management plays a big role.

Lastly, "Accident data must be shared in society." We must learn from other companies and industries, and the data on accidents/disasters must be the common assets. In a society where things are shared throughout, accident/disaster data are also shared and companies need to build mechanisms.

The above is the Future Safety Concept, the guidelines to ensure future safety by achieving safety, health and wellbeing of all.

Conclusions

The Future Safety Concept addresses the principles of future safety looking into the future society. Effort has been made in Japan with its eight principles, and Safety 2.0 and collaborative safety are part of it, and a proposal for IEC standardization is being prepared.

The new concept and Vision Zero share the same value. I hope that the attendees of the Vision Zero Summit collaborate toward the Future Safety Concept and Vision Zero—for the safety, health and wellbeing.

Collaborative safety, in which all stakeholders fulfill their roles, is influenced by Japan's "Safety in Harmony" concept and the Safenology—a new academic safety study in a holistic view of incorporating technology, human, and organization [4]. We have a unique *anshin* concept (a sense of trust and assurance without any fear or stress), hard to translate into other language with its distinctiveness. This will bear importance for Vision Zero and the Future Safety Concept both aspiring to achieve health and wellbeing.

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The Nordic Future of Work Group

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Abstract

The Nordic Future Group started its work in 2016. The aim has been to identify and formulate challenges of future work, and ideas on how to tackle some of the challenges anticipated within the future work, especially related to the Work Environment Authorities responsibilities both today and tomorrow. The work has given important insights into how each country looks at specific national challenges and to some extent what measures has been taken to deal with them.

Introduction

The Nordic Future of Work Group:

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The Nordic Future Group started its work in 2016. The aim has been to identify and formulate challenges of future work, and ideas on how to tackle some of the challenges anticipated within the future work, especially related to the Work Environment Authorities responsibilities both today and tomorrow. The work has given important insights into how each country looks at specific national challenges and to some extent what measures has been taken to deal with them.

Execution

The Nordic Future Group notes that, while traditional forms of work will prevail for quite some time, the new forms of work needs the attention of the labour inspections to prepare in advance.

Ongoing megatrends

- The pace of change in society is fast and it brings a high degree of complexity. Newness require from the employees more diverse and constantly shifting qualifications and continuous updating and upgrading of skills.
- A higher competence in communication, both inter-person and ICT, and (self) management, including a higher level of own initiative is needed.
- On-going automatization and robotics can, and probably will, polarise the work tasks in "low-income - low skills tasks" and "high-income - high skills tasks".
- Migration and the globalized world provide access to a more diverse, multi-skilled and multi-language work force. The digitalisation provides access to a broader labour force market, which bring more intense and even fierce competition.

- Global high-speed broadband connection, distance work and sharing economy can lead to the blurring of the role and responsibilities of the employer in relation to the employee. Combined with mobile work the physical work site is disappearing. This poses two major questions to the labour inspectorate: whom and what to inspect, and how to encourage better primary prevention at the work site?

Findings

Challenges today and in the future

Work, and thereby, work-environment issues, are being more fragmented. In the digital age with more of crowd-working, teleworking and Internet of Things challenging the physical and psychological well-being of the employees/workers. This may shift OSH-focus towards individualization as well – which presents a risk of individualizing the risks rather than placing them with the employer and/or task-provider.

Around 2/3 of all those employed in the EU have a continuous full-time employment contract. The situation has remained almost the same for a decade. At the same time self-employed and part-time workers represent an even bigger part of employed people. It has been estimated that one third of all employees have atypical work contracts, such as fixed-term, part-time and leased employment relationships and they are becoming more commonplace.

One of the trends is that employees dealing with non-physical production not necessarily will be tied to a physical work place in the future. They work either in an office without fixed place, in their home, in a train (commuting from one place to another) or in any location in the world where they might be. This also means that there is no fixed working times/day. The same can partly be applied to jobs in sharing economy, renting economy etc. There are some risks related to this kind of working as it emphasises employee's ability to manage their own work.

From the OSH administration's perspective, the consequence of diversification and polarisation includes the lack of commensurability and difficulties with the setting of common universal standards. The modes of operation of the OSH administration and OSH enforcement, in particular, must become more diversified and be flexible. The actions of the OSH administration must be more directed at specific hazardous occupations, small groups of employees and specific work tasks within a specific sector, instead of being sector-specific or looking into broader risks.

Work related diseases is an important issue today, and will be in focus for OSH also in the future. Some occupational diseases will remain the same, for example diabetes and high blood pressure. WHO uses the term Non Communicable Diseases. Chronic disease results in large costs to the individual (physically, mentally, economically), but is expensive also for the employer and for society as a whole.

Some work-related diseases will be new. New risks are produced by rapid technological progress and increased use of chemicals and nanomaterials. Minimizing these risks requires a new kind of targeted risk assessment. The total strain (physical, mental, social) felt by employees is an issue that the OSH administration must review even more seriously. Following new research in this area is an essential part for this.

Conclusions

OSH management in traditional workplaces still has an important role to play in the work life of the future. The basics still need to be in order; work and workplace need to be safe and not harm workers health in any way, and both employers and employees have an important role to play. OSH training, risk assessments and provision of equipment's etc. is a responsibility for an employer.

Safety management and especially helping employers and employees to identify risk factors and assess risks is important, including those with non-traditional forms of engagements such as freelancers, crowd-workers and sub-contractors. Also, in the light of a more fragmented labour market there is a need to safe-guard that OSH-risks are assessed in a proper way for all workers in the labour market, and to increase safety awareness among workers outside managerial reach.

Dutch OSH Agenda 2030: trends & emerging risks at the workplace

Johan van Middelaar (TNO), Michelle Zonneveld (RIVM), Viola van Guldener (RIVM)

Keywords: emerging risks, OSH agenda, future of work, trends, occupational health and safety

Abstract

Future developments such as robotization, digitization and flexibilisation, are happening at an ever-increasing speed. Researchers indicate that future risks may become even more complex and uncertain. Dealing with increasing uncertainties in increasing complex environments will become a huge challenge to ensure healthy and safe working conditions. This presentation elaborates on gaining insight in future developments and emerging risks that could affect OSH at the workplace. During the research process, we realized that the process in itself was equally valuable, or even more valuable: we see a fundamental need for change in the way we think about emerging risks, such as trend scenario's and rise of new technology, and who, where and how we will work in future.

Introduction

Future developments and trends such as robotization, digitization, globalization and flexibilisation, are happening at an ever-increasing speed. Researchers indicate that future risks may become even more complex and uncertain. Dealing with increasing uncertainties and 'unknown risks' in increasing complex environments will become a huge challenge to ensure healthy and safe working conditions.

Execution

Mid 2018 the Ministry of Social Affairs and Employment in the Netherlands started the project 'OSH Agenda 2030'. The main goal of this project is to gain insight in future developments and emerging risks that could affect OSH at the workplace and to define OSH risks that these developments may entail.

Findings

During the research process, we realized that the process in itself was equally valuable, or even more valuable, than the end result. By bringing stakeholders together (such as employers, health & safety professionals, sectoral organizations and policymakers) we started raising awareness and buy-in for preparing a national agenda for 'emerging OSH-risks' at all levels: at policy level at the ministry, awareness within sectors and individual companies and commitment at OSH-practitioners at the work floor.

Conclusions

The national OSH agenda in NL emphasizes a fundamental need for change in the way we think about OSH and emerging risks in particular, such as trend scenario's and rise of new technology and who, where and how we will work in future. We will elaborate on some examples with respect robots and/or application of predictive analytics for the benefit of OSH at the workplace.

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Employee monitoring – does the end justify the means?

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Abstract

With the emergence of new technologies, organisations have the ability to consume unprecedented levels of data. Monitoring capabilities have reached a level of sophistication once only dreamed of. This creates conflicts with employees' right to privacy.

Employee monitoring is often regulated by law, but legal compliance alone will not be sustainable in the long term. Laws cannot keep up with the pace of technological advancements. Laws also often give discretion to employers as to how far they can go. At the same time, employees are more concerned about the use of their data.

To address these challenges, employers should apply their own "ethics lens" when developing employee monitoring. Organisations need to be aware of where monitoring crosses the line and enters the realm of creepiness.

Introduction

Electronic employee monitoring is defined as "the use of electronic devices to review and evaluate employees' performance; electronic surveillance; and employers' use of computer forensics" [1].

With the emergence of new technologies, organisations can not only collect and store vast quantities of data but use this data in a wide array of fashions and consume it at an alarming rate. Organisations are increasingly involved in ventures designed to identify patterns and predict employee behaviour. Employers are increasingly investing in powerful monitoring and analytics tools to infer employees' performance, health, retention, and more.

While the intentions may be good, conflicts are created with employees' right to privacy. Studies show that employees are increasingly critical and worried about the unfair use of their personal data and "big brother" surveillance [2].

To address these concerns, legislators have enacted laws to regulate the gathering and use of employees' personal data. In Finland, the Act on the Protection of Privacy in Working Life (759/2004) states that employers are only allowed to process personal data that is directly necessary for the employment relationship. In addition, the processing of employees' personal data must comply with the General Data Protection Regulation (2016/679) of the European Union (GDPR). However, legal compliance alone will not be sustainable in the long term. Despite their best efforts, laws and regulations will never keep up with the pace of technological advancements. Laws, including the GDPR, also have the potential to be interpreted (and misinterpreted) to suit specific purposes – a benefit which employers are all too keen to leverage.

Execution

It is clear that every employer processes the personal data of its employees – for example, their names, contact details, bank account numbers, salaries, and performance evaluations. The need to process such data is self-evident, and processing such data is often mandatory for employers.

Employee monitoring, however, goes beyond such mandatory data processing. Vast amounts of data can be accrued every day, for example, by the use of video surveillance, digital applications, location tracking systems, mobile devices, wearables, and "smart" offices. Some companies are even using sensors in helmets and hats to scan employees' brainwaves to detect fatigue, stress, and emotions, such as anxiety and depression [3].

Due to new information and communication technology, the movements of employees can be tracked, their interactions recorded, and their performance analysed in real time. Among the well-publicized examples of such real-time monitoring is Amazon's intent to track their warehouse workers to determine distance travelled, time taken for tasks, and other activities [4].

So, how can an employer decide what kind of monitoring can be considered appropriate? As stated before, an attempt to follow the rule of law will get organisations only so far. The design and deployment of employee monitoring practices should also include ethical considerations.

By embracing and expanding the well-established "Privacy by Design" principle [5] to include not only legal but also ethical perspectives, an organisation can evaluate ethical impacts at the initial design phase. This allows an organisation to manage ethical risks up front, making the respect for privacy and data ethics key ingredients of the monitoring solution, rather than a mere afterthought in the development process. This may seem complex, but it is actually easier than applying moral deliberation after a design is fully developed.

Privacy professionals should be involved in these conversations from the very start. Others, such as HR managers and technologists, involved in the design process should be educated on ethical awareness and individuals' rights. Employees should also have a voice in the ethical discussion about the way their personal data is used.

Although the concept of Privacy by Design is primarily intended to mitigate risks associated with new and emerging technology and applications, employers would be well advised to conduct similar analysis on their existing employee monitoring applications. The foundations for such a procedure are already a legal requirement under the GDPR.

Findings

The following advice is provided to aid organisations to the design of privacy-friendly and ethically sound employee monitoring applications:

1. Remember who is in control. A fundamental question is "who actually owns the employee data?" While the concept of ownership is notoriously difficult to apply within the realm of data, European legislation clearly puts the individual – in this case, the employee – in control of their personal data. The ability for an employer to understand this helps to develop legally compliant and ethically sound solutions.
2. Establish effective governance. Employee monitoring is an undertaking that requires diligent management oversight. Organisation leaders should be accountable for any inappropriate monitoring practices or use of accrued data.

3. Do not hoard data. In the data lifecycle, collection is the easiest part. It is the removal of data that causes organisations headaches. Companies should aim to adopt the mantra of data minimisation, to only collect personal data that is directly relevant for the purpose. Organisations should also aggregate and anonymise the data where possible; and not to hold the data any longer than necessary.

4. Beware of unfair biases. Large datasets do not always yield reliable and objective truths. Algorithmic decision-making can be biased too [6]. For example, a machine-learning algorithm trained on historic employment data may conclude that most managers are male, thereby assuming that women are less interested in managerial positions . In this case, an algorithm might actively replicate the original gender bias.

5. Consider the value add to employees. Employees are usually more open to new monitoring practices if they benefit from it [7,8]. For example, tracking devices that monitor employees' physical activity could help them improve their wellbeing. It is worth remembering that consent is not a valid legal basis for processing employee data under the GDPR [9].

6. Do not go overboard. Consider what data might be considered too personal to be gathered and which actions can be seen as being too private to be monitored. Understand the feelings of your employees along with their comfort level. Keep the channels of communication open.

7. Accept what you cannot change. Accept that certain surveillance or analyses cannot be performed. Investigate whether other, less intrusive methods exist to accommodate monitoring needs.

8. Be transparent. Transparency is key when it comes to earning trust among employees. Employees should be well informed of how they are monitored, and to what end their personal data is used. An employer should carefully consider how to communicate monitoring practices. The monitoring should never come as a surprise to an employee.

Conclusions

In the absence of clear-cut provisions of law, employers need to consider with care where employee monitoring crosses the ethical line and enters the realm of creepiness. These considerations should be embedded into the design process of any new monitoring application.

A failure to handle employee data ethically can lead to a poor employee experience, eroding trust, and increased turnover. When employee expectations are not met, the psychological contract is broken, and the relationship between employee and organisation starts to deteriorate.

Every organisation and individual is different, which is why employers need to know their staff – their feelings, their sentiments, and their cultural preferences. As with so many employment issues, the key to ethically sound monitoring lies in the mutual understanding and respect of employer and employees.

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The Way We Work Has Changed - Now Let's Catch Up for WHS

Jillian Hamilton, Manage Damage, Australia

Abstract

Welcome to the future – it's already here – it's today; our systems and approaches for WHS are not yet future proof or today ready.

What does the future / today look like?

- Globalisation
- Employment or Engagement
- New Types of Engagement
- Subcontractor Management
- Inspections and Regulator Management
- Robotics in the Workplace
- Legislation and Documentation/ Codes not yet caught up to todays "future"
- Corporate Social Duties

We need to install systems now to catch up to these changing factors that we suggest are future issues – in every workplace we are already here in some fashion – time to identify these risks at your workplace and then start to close the gap of risks we face daily.

Introduction

Welcome to the future – it's already here – it's today; our systems and approaches for WHS are not yet future proof or today ready.

What does the future look like?

- Globalisation
    - Truly competing internationally
    - Lower Margins
    - Supply International
    - Complexity of Compliance
- Employment or Engagement
    - Do we still employ in traditional senses?
- New Types of Engagement
    - Remote Workforces
    - International Workforces
    - Gigsters
- Subcontractor Management
    - Traditional Supply Chain no Longer
    - This impacts your Financial Teams, managing more and more payments, your safety teams reviewing more and more "subcontractors", your managers – managing outputs of more and more people etc

- 90 / 10 switch – used to manage 90% of risk by managing 10% of our subcontractors or employees
    - Now 10% of employees are internal and 90% of risk is not managed by managing 10% of subcontractors – all external
- Inspections and Regulator Management
    - Traditional Supply Chain no Longer
    - 90 / 10 switch – used to manage 90% of risk by managing 10% of our subcontractors or employees
        - Now 10% of employees are internal and 90% of risk is not managed by managing 10% of subcontractors – all external
- Ensuring Third Parties
    - Quality
    - Reliability
    - Trust
    - Insurance
        - Why even insure?
        - Why don't we follow the Uber models?
        - Why doesn't our businesses approach the market the way Uber has?
        - Companies are doing it and will do it for margins
    - Disputes
- Robotics in the Workplace
    - Plant Management
    - Already in workforce daily
    - Safety in Design is lacking
- Legislation and Documentation/ Codes not yet caught up to todays "future"
    - Our nations are not yet caught up
    - We need to collectively work together on these matters
    - We face the same issues why are we working in silos on the solutions
    - If we are truly global why are we wasting money time and effort on individual solutions
- Corporate Social Duties
    - The generations of today do not stand for bad environmental impacts from your products
    - The impacts of mental health insurance claims as this is now a real thing at least in first world – and Ms Kate with William is speaking in Pakistan to children at School in October!

Execution

It's now time for us to assess the risk in our own workplaces – we need to know the Macro and Micro-economics of our businesses.

I meet so many WHS professionals whom has no idea who is their businesses customers;
Where do they do work?
What is their businesses drivers?
What is the business plans in next 1 year, 2 years , 5 years & 10 years?
How do they intend to grow; merge, aquire, grow by new sales?
How do they plan to increase the profit margins in a reducing margin environoment?

If we don't know what our business intentions are we can not assist them in their risk management.

- Globalisation
    - Complexity of Compliance
    - How can you catch up – well if you are only working in one country – congratulations – you are unique!
    - If you are multi global and multi state you must start to understand the requirements for your business before they start to be an issue for your business.
    - Jump the gate before the gate hits you as it closes on you with a international fine!
- Employment or Engagement
    - How does your employer employ today?
    - Now look outside your office
    - Outside your factory or window
    - How does that part or thing get made?
    - Offsite? By who?
- New Types of Engagement
    - Do you use Remote Workforces? No – sure it's a no?
        - Check your accounts teams
        - Check your IT teams
        - Check Quality teams
    - International Workforces
        - Who advises your business
            - Internally and externally
            - Boards – who is on your boards? You don't know...
    - Gigsters
        - Who helps you remotely or internally who is not an employee?
        - Who holds legal liability for them? See Diagram 1
        - How are they engaged?
            - Do you meet them or do you just engage?
            - Do you order on an App?
        - Contractor
        - Consultant
        - Agent
            - How do you know if they are insured?
        - They are Subcontractors – or don't you treat them like this?... How do you classify them?
- Subcontractor Management
    - Do you have a clear picture of who are your third parties – IE anyone who is not an employee.
    - Do you know the actual impacts this has had on your Financial Teams, managing more and more payments, your safety teams reviewing more and more "subcontractors", your managers – managing outputs of more and more people etc – look for compliance internally – have they been collecting all the insurances have they been doing the checks and balances? Have you?
    - Since you are paying everyone less – where are they getting their extra moneys?
        - Are you checking the additional work hours your third parties are working? – Are they fatigued working extra hours now to make the same money?

- Inspections and Regulator Management
    - Have you caught up on the intentions of your regulators and inspectors – what do they plan to do to manage the millions vs many?
    - What is their approach?
    - Have they changed laws or approaches to ensure the masses are protected? If so this might mean your compliance is no longer.
    - If the law changes so much your systems – have they?
- Ensuring Third Parties / Subcontractors
    - Who can engage a third party or subcontractor?
    - What is the rules around engagement?
        - Yes 1 person engagements
    - How much is unregulated? Ie how much can be spent outside the regulated circles – credit cards etc – then how to manage that risk?
- Insurance does your company even check if there is an insurance?
    - Do you know the reasons for insurance in your business?
    - Has your business made a standard for insurance?
    - Who is responsible for the Worker?
    - The challenges with the new forms of Employment
    - Who is legally responsible for their insurance?
    - What is your legal teams advice – then ask them if they have considered WHS Laws as well as IR HR Laws as well as Liability Laws?
    - Insurance Options for Third Parties
        - Not all nations are caught up with insuring the Gigsters
        - What is your nations approach?
        - Is there options for affordable self insurance for Gigsters?
    - Disputes
        - How do we manage these very external – low margin small players if no insurance but caused a $10M error?
        - Or they end up a workers compensation claim for you
        - Or they cause a workplace death?
- Robotics in the Workplace
    - How are you currently managing your robotics?
    - How is your Safety in Design?

Findings

Companies we have reviewed we have found;

	Compliant	Not Compliant (Issues Known)	No Idea of Issues
Small	Very few due to margins	Almost all	Almost all
Medium	Some think they are	Many	Many
Large	Think they are	Many	Many

Challenge is we have been auditing for different reasons – asking different questions!

- Auditing – our Current Outdated - Systems and Processes
  - Our systems are asking are we compliant for old systems
  - Our Audits haven't been updated for the "future"/today yet!
  - Our Audits and Inspections are asking old questions
  - Our Clients who ask us are also auditing with old mindset and old questions
  - But I have a 100% score on 4801, 9001, 18001 and all internal audits – yes – which means you are definitely not compliant with the future or today's business environment.

- Our WHS Leaders are we really changing as we need to?
  - Where can we learn to be more macro environment savvy and able to be lean and work together with our business to find solutions as a team
  - Your portfolio is changing daily see Diagram 2

- Many Companies are trying to Contract Risk
  - But not legal liability

- Your customers want way more for less
  - They want more
  - They want it 247365
  - They want it for less than they paid before
  - They want it now or yesterday
  - They want it to be socially responsible

Conclusions

We need to reassess today about our current futures! And review where we are at compliance for today's business environment we are working within.

There is options for compliance and excellence but we must fully understand our own risk profile today before we can make our own solutions.

We will need to engage and work closely with our leaders so that they understand with reduced margins the risk profiles alter and we must also alter our approaches to compliance.

Safety Governance has never been more important for us to adequately translate risk from operations to decision makers we must understand our macro and mirco operating environments as a global society and prepare with our leaders to work towards our new world being low cost, high reliability, well ordered and back to compliant.

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Diagram 1

Diagram 2

EVOLUTION SAFETY-HUMAN

Icon	Description
SAFETY	
SAFETY & FIRST AID	
SAFETY & FIRST AID & ENVIRONMENT	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE & HEALTH	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE & HEALTH & MENTAL HEALTH	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE & HEALTH & MENTAL HEALTH & LEGAL	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE & HEALTH & MENTAL HEALTH & LEGAL & CYBER	
SAFETY & FIRST AID & ENVIRONMENT & QUALITY & CULTURE & HEALTH & MENTAL HEALTH & LEGAL & CYBER & PROGRAMMER	

Timeline:

S	SF	SFE	SFEQ	SFEQC	SFEQCH	SFEQCHM	SFEQCHML	SFEQCHMLC	SFEQCHMLCP
25 m yrs go	1 m yrs ago	18 yrs ago	16 yrs ago	9 yrs ago	7 yrs ago	6 yrs ago	2 yrs ago	Present	Next Year

Introduction of Safety 2.0 and Shimizu Smart Tunnel System to Improve Productivity and Safety

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Abstract

The rate of occupational fatality in Japan is decreasing steadily but is still relatively high when comparing with other developed countries. Considering future labor shortage due to declining birth rate and aging population in Japan, the need to improve productivity and safety is imperative. This paper will introduce Safety 2.0 and Shimizu Smart Tunnel system to improve productivity and safety. The main approach of Safety 2.0 is through collaborative safety between human and machine where the machine will carry out risk assessment of surrounding area. The integration between machine and human will be recorded and analyzed by artificial intelligence (AI) and the guidance of risk assessment will be available to construction manager for further action.

Introduction

Our study is based on values of "Guide post of safety for the future of the world" which indicated in "The future safety initiative 2.0". The vision has 8 items which are 1: Leadership and bottom up, 2: Safety is an investment, 3: The key point is human resources, 4: Pursuit of technology, 5: No risk is impossible, 6: Build safety with all stakeholders, 7: Total risk management, and 8: Sharing the information. Among them, items 1,2 and 4 especially has a large impact for the performance of our company's vision for safety. We are acutely aware of the present safety situation behind the background of the vision. Recent statistic of occupational accidents in Japan shows the fatalities rate for all industry is decreasing but for the last 10 years the number of fatalities in construction industry is slightly increased. Construction industry make up around 30% of the total number of fatalities and casualties. After compared the statistic of occupational fatalities in Japan with countries such as England, Denmark and Finland, the fatality rate in Japan is still considerably high. Declining birth rate and aging population in Japan possess many challenges as shortage of labor is becoming more and more pressing issue. Construction industry bears the brunt of maintaining and renewing social infrastructure hence it is vital to conduct work-style reform which includes securing stable income, providing regular holidays and prioritize safety at construction site. In other words, it is necessary to improve productivity, creating attractive and safe construction sites where diverse workforce such as younger generations and women can or want to participate in this industry.

Execution

It is necessary to improve productivity and safety into an integrated management system as well as implement a PDCA (Plan, Do, Check, Act) cycle at each construction site. On-site safety management is carried out based on risk assessment at the construction planning stage, but compared to risk assessment in the manufacturing industry, it is difficult to identify the state clearly since the degree of spatial freedom of self-propelled heavy machinery in the construction work is higher and more dangerous. Risk assessment includes identification of risk sources that may harm humans and the environment, extracts potential risks and implement risk reduction

measures. In addition, by disclosing residual risk information, it is possible to prevent accidents in the first place.

As a part of next-generation construction technology development to utilize IoT and AI technology, "Shimizu Smart Tunnel" for civil engineering field and "Shimizu Smart Site" for architectural field were planned to implement at the model site. Application of risk assessment has been carried out based on the characteristics of each industry in Japan. Although this approach has many issues for improving safety in construction industry, various practical efforts were made to realize the on-site systematization similar to a factory production. In the construction industry, the safety countermeasures and risk assessment largely depending on management system as well as education and training of workers. These safety countermeasures are largely influence by the unique characteristic of construction industry which are (1) single large scaled project/product, (2) heavily influenced by environment factor due to changing of site condition, and (3) the application of construction machinery where the equipment are leased product and short terms. For these reasons, it is important to select measures according to the type of work to ensure the safety of workers through the safe operation of autonomous machinery by managing unmanned construction and facilities. Rearrangement of safety measures were made which includes tangible and intangible measures based on "Safety 2.0" as a basic concept of safety management for the development of "Shimizu Smart Tunnel". Here, the tangible measure was defined as the utilization of ICT to guide and direct both human and machines while intangible measure was defined as the process of utilizing ICT to collect, organize and analyze various information in tunnel site. In addition to these management system measures, the concept of complementing human error as conventional risk reduction procedures (Supportive Protective System, SPS) has been adopted too. In the future, risks identified shall be incorporated in the risk assessment into ICT as countermeasures at tunnel construction site.

Findings

Shimizu Smart Tunnel: The development of Shimizu Smart Tunnel which utilize ICT, IoT and Artificial Intelligence (AI) is in progress and the system is projected to be implemented by 2020 in Mountain Tunneling (NATM) site. This system aims to effectively manage the safety of site by sensing and make cover on human error through "Support Protective System". At the same time, it utilizes the approach of collaborative safety (Safety 2.0) by integrating comprehensive data within the tunnel. The data of the tunnel face ground condition, machines, tunnel environment and workers will be acquired and after the data has been analyzed by AI, it will automatically operate the machine (autonomous machine), guiding the workers through voice command or warning and continuously evaluating the overall tunnel conditions. This will provide an optimal working environment for humans and machines and reduce serious accidents at the construction site. At the same time, significant labor and cost savings can be achieved through the realization of automation of construction machineries by using the sensing technology to quantify the experience and knowledge of skilled workers. In the future, integration of various kind of data is vital to further improve the productivity and safety in tunnel and other construction field. Shimz Smart Site: Shimz Smart Site is a next-generation production system in which robots and humans will collaborate to move construction projects forward. After a year and a half investing over 1 billion yen on intensive teamwork with universities and partners from other industries, Shimizu has completed the basic development and are ready for the next phase. The robots undergoing autonomous control testing at the robot laboratory include: the Robo-Carrier, which conveys materials horizontally; the Robo-Welder, a robot that welds steel columns; and the Robo-Buddy,

a multipurpose robot that handles construction work for ceilings and floors. Each one is a primary structural element of the Shimizu Smart Site. An operator uses a tablet to send instructions that the robots carry out autonomously. After the construction work on the foundation is completed at a site, an all-weather cover is installed to provide a lightweight shelter for the building against all kinds of weather. A new Exter crane, which is located beneath the cover, then lowers the columns and beams of the steel frame into position sequentially and Robo-Welder welds the columns to complete the framework. Robo-Buddy executes the final stage of finishing the floors and ceilings from the lower floors upward. After Robo-Carrier and other horizontal and vertical conveyor robots transport the materials that have been delivered to the construction site to their temporary staging areas at night, they then transport them to the location where a Robo-Buddy performs the work.

Conclusions

This paper introduced domestic research trends related to productivity/safety, occupational accident in Japan as well as the approach for risk management under the corporate management to reduce serious accidents in the construction industry. In "Shimizu Smart Tunnel", attempt is being made to demonstrate that the concept of Safety 2.0 can be incorporate after considering the operation method where it can provide an optimal working environment for humans and machines at the construction site. It is necessary to fully utilize ICT/IoT and autonomous machinery to ensure high productivity and safety as well as the establishment of appropriate standard for this approach. Additionally, it is necessary that both site and top management of an organization/company to share a common and full understanding of basic risk assessment as well as ensuring the implementation of safety measures policy to improve the overall safety and wellbeing of the organization/company.

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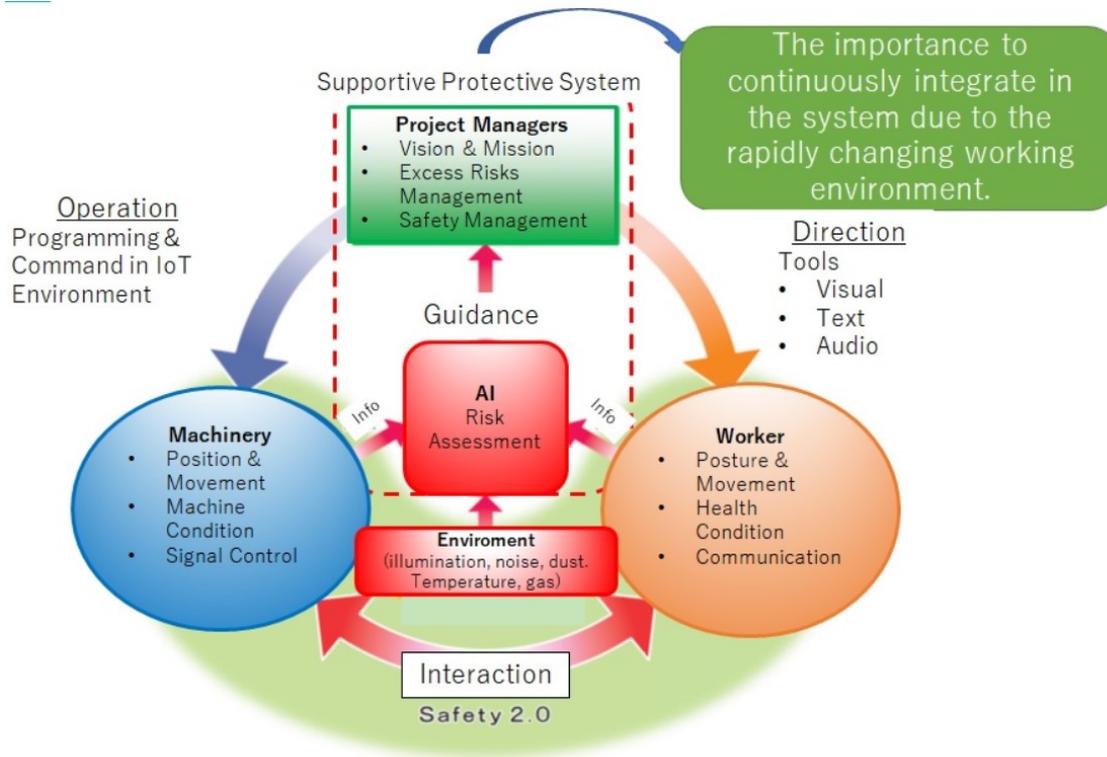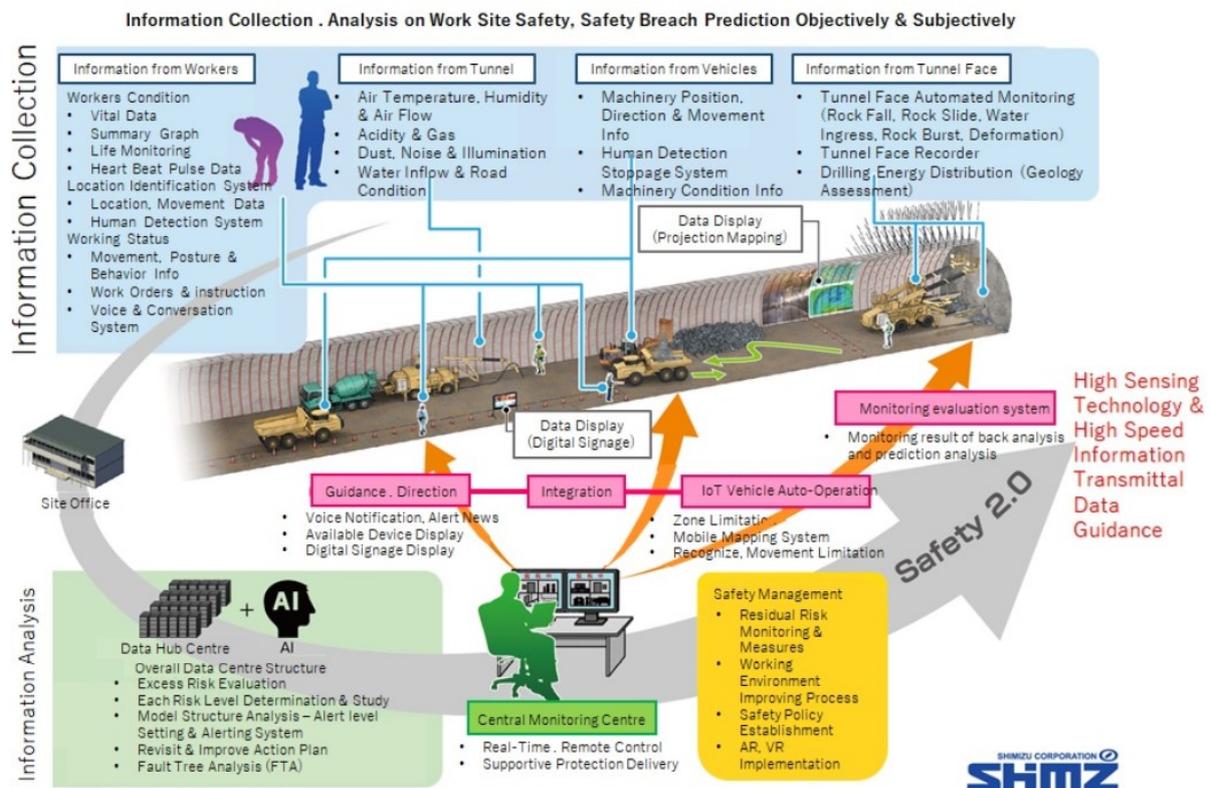**Figure 1.** The overall concept of Safety 2.0 and supportive protective measures (SPS)

Figure 2. Overview of Shimizu Smart Tunnel

Discovering Safety – A data driven approach to health and safety performance improvement

Helen Balmforth and Steven Naylor, UK Health and Safety Executive (HSE), UK

Abstract

The Discovering Safety Programme is an international research programme being delivered by the UK's Health and Safety Executive (HSE). It aims to bring about step change improvements in global health and safety performance through better analytic exploitation of routine health and safety data. The research being delivered is founded on intelligent use of HSE's 40 year archive of regulatory intelligence, which includes incidents reported by dutyholders, the findings of inspections and lessons learned from investigations. The HSE data archive is to be supplemented with other national regulators' and industry held data over the course of the programme, enabling a global picture of health and safety performance to be established. This paper provides an overview of the programme.

Introduction

The Discovering Safety Programme aims to improve global health and safety performance through novel analytic exploitation of routine health and safety data. The programme is funded by Lloyd's Register Foundation and is being delivered by the UK's Health and Safety Executive (HSE), with the University of Manchester and other partners. It is a long-term programme of work that is seeking to understand how to access and use routine safety and health data in new ways to provide a new approach to improving performance by applying novel data science, artificial intelligence and machine learning techniques in health and safety contexts.

The Discovering Safety programme has three main objectives:

1) to deliver improvements in global health and safety performance by breaking through the performance plateaus widely observed internationally, particularly in developed countries
2) to deliver accelerated, step change improvements in performance in emerging economies, particularly those with less mature health and safety systems, by creating mechanisms for effective sharing of knowledge and cross country learning
3) to understand and realise the value that data can bring to improve health and safety in a global context, including systems and processes to collect, monitor and analyse data to drive health and safety performance improvement

Key to the programme is the extraction of intelligence from HSE's archive of health and safety data, which includes records of incidents, accidents, inspection and lessons learned from investigations, all gathered through HSE's regulatory function. The HSE data archive is being supplemented with other sources of information from across the globe.

Execution

The programme is currently in discovery phase, which started with a user requirements gathering exercise that explored organisational health and safety challenges with a range of stakeholders, and asked how data could be used to provide new insight to address. From this a set of Industry

Use Cases were identified that address different health and safety issues, for a range of industry sectors. The use cases deliver solutions with tangible benefits to a range of stakeholders and are an important part of the way the programme intends to make real impact from the research undertaken. Key deliverables will include data-driven knowledge and learning feeding into education and training, and commercial tools and services based around intelligent exploitation of health and safety data. The initial industry use cases are listed below:

- Intelligence about Loss of Containment – generation of learning relating to incidents involving loss of containment in the chemical and petrochemical industry, particularly incidents involving release of toxic, flammable and explosive substances, which are often precursors to major accidents happening. This is endorsed by the process safety sector.

- Product Safety Insights – development of a data resource to support the early identification of safety issues associated with product use in industrial settings which have the potential to lead to harm when used in safety critical contexts. This has cross sector endorsement.

- Health and Safety Performance Benchmarking – development of methods for comparing health and safety performance indicators to support targeting of organisational performance improvement initiatives and peer-to-peer industry learning. This is endorsed by a range of industry trade bodies and professional associations.

- Lead Indicator Intelligence – generation of learning relating to what makes effective leading of health and safety performance in different industry contexts, and how to use associated KPI's to drive health and safety performance improvement within organisations. This has cross sector endorsement, focusing initially on the construction and process safety sectors.

- Safety Risk Library for Construction Projects – development of a safety risk library for the construction sector to inform project design and risk mitigation decisions at the preconstruction stages of projects. This is endorsed by the construction sector.

Findings

An indication of progress to date, technical challenges and early outputs is provided with reference to the work undertaken to date on the safety risk library for the construction projects use case.

The sector intelligence accrued over the initial stages of work, generated through a combination of desktop literature review, engagement with relevant specialist research centres and the carrying out of a number of industry workshops, identified that the construction industry's use of building information modelling (BIM) tools was key to releasing the aims of the use case.

A widely held view across the industry is that if health and safety is to benefit from the use of BIM on construction projects then it is essential that the range of data needed to make the right decisions from a health and safety perspective is made readily available and is easily integrated within existing BIM tool usage. A key benefit of this is that it will allow better consideration of health and safety risks and design of risk mitigation strategies at the design stages of projects, before work commences.

To realise these ambitions, the project team are working in partnership with a number of industry BIM platform developers to create a platform agnostic add-on for use by the industry when designing future projects. The ultimate aim is to provide designers on construction projects with a queryable knowledge resource to support health and safety risk mitigation decisions on their projects. Specifically, the tool will promote the mitigation of risks through elimination rather than over reliance on administrative or end of pipe measures, implemented once construction operations have actually started, which tend to be less effective options.

A user specification for the solution has been developed through industry engagement work undertaken over recent months, and work on building a risk mitigations library is currently underway. In the prototype solution being developed, the designer will have the opportunity to enter specific information on aspects of the project design, including stage of construction, specific building elements being used, work activities, and hazards and associated risks; the solution will then return design mitigation options based on the different information entered. A key technical challenge associated with the work is creating a comprehensive database of industry-validated risk mitigation options for different combinations of construction work and their associated health and safety risks. Observations made on past inspection of construction sites undertaken by HSE inspectors, along with lessons learned from past incident investigations and prosecutions, is providing key knowledge to inform thinking in this regard.

Conclusions

The programme is delivering proof of concept tools for stakeholders to pilot over the next six months, with the aim of upscaling these and delivering a range of industry deployable solutions in subsequent phases of the programme. Supporting industry in being able to feed their routine health and safety and wider operational data into the programme is regarded as vital for the programme's longer term success and for developing new industry use cases as the programme progresses. Developing data governance models for supporting this that provide industry with the required assurances that data privacy and confidentiality concerns are adequately addressed will be key for making this happen. The international Health and Safety community is a key stakeholder who will benefit from the outputs of the work. As such the programme team would like to invite you to get involved as we start this exciting new programme of work. More information is available at www.discoveringsafety.com.

Acknowledgements

The Discovering Safety Programme team wish to thank the numerous industry stakeholders who have helped shape the early phases of the programme by contributing to the early workshops and scoping surveys undertaken to date.

Zero Accidents in the Construction Industry 2020 – safety-level results in the building construction industry in Finland

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Keywords: Construction industry, Accident statistics, Zero accidents, Occupational safety

Abstract

The "Zero accidents in the construction industry 2020" project, launched in the construction industry in 2010, is now approaching its end. The aim of this study was to determine how the safety level of this industry has developed over the past ten years. The study also compared the situation in the Finnish construction industry with the international situation and with the situation in other domestic industries. The methods used were statistical analyses and thematic interviews in selected companies. Implementation consisted of the following steps: a) Statistical analysis of accidents from national sources and Eurostat b) Thematic interviews in selected building construction companies, the items of which were specified at the beginning of the study, and c) Analysis of results. According to the results occupational safety in the construction sector has improved significantly over the last ten years. The final results of this study will be published by the Confederation of Finnish Construction Industries in the end of this year (2019).

Introduction

Occupational safety in the Finnish construction sector has been improving over the last ten or more years. The number of accidents at work in relation to the hours worked (frequency of accidents) continues to decrease. Compared to other accident-dense industries, the development of the construction sector has been remarkable, especially in cases of more severe accidents.

However, the amount of small accidents is approximately at the same level as it was ten years ago. The frequency of small accidents increased during the economic expansion of the sector, although the frequency of severe accidents did not. Fatal accidents have also decreased. Younger workers and especially agency-hired workers are more prone to accidents, but fortunately these accidents are usually not severe. The frequency of more severe accidents is approximately equal in the different age groups of construction workers.

The improvement of occupational safety in the construction sector is a sum of many factors, but three factors can be highlighted. The first is safety culture. Workers at all levels in the sector now take safety issues more seriously than before. The second factor is the development of protective equipment and their use. Today, protective equipment is used much more often than before, and its quality has improved. The third factor is the effort that construction enterprises put into occupational safety. It is currently well acknowledged that safety issues impact on enterprises' finances and reputation. Multifaceted communications on safety issues and safety competitions between enterprises are other relevant factors, as is the overall prioritization of safety.

The most significant challenges to the occupational safety of the construction sector are shared workplaces and economic expansions. At a multinational construction site, communication between different language groups might cause practical challenges. Construction workers with at least ten years of experience, who were interviewed for this report, considered that the development of occupational safety has been mainly positive.

Execution

The study compiled the most relevant statistical data on the occupational safety situation in the construction industry and its development over the last decade. The main material was data from the Workers' Insurance Center (TVK), from the years 2007–2017, i.e. the period under review. In a few cases, statistics on construction sub-sectors were compared according to Statistics Finland's classification of economic activities, which entered into force in 2008. This report covers only accidents at work. Commuting accidents have been omitted for the sake of clarity.

In addition to the main construction industry, the study also presents accident frequencies and the number of accidents in the building, civil engineering and specialized construction sub-sectors. There is a risk of misalignment in accident frequencies for sub-industries, because in business statistics, the hours worked by companies are not always immediately registered in the correct sub-sector. Therefore, the accident frequency of the main construction industry is the most reliable subject. TVK's statistics do not include accident figures for the construction products industry.

We interviewed 30 people working in 15 construction companies operating in Finland for the study, representing the managerial and employee level. We also interviewed a senior inspector of the Occupational Safety and Health Management Team of the Regional State Administrative Board. The theme of the interviews was the development of safety in the construction industry over the last ten years.

Employees from three large and seven small or medium-sized (SME) companies in the building industry participated in the interviews. Two large companies and one SME represented infrastructure construction. One large company and one SME represented the construction products industry.

Findings

Statistical overview

The study first carried out a comprehensive statistical analysis of the development of the accident situation in the construction industry over a period of more than ten years. Accident frequency started to decline in 2007 in the main construction sector (all construction sectors). The positive development of the building construction has contributed strongly to the fall in accident frequency in the entire core business. According to preliminary data, in 2018 the accident frequency for the main construction sector was 60 (accidents per one million hours worked). In 2007, the same accident frequency was 80 (TVK, 2019c).

The number of deaths is also decreasing, but these figures vary every year. It is more a question of long-term positive development than steady positive development. In 2018, three to four workers died on construction sites, whereas in 2007 this figure number was eight (TVK, 2019c).

Compared to the main industries, construction is known to be the most dangerous, but compared to other accident-predominant industries, occupational safety in construction has improved the most in the last decade or so.

In 2017, over 62% of occupational accidents in the construction industry resulted in sickness absence of up to three days. Ten years earlier, minor accidents (0–3 days' absence) accounted for half of all accidents in the main construction industry. In 2017, more hours were worked in the construction industry than ten years earlier, but the number of serious accidents was 22% lower (Tapaturmapakki, 9/9/2019).

In most cases, younger workers are injured in construction work. In 2017, in terms of minor injuries, the accident frequency among young workers was 54 and among older workers 30.

In cases of fatal accidents, the frequency in the Finnish construction industry has long been below the EU average and lower than in most comparable EU countries (Eurostat, 2019).

Interviews

The following topics were discussed during the theme interviews of managers and employees: 1) Improvement of occupational safety in the construction industry over the last ten years 2) How to look after subcontractors' occupational safety 3) Essential improvements 4) Occupational safety training 5) Communication 6) Future development of occupational safety.

When asked how supervisors and managers see the development of safety in the construction industry over the last ten years, almost all their answers included the two phenomena of protective equipment and attitude change. Some interviewees thought that the change in attitudes was perhaps the most important factor behind improved occupational safety. Main contractors are now taking more responsibility for the safety of subcontractors.

According to supervisors and managers, the most important improvements in occupational safety over the last ten years have been not only the development and obligatory use of personal protective equipment but also the development of equipment such as hoists, scaffolding and ladders, and the instructions for their use. Railings and hole covers are also taken care of better than before. In addition to protective equipment, the employees claimed that the most important improvement was that accidents are now investigated in more detail than before. In addition, work orientations are paid more attention.

The supervisors and managers saw safety training as an important factor in improving occupational safety. The employees also found occupational safety training useful when it was carried out in-house.

The supervisors and managers saw communication as an important issue for occupational safety, because it created a positive image of occupational safety. The employees also considered occupational safety communications important.

All the interviewees had an optimistic view of future occupational safety development in the construction industry. Most of those interviewed thought that safety would inevitably move in a better direction, but not necessarily as fast as it has been moving so far. On the other hand, a few interviewees considered the current occupational safety situation so good that it would be difficult to improve it.

Conclusions

In the light of the statistics and interviews, the Zero accidents in the construction industry 2020 project has seen good progress in the field of occupational safety. There are several reasons for this positive development. Changes in attitudes as well as improved personal protective equipment and their widespread use have been key factors. Attitude change is a multifaceted phenomenon that involves not only employees' personal attitudes but also investing in safety at work and prioritizing safety. According to the interviews, corporate occupational safety communications and their prioritization have a significant impact on occupational safety.

Shared workplace challenges give rise to workplace management challenges, which also complicates workplace safety management. The study concluded with recommendations related to: prevention, communication and safety management, communication between employees, training, avoiding scheduling pressure, collaborative planning, personal protective equipment, the utilization of artificial intelligence, and big data.

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Safeguarding Supportive System (SSS) for residual risks in Integrated Manufacturing System (IMS)

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Abstract

"Safeguarding Supportive System (SSS)", controls and prevents human error using ICT at Integrated Manufacturing System (IMS), was established. 1) Validity of SSS by calculating mechanical outage time and working time, and 2) effectiveness of behavior analysis intervention were examined. Subjects were engaged to SSS introduction (sss) and emergency stop (Emergency) conditions. Total time, duration from start to goal, was significantly longer in sss than Emergency. Machine outage time, assumed maintenance happened once every 30 minutes among 8-hour labor, became significantly shorter in sss than in Emergency. We concluded that 1) introduction of SSS is useful on both safety and product efficacy, and 2) some feedback might function to promote work.

Introduction

Some novel forms of society, Society 5.0 and/or Connected Industries, have been proposed in Japan. Work style in such society, workers sometimes have to work without stopping machine because all machines are connected with IoT and worker has to maintain working condition. Therefore, some cases would not be able to apply "stop and isolation strategies" anymore. Worker's safety under such society has to be protected by electronic devices such as Communication Technology (ITC) not depending upon human attentiveness. However, ISO11161-"Safety in an Integrated Manufacturing System"-does not offer an effective method of ensuring safety in dangerous point-approach work. Recently safety management system, which is suitable to such novel societies, especially for working site of Integrated Manufacturing System (IMS), has proposed as Safety 2.0 from Japan. As a form of Safety 2.0, we established a novel safety management system, "Supporting Protective System (SSS)". The SSS focuses on the residual risk after implementing the 3-step method of ISO 12100/JIS B 9700. Now the SSS is proposed to ISO as ISO/TR 22053. It is the system to control and prevent human error and intentional unsafe behavior from the mechanical side (hardware side) using appropriate Information and ICT combination. In the present study, the effectiveness and usefulness of the SSS were evaluated with a procedure of Behavior-Based Safety (BBS). BBS is a group of Behavior Analysis, which aims to predict, control and solve the problem of behavior. In addition, stress symptom and work load of subjects (workers) during experiment were measured with self-report questionnaire.

Execution

Subjects: Ten graduate school students (M = 9, F = 1).

Work place for experiments: A workplace for experiment (Fig.1) was built in the National Institute of Occupational Safety and Health, Japan (JNIOSH). We assumed the work place as a manufacturing industry, including irregular work such as cleaning, teaching or maintenance of robot. All subjects participated under the following 2 experimental conditions 4 times each.

1) The SSS condition: Three machines in zone 1 were stopped, and the rest kept working. A subject entered to the work place from the gateway (Fig.1A), hung a tag (3 x 3cm, Omron, Japan) over the main (Fig.1B) and the sub control boards (Fig.1C), for stopping 3 machines, for confirmation of own authority and for selecting work in zone 1. After that the subject moved to a button place (Fig.1D). The subject was required to press button 4 times each at upper and bottom locations of the belt conveyor as a work. The subject hung a tag to the sub and the main control boards again after the work and pushed the restart button of the restart board (Fig1E).

2) Usual emergency stop condition: After stopping all machines by pushing an emergency button of an emergency stop board (Fig.1F), subject moved from the gateway to zone 1, and was required to push the button 4 times each at upper and bottom locations of the belt conveyor at the button place. After leaving from zone 1, the subject released the emergency, moved to the restart board. Half subjects and the rest of them were assigned to feedback condition and no-feedback condition, respectively.

Feedback condition: Five subjects in the feedback group were able to see the button-press time (work time) on the screen of the tablet, and described the total time (time from the start to the end) by experimenter immediately after the session.

No-feedback condition: Rest of five subjects were assigned to the no-feedback condition. The work time on the tablet screen was hidden by a sheet of paper. Also, the total time was not told to subject in no-feedback group.

Button press task: Though task in work site should be similar task of robot maintenance or cleaning, it was expected to have huge individual differences. Therefore, we selected very simple task, button press task, which was engaged on a belt conveyor at zone 1.

Average total times of the SSS condition and usual emergency stop condition were compared and analyzed by Student's t-test. Statistical analyses of the effects of repeated sessions were performed with repeated one-way analysis of variance (one-way ANOVA). All numerical values are expressed as the mean and se. Values of $p < 0.05$ were considered statistically significant. All statistical analyses were performed using EZR software version 1.27 (Saitama Medical Center, Jichi Medical University, Saitama, Japan).
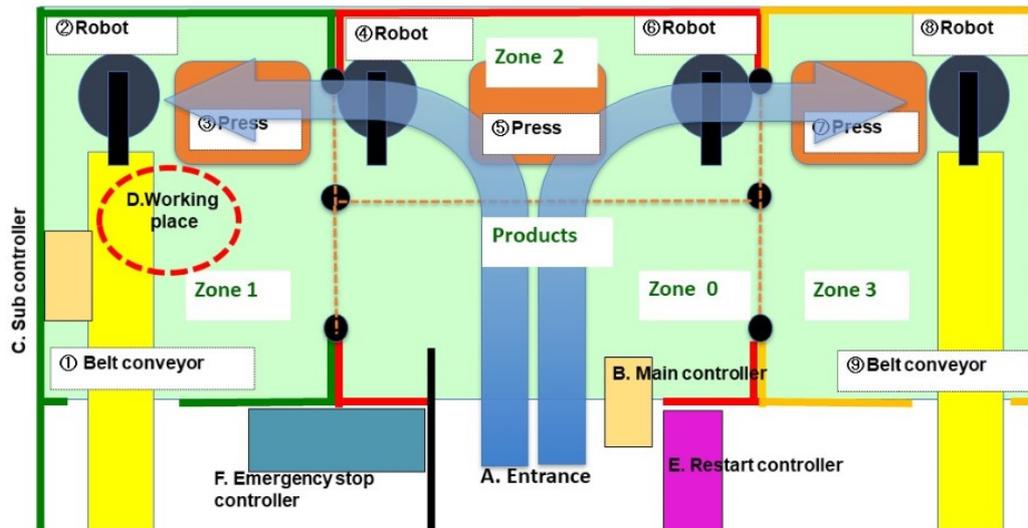
Fig.1. Work place for experiments.
1-9 means machines in the work place. Zone 1 (Left, Solid line) has a belt conveyor, a rock crusher and a robot. Zone 2 (Middle, Dotted line) has 2 robots and a rock crusher, assuming rock crush work. Zone 3 (Right, Broken line) has same machines as zone 1. Under the SPS condition, machines 1-3 are stopped, and all machines are stopped in the usual stop condition. A. Gateway, B. Main control board, C. Sub control board, D. Button place, E. Restart board, F. Emergency stop board.

Findings

Average total time of the SSS and the usual stop condition groups were 78±8.7 and 54±4.4 seconds, respectively.

We assumed that irregular work occurred once per 30 min out of 8-hour-work time. Then mechanical outage time was calculated using average total time of each condition (16 times x the number of outage machine x total time). The machine outage time of SSS and the usual stop conditions was 3744sec (62.4 min) and 7776 sec (129.6 min), respectively. There was no difference in work time of the upper and the bottom locations of belt conveyor between the SSS and the usual stop conditions, but repeated factors were effective in both conditions. Decrease rates of total time from the first work of the feedback group was greater than that of the no-feedback condition. In self-reported questionnaire, 7 subjects reported stress decrease or no-change during experiment.

Even if the total time took longer in the SSS condition than that of the usual stop condition, machine outage time was shorter in the SSS condition than that in the usual stop condition. In addition, it was suggested that some feedback to the work possibly promote further work. Usage of feedback might be applied as a good promoter for self-encouragement for working. These results suggest that introduction of the SSS guarantees both safety and operation efficacy. It is possible that some feedback to the work promote further work. Also, it was suggested that repeated factor of the work in the present study played the role as promoter for work. Result of self-report indicated that the present experiment was not stress for more than half of subjects.

Conclusions

The results of the present study suggested that introduction of the Safeguarding Supportive System may provide both safer work and better work efficacy.

Some feedback to worker's own work may function as reward, it guides better result.

It would be possible that more precise analysis of reinforcement procedure including feedback helps to establish more effective learning process of the work. Then, the SSS would be suitable for current style of society.

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Occupational accidents in delivery transportations - findings based on a merger and analysis of two Swedish databases

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Abstract

Safe delivery transportations are a basic prerequisite for modern society. Nevertheless, delivery transportations are very hazardous and include a variety of risks to accidents. Truck drivers' occupational accidents in Sweden in 2005-2014 were analyzed by merging the databases of Swedish Social Insurance Agency and Swedish environment authority. Altogether 3188 accidents following the Eurostat standard were included. Nine 3D-diagrams were created displaying the compensated days on average, the total number of compensated days and the invalidity percent for each paired combination of three main variables: 'Contact mode of injury', 'Deviation', and 'Material agent'. The diagrams visualize the differences among the paired combinations and foster discussion on accident prevention measures.

Introduction

Trucking industry is amongst the most hazardous industries (Anderson, Smith, & Byrd, 2017). Truck drivers, as "lone riders" constantly face situations where they can choose whether to act safely or unsafely and in a sustainable manner (Douglas & Schwartz, 2016; Dubey & Gunasekaran, 2015). Despite a rapid technological development in the field of trucking, totally driverless trucks are not insight in the near future (Freeman, 2017), and even with driverless trucks, the hazards outside the cabin will likely remain.

Very little development has been achieved by different occupational accident prevention measures. This is due to the characteristics of the trucking work. In addition to driving, trucking work comprises of a variety of other tasks and assignments performed outside the cab (Anderson et al. 2017; Reiman, Forsman, Målqvist, Parmsund, & Lindahl Norberg, 2018; van der Beek, 2012).

For instance, Reiman, Putkonen, Nevala, Nyberg, Väyrynen, & Forsman (2015) have utilized large accident statistics databases to provide more in-depth understanding on the causes of accidents outside the cab in the trucking industry. To our knowledge there are no studies piecing together such data sets from different sources at the trucking industry. The aim of this study was to analyse drivers' out of the cab accidents by combining two different Swedish databases; a national register utilizing Eurostat categorisation codes and a register of an insurance company, to facilitate the combination of categorised accidents and fully accurate compensation data.

Execution

The focus of this study was on accidents that had occurred for truck drivers outside the truck cab. So, only those individuals who have been coded as either heavy truck/lorry drivers, lifting truck operators, transport labourers/freight handlers or transport clerks were selected. In this study two large Swedish accident statistics databases were merged. The actual compensation (including all compensated cases; also those with no sick leave days) register of a large insurance company

(AFA) was used together with the reliable national coding of the Swedish Work Environment Authority to provide better understanding on the accidents.

The accident database by AFA contains 6817 accidents that had been approved, i.e. in which monetary compensation has been paid among truck drivers in 2005-2014. The accidents are not coded, but they contain short descriptions of the accidents. SWEA database contains 12 659 accident reports. Altogether 5226 accident reports from SWEA among the 6817 compensated accident cases by AFA were matched. From those matched accidents 3188 contained reliable coding information in which the coding system on European Statistics on Accidents at Work by the Eurostat had been utilized. In the coding system each accident is coded by the contact mode of injury (the contact that injured the victim), deviation (last event differing from the norm and leading to the accident) and material agent (material agents associated to the deviations and contact modes of injuries). In addition, the total number of sick leave days compensated for the accidents was used in the analyses.

For the merged set of accidents (n=3188), three 3D-diagrams were created for each of the following outcomes: the compensated days on average, the total number of compensated days, and the invalidity percent, one diagram for each paired combination of the following three variables: 'Contact mode of injury' (aggregated into seven categories), 'Deviation' (seven categories), and 'Material agent' (four categories).

Findings

An analysis on the contact modes of injuries revealed the following findings. Altogether 159 305 lost working days were compensated by the insurance company during the inspection period. Roughly two thirds (63.6%) of those compensated days were related to impacts against stationary objects. From those 101 260 accidents, buildings, structures and surfaces were identified as the principal material agent for over two fifths (42.3%) and vehicles for one third (36.0%) of the compensated days. When the compensation days were compared by their average lengths, the distribution was clearly more evenly distributed. In the category of impacts against a stationary object, the average length varied from 54.6 days to 67.4 days. However, similar kinds averages were detected from the physical stress to the musculoskeletal system compared to the material agents Removal, material, waste (76.7 days) and Buildings and structures (61.4 days) and on cases where the subject had been Trapped or crushed in contact with buildings, structures and surfaces (60.7 days). See an example of the visualized 3D-diagrams in Figure 1.
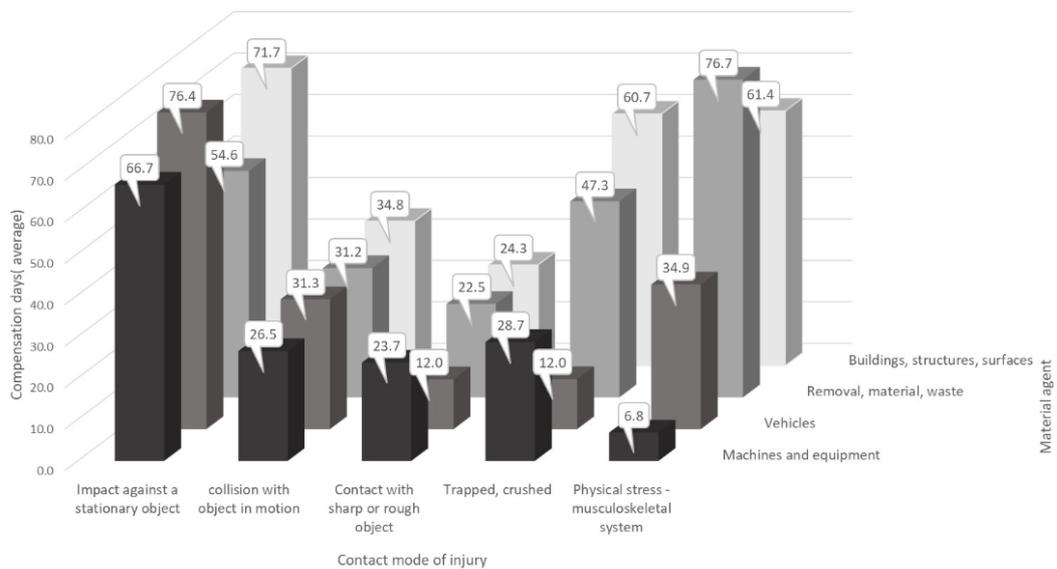
Figure 1: Compensated days on average against Contact mode of injuries and Material agent.

Concerning deviations, falls were the most significant deviation group, as visualized in a 3D-diagram in Figure 2. In total 94 330 (59.2%) compensation days were related to falls. When compared to the material agents, the primary material agent group was Buildings, structures and surfaces, with a 42.9% share of all falls. In addition, falls from the vehicles were common, with a 37.8% share of the compensation days categorized under falls. Concerning other deviation groups Loss of control for equipment in combination with Removal, material and waste was identified as a major deviation group, with a share of 18.7% of all compensation days.
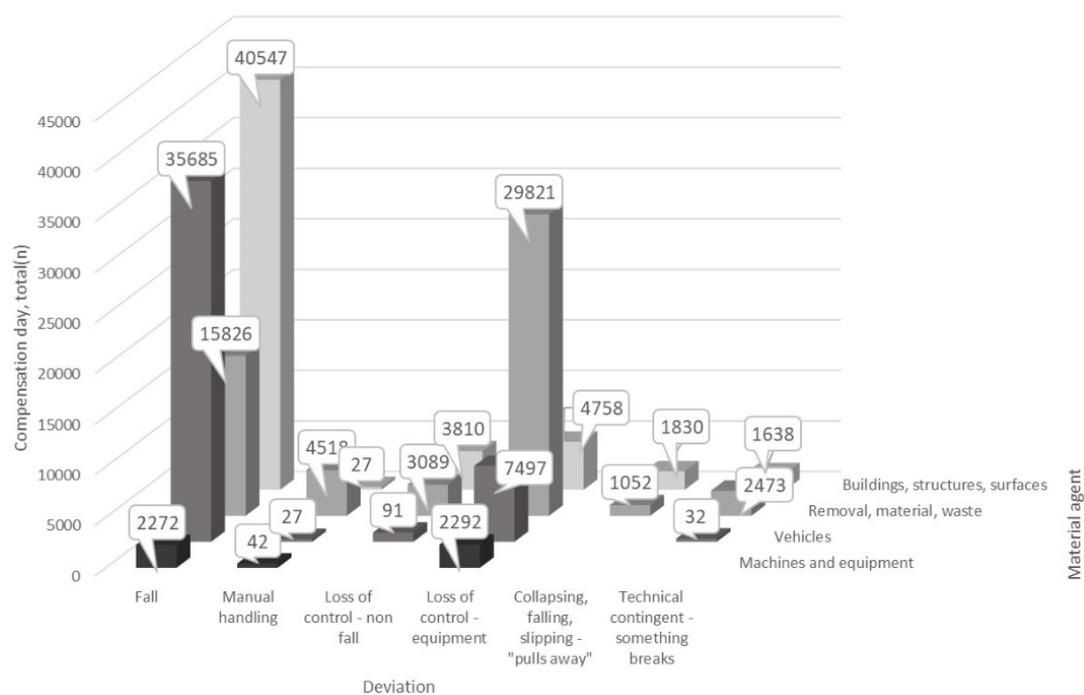
Figure 2: Compensation days (total) against the deviations and material agents.

Similarly, to the contact mode of injuries, the average lengths of the accidents were more evenly distributed amongst the deviation categories when compared to material agents. Yet again, the largest averages were related to falls, ranging from 65.1 days to 90.9 days. However similar kinds of high averages were related to technical contingents, i.e. to Something breaks in relation to buildings, structures and surfaces (96.4 days) and manual handling of machines and equipment (70.8 days) and removal, waste, material (66.4 days).

When contact modes of injuries were compared to deviations, Falls and Impacts against stationary objects were by far the most significant combination with a share of 57.6% of all compensation days. However, when the average lengths of the absences were compared, the distribution was, again, more evenly distributed.

Conclusions

In this study accidents from two different databases were combined and further analyzed. Analyses of these two combined registers resulted in precise and reliable results for variable combinations. As an example, the diagrams show how the total number of compensation days and the invalidity percent concentrate on certain combinations; however concerning the compensation days on average the distribution is more evenly distributed. This kind of detailed information as exemplified in Figures 1 and 2 as a new way of data analysis provides valuable information on the preceding factors of the accidents and helps prioritizing accident prevention and occupational safety measures towards vision zero.

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The number of fatal workplace accidents almost halved – Analysis of fatal accidents at work in 2009–2018

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Keywords: Fatal workplace accidents, TVK analysis, workers compensation,

Abstract

TVK is the official Finnish statistics authority for accidents at work and occupational diseases. Every calendar year, insurance institutions underwriting insurance as defined in the Workers' Compensation Act as well as the State Treasury have to provide TVK with information, broken down by policyholder and accident, necessary for the purpose of compiling statistics. These statistics also include fatal workplace accidents. The data for 2009–2017 is based on TVK's register of occupational accidents and diseases and the data for 2018 on cases reported to TVK. Consequently, the figures for 2018 are still subject to change and should be regarded as an estimate.

Introduction

TVK analyses the data to establish publications in work safety. The general goal is to spread the knowledge of workplace accidents in Finland and to enhance work safety. Based on this data this analysis looks at what kind of fatal workplace accidents have occurred over the last ten years and the direction in which they have developed.

Findings

In 2009–2018, a total of 279 fatal workplace accidents occurred in Finland. A significant part of these took place in the transportation and storage, construction and manufacturing industries. Within this time period 239 employees and 40 entrepreneurs lost their lives in accidents at work. Most of these occurred in the transportation and storage, construction and manufacturing industries (see Table 1).

Table 1. Fatal accidents at work in 2009–2018 by branch of industry

Industry	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	TOTAL
A Agriculture, forestry and fishing	3	2		1	1		1	2	1		11
B Mining and quarrying	2				1		2				5
C Manufacturing	1	8	1	5	4	4	3	4	4	6	40
D Electricity, gas and heat supply, cooling	1	1		1							3
E Water supply, drain and sewage disposal			1		1		1	2	1		6
F Construction	8	7	4	9	4	9	3	9	2	6	61
G Wholesale and retail trade	7	1	4	2	2	1	2		1		20
H Transportation and storage	7	8	12	7	5	5	4	4	7	5	64
I Accommodation and catering activities				1			4				5
J Information and communications			2				1				3
M Professional, scientific and technical activities		3	1	3	1	1		2			11
N Administrative and support service activities	1	3	1	2		2	5	1	2		17
O Public administration and national defence, excl. the municipal sector	2	3	2	1	1	2	3	4			18
P Education							1				1
Q Health and social services					1		2	1			4
R Arts, entertainment and recreation			2			1					3
S Other service activities					1		2			1	4
T Households as employers							1				1
U Activities of international organisations					1						1
(empty)		1									1
All in total	32	37	29	36	18	29	30	30	19	19	279

About 65% of those who died were over 40 and about 92% (256) of them were men. The highest number of fatal accidents at work occurred in the age group 50–59 (91). 9.8% of the fatal accidents in this age group occurred in women. Odd bit of trivia is that an accident was most likely to occur in May and on a Wednesday.

A significant portion (20.4%) of cases were due to slipping, stumbling and falling or fall of persons. The second highest number of fatal workplace accidents occurred as a result of breakage, bursting, splitting, slipping, fall or collapse of material agent (19.4%). In about 17% of cases, the deviation that preceded the injury was loss of control (total or partial) of machine, means of transport or handling equipment, hand-held tool, object or animal.

In the majority of cases (58.8%), the injury resulted from the victim being trapped or crushed, or from the victim's impact against an object. 15.4% suffered fatal injuries due to collision with an object in motion. In a significant portion of these, victims were run over by machinery, equipment and vehicles.

The majority of these fatal workplace accidents occurred on construction sites (5 accidents), mainly in the area for storage, loading and unloading (5), at the production facility, factory or workshop (5).

The persons who died in accidents at work were mainly employed in occupations related to installation or construction (6), as operators of machinery or vehicles (5) and in manufacturing or production (4).

In 2018 according to information received by TVK, there were 19 fatal workplace accidents across 18 different incidents in Finland. Of these fatal workplace accidents, 16 happened to employees and three to entrepreneurs. All the deceased persons were men and two of them were foreign employees of a foreign company. In three cases, the deceased person was an agency worker. The lowest number of fatal workplace accidents in recorded history is from 2013, when 16 employees and 2 entrepreneurs lost their lives in work-related accidents. However, the number of fatal accidents at work has been on a downward trend over the last ten years. Ten years ago, in 2009, when the number of fatal workplace accidents was the lowest recorded up to then, there were 32 fatal workplace accidents (see Diagram 1).

Diagram 1. Fatal accidents at work in Finland in 2009–2018. The diagram data is presented in Table Appendix 1A.
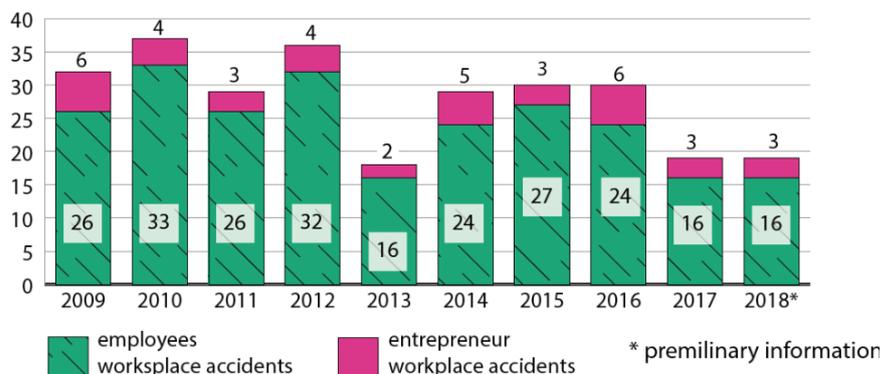
*The figures for 2018 are based on cases reported to TVK, not on the register of occupational accidents and diseases. The figures may still change.

markets.b...

Conclusions

When looking at the number of fatal workplace accidents, it should be noted that even a small change in the figures on an annual basis may appear significant as the number of cases is rather low. Fatal accidents at work are usually isolated cases, making it challenging to analyse trends and draw conclusions from them. The distribution of the cases in, for example, the subcontracting chain across many different industries and modes of injury also creates challenges for drawing clear conclusions. Despite these facts it is safe to say that there has been a clear downward trend and the number of fatalities has fallen remarkably over the last 10 years. In general the number of all workplace accidents have decreased and also the severity of accidents has eased.

References

The data for 2009–2017 is based on TVK's register of occupational accidents and diseases and the data for 2018 on cases reported to TVK. Consequently, the figures for 2018 are still subject to change and should be regarded as an estimate. For example, a serious occupational accident in which a person dies only later from the injuries resulting from the accident does not immediately come to our attention as a fatal accident at work. Therefore, the figures for 2018 are not fully comparable with those of previous years. For entrepreneurs, the figures for 2009–2017 only include the workplace accidents of those with voluntary workers' compensation insurance.

Decoding Heartbeat Data for Better Health and Performance

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Abstract

Heart rate variability (HRV) provides a non-invasive window to autonomic nervous system (ANS) activity reflecting health and fitness of an individual. We have developed a method that utilizes HRV for quantification of ANS state and for evaluating stress, recovery, sleep, physical activity, and fitness level (VO2Max) from wearable data. The method has been applied in occupational settings for over 300,000 employees to evaluate their lifestyles, work ergonomics, and workload. Studies show associations between HRV-based stress and psychological work stress, effort, and emotions as well as chronic work stress, and burnout symptoms. The method can be used for identifying and managing lifestyle- or work-related risks and to motivate individuals towards healthier lifestyles.

Introduction

Heart rate variability (HRV) provides a non-invasive window to autonomic nervous system (ANS) activity reflecting health and fitness of an individual. We have developed a method that utilizes HRV for quantification of ANS state and for evaluating stress (sympathetic dominance), recovery (parasympathetic dominance), sleep, physical activity, and fitness level (VO2Max) from wearable sensor data. The developed digital model can be used as a vehicle for delivering feedback and for fostering healthy lifestyles based on personalized data on key well-being factors. The basis for building the model is that many essential bodily functions such as inhalation and exhalation, control of breathing, hormonal reactions, metabolism, energy expenditure, physical activity, body movements or changes in posture, cognitive and mental processes, autonomic nervous system function as well as stress reactions and relaxation are reflected in the dynamic control of heart that may be evaluated using HRV information. The model is capable of monitoring HRV changes and autonomic nervous system balance in demanding and ever-changing real-life conditions, dynamically.

The development of the method has been based on empirical data and physiological modeling of bodily functions. Numerous empirical datasets in various different experimental settings have been used to tune the model. The datasets include thousands of laboratory assessments, and hundreds of thousands of measurements from real-life. The datasets include essential physiological signals like ECG-based heart rate, respiration, energy expenditure and maximal oxygen consumption. This paper describes the background and the scientific findings of the method.
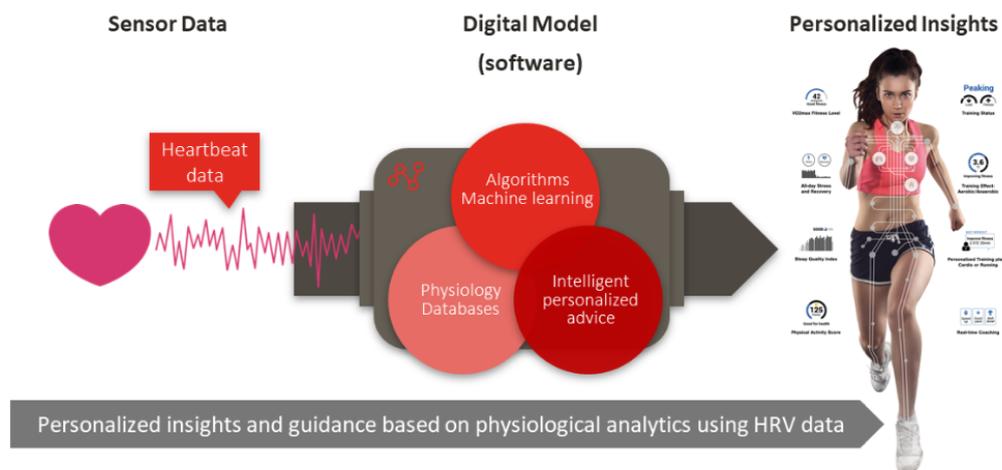
Figure1: Digitized physiology with HRV data

Execution

The method analyses continuous HRV data, adaptively segments the data into semi-stationary segments, and classifies these segments into physiological stress, recovery, and physical activity periods. Stress is defined as a sympathetically dominated state that is caused by something else than acute physical activity or recovery from activity. Recovery refers to state wherein the parasympathetic nervous system is dominating. Physical activity is recognized from oxygen consumption (VO2), which is modelled by for example extracting respiration frequency from the HRV data. Oxygen consumption can be further used for estimating energy expenditure. Further, VO2Max can be assessed with wearable data by combining information on internal (HRV) and external body load (acceleration or GPS data).

The method includes an assessment of the balance between stress and recovery, the restorative effect of sleep, and the magnitude of health effects of physical activity. The balance between stress and recovery is defined based on the overall amount of stress and recovery during the day as well as relaxing moments found from awake time. The restorative effect of sleep is scored based on the amount of detected recovery during sleep, sleep duration, and the quality of recovery defined by nocturnal HRV compared to others at same age group in a large population database. The balance between stress and recovery reactions is further used for estimating whether the body resources have been accumulated or consumed during the measured period. The fitness level is defined as ml/kg/min and classified verbally from very poor to superior by comparing to a reference result based on gender and age groups. In addition, the method gives feedback on the physiological impacts caused by training sessions, energy expenditure, steps taken, and HRV-metrics.

The method has been used for fostering behavior change, stress management, and empowering employee well-being. The service includes 1) collecting HRV and acceleration data with an unobtrusive wearable sensor and keeping a diary on behaviors, 2) building a personalized digital model of physiology, 3) reporting and visualizing the data together with diary markings on the daily actions and body's responses for various activities and behaviors, and 4) feedback sessions delivered via health and wellness specialist tailored for the needs of every participant. The goal of the service is to foster self-learning of the participant by making visible what kind of effects the daily decisions and actions have on the body's responses, overall well-being, quality of life, and

eventually health. The key principle in applying the method for stress management is not about avoiding stress, but about managing the overall load of life and securing sufficient recovery for the experienced load. It's important to find a balance between work, leisure time and sleep, and between activity and rest.
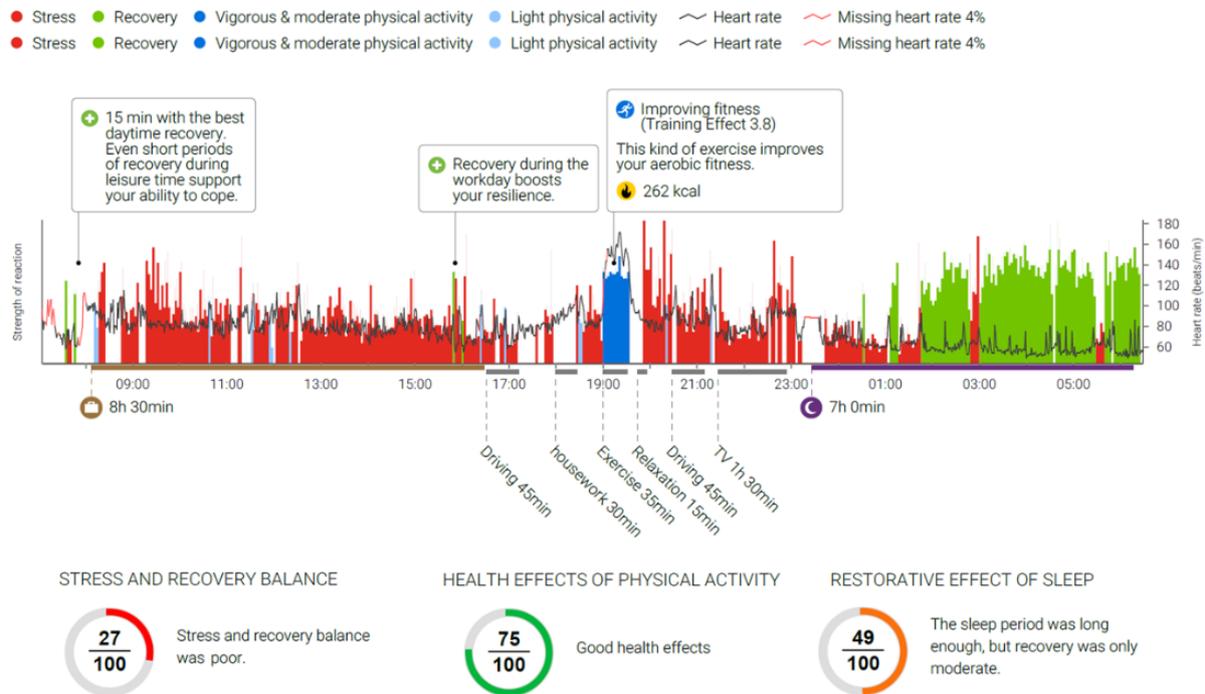

Figure2: An example lifestyle feedback using real-life HRV

Findings

The method has been validated against laboratory measures and found accurate and feasible for real-life use in several studies. The HRV device (Bodyguard 2) detected 99.98% of the heartbeats with 0.04% extra detections when the Firstbeat artifact correction was applied. There has been a very strong correlation between the Firstbeat estimated VO2 (r=0.98) and energy energy expenditure (r=0.96) against the gold standard during exercise. The average deviation of 2.1-3.5 ml/kg/min of Firstbeat estimated VO2 compared to gold standard in real-life has been reported. Differences in mean energy expenditure of only 0.4-5.7% during exercise test and only 0.6-6.1% during walking against gold standard has also been found (Robertson et al. 2015). Firstbeat VO2Max evaluation using GPS-data in running and cycling has been shown to be highly accurate with a mean percentage errors in the range of 5-7% compared to gold standard. In a recent study, fitness level of 27 subjects was evaluated with a mean percentage error of 7.8% (3,5 ml/kg/min) compared to laboratory reference using the walk test.

The method has been used to reflect objective physiological stress and recovery in several scientific studies in various settings. There have been significant associations between HRV-based stress and subjective well-being. Subjective stress was directly associated with HRV-based stress and inversely with HRV-based recovery in psychologically distressed persons (Föhr et al. 2015). There has been an association between self-reported burnout symptoms and HRV-based stress (Teisala et al. 2014). Further, daily emotions at work and chronic work-related stress were in connection to HRV-based recovery (Uusitalo et al. 2011). A correlation between awakening cortisol response and HRV-based stress and recovery during sleep has been found. Recently, the

method was used for analyzing the stress and recovery balance of executives. The study found that stress generated or maintained outside working hours correlates with a lower quality of recovery during the 24h workday (Crespo-Ruiz et al. 2018).

Studies have found positive effects when the service has been used as an intervention in health and well-being management programs. Recently, a study found that personalized approaches that reduce stress levels, increase recovery levels, and promote healthy sleep habits play an important role in weight management and glycemic control in type-2 diabetes management. (Mussa et al. 2019) Earlier, the service was used as an intervention in a study utilizing several technology tools and rated as the most useful intervention component. The method has also been effective; 82 % of the users of the service report they made lifestyle changes for better performance or health based on the feedback. The accumulated extensive database of the service has also been used for providing insights on employee wellness trends.

Conclusions

There is an enormous need for preventive healthcare solutions for managing risks related to poor lifestyles. This paper described a method for evaluating and utilizing data on key lifestyle components including stress, recovery, sleep, and physical activity by digitizing physiology with wearable HRV data. To date, the presented physiology-based employee coaching service has been delivered to over 300,000 employees. 82% of the participants reported they made changes in their lifestyles for better performance or health and 96% would recommend the service to others. Employers have shown savings of up to 30 % in their health care costs. All this manifests the great potential of using personal real-life wearable data for fostering well-being in occupational and preventive health care settings. We conclude that wearable HRV data can be used for promoting lifestyle change and for supporting employee well-being, performance, and health.

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The design of the "Vision Zero" network of collaborating centres for implementation of the "Vision Zero" in practice. (Poster)

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Abstract

Since the "Vision Zero" campaign was declared we need specific tools to implement it in the occupational safety and health practice of various countries. Really, the best tool is a global network of the "Vision Zero" Centers similar to the ILO-CIS network of informational OSH centres. Every centre of this network shall operate on the basis of large research, educational, training and OSH consulting organization with good traditions and wide experience in this area. The coordinator of this network shall be the ISSA-Vision Zero Council. It can work on the basis of world known research organisation, for example, - the FIOH. We see the main aim of a collaborating center network activity as informational service, consulting, training and operation certification for enterprises.

Introduction

The principles "Vision Zero" have international character and "Vision Zero" is voluntary programme. It is very good for traffic safety. But OHS has national character and it is regulated by national legislation. It situation demands special approaches at implementation of the principles "Vision Zero" in practice. They connect with transformation voluntary character of the "Vision Zero" to mandatory character of national OSH requirements. Our practice shows that the employer (at least in Russia) fulfills mandatory requirements of OSH and realizes them through creation of OSH management system. As all ideas "Vision Zero" left the best practice of the organization of OSH at the enterprises, the employer uses them as a specification of the work on OSH. He considers the campaign "Vision Zero" only as image. In this sense he very needs the certificate according to "Vision Zero", training in "Vision Zero" procedures, consulting in implementation of the "Vision Zero". All this can make international network of the cooperating centers. Experience of such network on OSH is.

Execution

All offers and conclusions of this work are based on our long experience of successful work of the international network CIS of the ILO – information Centres on OSH. We complemented their functions with training, consulting and certification. The last is very necessary for the enterprises as a form of the public declaration on compliance of work on OSH at the enterprise to the main requirements "Vision Zero". The payment of the enterprises for certification, training and consulting will allow find financial resources for performance of this work.

Findings

In our opinion, the network of ISSA "Vision Zero" Centres has the following objectives:
a) to increase the effectiveness of occupational safety and health knowledge management in the world; b) to collect and disseminate systematically and rapidly useful information relevant to the safety and health of workers in all sectors of economic activity and "Vision Zero" practice; c) to contribute to the development of occupational safety and health training, consulting and certification, and to assist national bodies in carrying out work on OSH. The "Vision Zero" Centres

Network consists of the ISSA International Vision Zero Council and Collaborating Centres. The status of Collaborating Centre is conferred after determination by the ISSA International Vision Zero Council that the candidate institution can significantly complement the role of such Centre. There is small fee for membership in the "Vision Zero" Centres Network.

Conclusions

We are deeply convinced of need of creation of such network and are ready to become its first pilot center in which questions of introduction "Vision Zero" find the standardized and unified look and self-financing.

Acknowledgements

Occupational safety and health challenges of home care personnel (Poster)

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Keywords: home care; personnel; occupational safety; occupational health

Abstract

Care personnel often have musculoskeletal disorders and sleep disturbances. In this study, a questionnaire was utilized to identify occupational safety and health (OSH) challenges and associations with possible sleep disturbances among home care personnel. The questionnaire was given to 19 workplaces in the Stockholm County in 2017, and 469 employees answered. Preliminary results show that among identified OSH challenges were high psychosocial and physical workload, and dissatisfaction with the leadership. Lack of satisfaction with the work, dissatisfaction with the leadership, high qualitative demands and pain disorders were significantly associated with sleep disturbances. The results support the importance of promoting a good organizational work environment in the home care services.

Introduction

The demographic developments in Europe has increased the need for cost-effective social and health solutions and practices in which services are provided outside hospitals and nursing homes. Home care services provide assistance in activities such as personal care, cleaning, shopping, and more demanding personal care. Working in other people's home environment causes unique hazards which include ergonomic hazards, physical risks, biological hazards such as communicable diseases, high psychosocial work load, violence, aggressive animals, unhygienic conditions and hazards on the road due to moving between homes (de Jong et al., 2014).

Musculoskeletal disorders (MSDs) such as low-back pain, and neck and shoulder pain are common causes of sickness absences. Verbal abuse, such as inappropriate language and yelling, is common and physical abuse, such as biting and hitting with objects, occurs (Markkanen et al., 2014). It has been noted that fatigue may contribute to medical errors and has effects on performance (Barker Steege & Nussbaum, 2013). The aim of this study was to contribute to the understanding of the problems by performing an analysis of the identified

OSH challenges and possible associations to reported sleep disturbances among home care personnel. The study aimed to answer the following two research questions:

- What kind of OSH challenges are identified by the home care personnel?
- Which of the identified OSH challenges are associated with the sleep disturbances?

Execution

Quantitative data from a questionnaire was utilized in this study. The questionnaire was given to 19 small and medium-sized workplaces in the Stockholm County in 2017 and 469 employees answered. The respondents were mainly women, 84.9%, while 15.1% were men. The mean age was 45.3 years (SD = 13.4). The education levels were junior high school 15.4%, high school 53.1%, university or polytechnic 16.6%, or something else 14.1%, while 0.9% did not provide any information. Of the respondents, 38.8% had less than six years of work experience in home care services, 14.5% had six to nine years of work experience and 43.9% had ten or more years of work experience while 2.8% did not provide the information. The respondents were employed by the municipality, 71.4%, or by private care providers, 28.6%.

A questionnaire used in earlier studies about home care services in Sweden was utilized (Petterson et al., 2006). The psychosocial factors at work were assessed based on the Copenhagen Psychosocial Questionnaire and the questions were answered using 4- and 5-item Likert scale (Pejtersen et al., 2010). Possible MSDs were estimated by using the Standardized Nordic Questionnaire (Kuorinka et al., 1987). Sleep disturbances were measured by using the Karolinska Sleep Questionnaire with a 6-item Likert scale (Akerstedt et al., 2008).

Eight different indexes were created to conduct the analyses. The quantitative demand consisted of six questions related to having enough time to do work tasks and feelings of time pressure and stress. The qualitative demand consisted of four questions related to the nature of the work and making decisions. A leadership consisted of six questions about leadership quality and managerial support. The contentment consisted of two questions about being satisfied with the work. The exhaustion consisted of six questions related to how it feels to work with the customers. The psychosocial workload consisted of four questions related to competing demands, handling unexpected events, making difficult decisions and whether the responsibility for the clients feels overwhelming. The physical workload consisted of five questions related to lifting and carrying, other heavy work, assisting in shower or toilet with limited space, awkward work positions, and sudden physical efforts. The sleep disturbance was created using questions; "During the last three months have you had/experienced: Difficulties falling asleep? Repeated awakenings with difficulties going back to sleep? Premature awakening? and Disturbed/restless sleep?" In the indexes, one or two missing values were accepted in order to minimize the number of missing values.

IBM SPSS Statistics 25 was used to conduct the quantitative analyses. Stepwise linear regression was used to analyze the associations between OSH challenges and sleep disturbance index. Age, work experience in home care services, work experience and level of education were treated as potential confounders.

Findings

Identified OSH challenges

Of the respondents, 48.8% reported that they had high psychosocial workload, 47.5% were not satisfied with the leadership, 44.3% had high physical workload, 40.9% had high quantitative demands, 38.4% had feelings of exhaustion, 31.8% experienced high qualitative demands while 25.0% had sleep disturbances and 17.7% were not content with the work.

Regarding MSDs, over 40% of the respondents had had pain in their upper back or feet and over 50% had pain in their neck, shoulders or low back in the last 12 months. In the last seven days, over 30% had had pain in their neck, shoulders or low back. In the last 12 months, over 30% had neck, shoulder or low back pain often or very often, and around 30% described the neck, shoulder and low back pain as strong pain. Table 1 shows the percentages of the respondents who had pain in the last 12 months and in the last seven days.

Body part	In the last 12 months (%)	In the last seven days (%)
Neck	51.8	30.3
Shoulders	53.7	32.6
Upper back	42.4	26.0
Low back	54.6	37.5
Arms	15.8	8.7
Hands	32.0	20.0
Hips	24.9	17.1
Knees	36.0	23.2
Feet	40.5	27.5

Table 1. The percentage of the respondents (N = 469) who had pain in the respective site in the last 12 months and in the last seven days

OSH challenges that were associated with higher prevalence of sleep disturbance

For the sleep disturbance index the stepwise linear regression presented as the final model the factors Not content with the work, Strong pain in shoulders, Dissatisfaction with the leadership, Strong pain in neck, and High qualitative demands. Table 2 presents the beta estimates for the final model. The results show that those who were dissatisfied with work or leadership, those with strong pain in neck or shoulders, and those with high qualitative demands were associated with higher prevalence of sleep disturbances.

	Beta estimates	p-value	95% CI
Index - Not content with the work	2.10	0.002	0.76 – 3.43
Standardized Nordic Questionnaire - Strong pain in shoulders	1.62	0.011	0.36 – 2.88
Index - Dissatisfaction with the leadership	1.06	0.045	0.22 – 2.10
Standardized Nordic Questionnaire - Strong pain in neck	1.60	0.012	0.34 – 2.85
Index – High qualitative demands	1.41	0.007	0.38 – 2.44

Table 2. Beta estimates for the question sleep disturbances with all five factors entered into the same model

Conclusions

Because of the demographic changes and increased need for home care, home care personnel's OSH should be improved. This study provided knowledge of some of the OSH challenges the home care personnel may experience. The most common identified OSH challenges were high work-related demands and workload, not receiving enough support from supervisors, and MSDs. Not being content with the work, dissatisfaction with the leadership, high qualitative demands and pain issues were associated with higher prevalence of the sleep disturbances. Based on this study, the politicians, as they have the responsibility for the reimbursement mechanisms, and the service providers should pay attention to the balance between resources and demands. Since

almost half of the respondents had high psychosocial workload, it should be prioritized and resources should be allocated to support and coach the personnel. Physical work environment needs to be improved in order to reduce the high physical workload and MSDs.

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Good level of physical fitness increases work ability and reduces exhaustion (Poster)

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Abstract

The Fit for Life Program together with seven hospital districts, implemented a project to increase employees' daily physical activity. Measuring the level of physical fitness and self-assessments level of exhaustion and ability to work was one part of the project. The data included results of 18-64 y men and women (n=2,689). The results revealed that 79% of the participants should improve their lifestyle. The participants with a good or excellent fitness level (BFI>1) assessed that their work ability was higher and exhaustion level lower than the participants with a lower fitness level. Good physical fitness has been shown to increase working ability and reduce exhaustion. Physical fitness should be given more consideration as a part of management and occupational health care plans.

Introduction

The Fit for Life Program (KKI) is a national health-enhancing physical activity programme for people of working age. The objective of the KKI programme is to influence structures and operational cultures to ensure that the working-age population will be physically active enough to remain in good health.

To maintain the Finnish welfare state and ensure the sustainability of the public economy, it is crucial that as many working-age people as possible are employed, remain healthy and maintain their occupational abilities. The careers of Finns are most often cut short by musculoskeletal disorders (33%) as well as mental health problems (31%).

By supporting the physical fitness of employees, the amount of sick leave and disability pension can be cut down and physical, psychological and social abilities can be promoted and maintained, thus maintaining the employees' work abilities until their retirement.

The objective of the KKI programme's key focus, 'Occupational ability for working life,' is that the work communities will invest in the work ability of their staff by supporting them in maintaining their physical fitness and healthy lifestyle. In 2018, KKI targeted its measures at the social and health care field in particular, as their personnel face many risks to their work ability. An example for this action was a three-year development project of Oulu University Hospital in 2015–2018, funded by the KKI programme, called Health for life from the workplace through self- and organisational management. This project resulted in decreased sick leaves caused by musculoskeletal disorders, yielding savings of nearly €900,000 during the project.

Execution

The KKI programme negotiated about cooperation with seven hospital districts. In all seven hospital districts, a day for measuring the physical fitness of staff members was held as a part of the project. KKI agreed with the HR management on how these measurements would support the plans of promoting the work community's health and how the measurement day would be arranged. The Regional Sports Federations acted as the regional partners.

The KKI measurement days were marketed through occupational health care, occupational safety and health and occupational well-being, and generally via email and intranet. The measurements were held at a testing laboratory built in a truck, which was parked in front of the hospital. In some organisations, the employees were allowed to take the tests during their working hours, which could be seen in the higher number of participants. The staff members could have their fitness level measured easily in everyday or work clothes without sweating or becoming winded in the Physical Fitness Index (BFI) measurements. The measurements were used to assess handgrip strength, body composition and endurance. The summary of all the different measurements formed the Body Fitness Index, i.e. a total grade of physical fitness on a scale from -5 to 5. The fitness classification is based on a large population sample (more than 100,000 people). Individual result comparisons were made with a person of the same age and sex.

In connection to the physical fitness measurements, the participants assessed their current work ability (0–10) and the level of exhaustion they felt after a workday (1–5). Self-assessment of work ability is a reliable indicator of the employee's risk of becoming unable to work in the near future. Self-evaluated exhaustion after a workday is an indicator of recovery. If exhaustion experienced after a workday is frequent, the employee is not recovering well enough from their workday, which thus decreases their work abilities.

After the measurements, the participants were given their own results as well as guidance for health-promoting exercise and healthy eating habits. Summaries of the staff results were compiled for the hospital districts, indicating the employees' level of physical fitness and its link to work ability and experienced exhaustion. These reports acted as guidelines for practical measures needed to support the staff's well-being. Later on, the personnel were referred by occupational health care to individual lifestyle guidance, group activities involving exercise or weight management groups, or other occupational well-being or occupational safety and health measures were implemented at the workplace in order to promote the physical fitness of the personnel and their ability to work.

Findings

In total, 2,689 employees, 89% of them women, measured their physical fitness level in the seven different hospital districts. Based on the Body Fitness Index, 40% of the participants received a result that was classified as 'alarming' or 'concerning' (BFI -1 – -5) and 39% received an average result (BFI below -1 – 1), while 21% of the staff had a good or excellent physical fitness level (BFI 1–5). This means that up to 79 per cent of employees would benefit from increasing their physical activity and/or improving their eating habits.

The more detailed results:

- The handgrip strength test was measured using a Saehan dynamometer. Of the whole staff, 25% had a good or excellent result, 34% average and 40% poor or passable. Handgrip strength predicts one's functional abilities in retirement.
- The Inbody 770 body composition test revealed the composition of the participators' bodies. Of the participants, 43% had a recommended body fat percentage (below 30% for women and below 20% for men), 24% had a result slightly above the recommended level (30–35% for women and 20–25% for men) and 33% had a result clearly above the recommended level (over 35% for women and over 25% for men). With regard to body composition, the amount of muscle mass was reviewed in comparison to height as well as the quantity of visceral fat inside the abdominal cavity.
- Endurance was assessed during rest, using a heart rate monitor and the Polar Own Index test. Its result is comparable to maximal oxygen uptake (VO2max). In this test, 49% received a good or excellent result, 29% an average result and 23% a poor or very poor result.

The link between occupational abilities and physical fitness was seen in the results.

- The self-assessment on the ability to work was positive as a rule: 13% assessed their occupational ability to be excellent (10), 68% to be good and only 19% passable (6–7) or poor (0–5).
- Of the people who had a poor physical fitness level (BFI<-1), 27% considered their own occupational ability to be poor or passable (1–7).
- Only 11% of those with a high level of physical fitness (BFI>1) assessed their own occupational ability to be poor or passable (1–7).

Experiencing exhaustion was linked to poor physical fitness.

- With regard to excessive exhaustion after a workday, 12% experienced it hardly ever, 35% quite rarely, 36% sometimes and 17% often.
- Of the people who had a poor physical fitness level (BFI<-1), 22% often experienced exhaustion after a workday and 39% sometimes.
- Only 9% of those with a high level of physical fitness (BFI>1) often experienced exhaustion after a workday and 31% sometimes.
- Experiencing exhaustion was also linked to shift work. In one hospital district, the results were compiled from the perspective of shift work in particular. The results showed that the physical condition of those doing daytime work is poorer than that of shift workers, but shift workers experienced considerably more exhaustion than daytime workers.

Conclusions

The Finnish social and health care field is currently under conflicting pressures. Operationally, there is a need to increase services and hire more staff. At the same time, employee cooperation negotiations are underway in several hospital districts due to the economic plight of municipalities.

The results show that a sufficient level of physical fitness supports work abilities and decreases the experience of exhaustion. The significance of physical fitness with regard to work ability should be taken into account more extensively as a part of occupational well-being and work ability management at the workplace.

The physical fitness measures gave the hospital districts a summary of the results of their personnel, which was used at their own discretion as a basis for promoting the staff's physical fitness and work ability. Additionally, the KKI programme has continued its promotion of physical fitness and work ability with a total of 16 hospital districts in 2019.

Acknowledgements

The role of external OSH consultants in attaining top management commitment and involvement in safety, health and wellbeing (Poster)

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Abstract

Top management commitment is crucial in order to improve the safety, health and wellbeing in companies, as reflected in ISSAs Vision Zero Golden rule no 1 – Take leadership and demonstrate commitment. This paper showcases the role of OSH consultants in cases from international pharmaceutical/chemical companies on how to implement Vision Zero Golden rule no. 1 on Top Management. The cases include:

- Assessment of the company's current OSH prevention level. The assessment is used as a baseline and framework for defining quantitative strategic targets for OSH prevention development.
- Structure and content for Top Management workshops that include enhancement of both OSH knowledge, skills and motivation
- Integration of safety, health and wellbeing

Introduction

Human House is a Danish based OSH consultant company with clients in all company sizes and industries both private and public. This paper showcases the role of external OSH consultants in attaining top management commitment and involvement in safety, health and wellbeing: External OSH consultants can offer added value on knowledge sharing, best practice and relevant tools to Top Management in order to enhance OHS leadership and commitment. External OSH consultants can facilitate discussions on relevant Vision Zero business cases to Top Management in order to integrate the companys OHS strategy into the overall business strategy of the company. External OSH consultants can gather and distribute Vision Zero experience from other companies for Top Management to be inspired and guided. It is important, that external OSH consultants programmes ensure in-house learning and motivation in the company after the consultancy process.

Execution

Human House has performed quantitative and qualitative assessments in international chemical and pharmaceutical companies to assess the current OSH prevention level. Both the companys OHS systems as well as the companys OHS culture and behavior have been assessed. The assessment methods include a OHS system analysis, interviews with managers and employees and an IT-based OHS culture questionnaire with international benchmark data.

Human House has developed an IT-based questionnaire in cooperation with an international pharmaceutical company to assess the company's current OSH prevention level. The assessment is used as a baseline and framework for defining quantitative strategic targets for OSH prevention development. Management and employees are asked to assess their company's current prevention level as either Passive, Reactive, Active, Proactive or Exemplary on 7 themes, reflecting the ISSA 7 Golden Rules.

Passive	Reactive	Active	Proactive	Exemplary
Profitability is the only focus. Minimum investment in H&S. H&S is seen as a cost; a necessary evil.	Profitability is the most important focus. There is some focus on H&S but only when accidents or work related sick leave occur. When work falls behind schedule, meeting deadlines is mostly valued higher than H&S.	It is communicated that H&S is just as important as work goals. When work falls behind schedule, meeting deadlines is however still valued higher than H&S in some cases.	Our company acknowledges that H&S contributes to financial return. Our company invests in preventing H&S problems, instead of just solving problems after they occur. H&S is seldom compromised for productivity.	H&S is a core value in our company. It is understood that business- and H&S excellence are achieved with the same actions. H&S objectives are as important as performance objectives. H&S is never compromised for productivity.
Management are poor role models. They often break company H&S rules.	Management gets involved in H&S only after an injury or work related illness occurs. H&S rules are enforced only after an H&S incident. H&S is inconsistently communicated as a priority.	Management conforms to company H&S rules and legal requirements, no more or less. Managers know how to say the right things, but do not always walk the talk.	Management are good H&S role models. They walk the talk in most cases. Management initiates and actively participates in prevention of H&S problems and development of H&S programs.	Management integrates H&S into every business decision and engages in continuous improvement regarding H&S conditions. Management display a personal vision and commitment to creating a strong, positive H&S climate and inspire employees to share their commitment.

Figure 1: Assessment of the current OHS prevention level - Vision Zero golden rule no. 1 - Take leadership and demonstrate commitment

Human House has facilitated numerous workshops for Top Management to enhance OHS leadership and commitment. The Top Management workshops include enhancement of both OSH -knowledge, skills and motivation within the Top Management group itself. Organizational development on OHS prevention requires consensus in the Top Management group on 3 fundamental questions. WHY shall Top Management integrate OHS into business leadership? WHAT leadership elements do Top Management want to focus on in relation to OHS? HOW do Top Management integrate SHW into business leadership?

Human House has developed a Leadership self evaluation tool on ISSAs Golden Rule no 1 – Take leadership and demonstrate commitment. The tool has 3 sections: Wellbeing, Health and Safety.

Figure 2: Leadership selfevaluation tool - Wellbeing

The purpose of the tool is self-reflection within top- and middle management on own OHS leadership performance in relation to wellbeing, health and safety.

Findings

Human House has the following general experiences across industries and company sizes:

- Retention and recruitment of highly qualified employees is the main Top Management motivation for improving the OHS prevention level
- There are significantly different OHS prevention levels on safety, health and wellbeing. Safety is often at the active/proactive level with regards to OHS Systems and culture/behavior, whereas health and wellbeing are at a lower, more reactive prevention level with regards to OHS Systems and culture/behavior.
- There are significant differences on prevention level between the companys geographical locations
- In general there is a higher prevention level on Systems than on Culture and Behavior

Conclusions

External OSH consultants can offer added value on knowledge sharing, best practice and relevant tools to Top Management in order to enhance OHS leadership and commitment. External OSH consultants can facilitate discussions on relevant Vision Zero business cases to Top Management in order to integrate the companys OHS strategy into the overall business strategy of the company. External OSH consultants can gather and distribute Vision Zero experience from other companies for Top Management to be inspired and guided.

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References

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