

The SRA Index (Sustainable Risk Awareness Index): A new KPI for Management Support

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Abstract. The objective with this project is to develop a key performance indicator (KPI) related to work environment deviations, such as risk observations, near misses and injuries. This as a support for managers decision making in steering companies towards higher risk awareness as well as to contribute to the development of safer and more sustainable work environments and jobs. In addition, the aim is to contribute to a work environment (WE) reporting standard with a KPI related to the severity of WE deviations. Based on a literature study an iterative development of such a KPI has resulted in the Sustainable Risk Awareness Index (the SRA Index) and a visualization of it and its components using the Risk Awareness Triangle, also developed in this project. The development of the SRA Index is described and the index is exemplified with data from the electrical installation sector, the healthcare industry and one of Sweden's largest private health company. Also the Risk Triangle is exemplified. The need for and the advantages of standardized methods to report WE deviations in companies sustainability reports are discussed. It is concluded that initial use of this KPI, according to management, fills an identified gap, it provides the management with a usable tool for systematic work environment overview and it supports their informed decision-making.

Keywords: Decision-making, Risk management, Work environment, Deviations, Risk awareness, Risk Awareness Triangle.

1 Introduction

1.1 Background

Work-related injuries are a burden and lead to negative consequences for those injured, for organisations as well as for societies. The ILO estimates that some 2.3 million women and men around the world succumb to work-related accidents or diseases every year, which corresponds to over 6000 deaths every day. Worldwide, around 340 million occupational accidents occur 160 million work-related illnesses occur annually [1]. Solely within the European Union, the costs of work-related injuries are estimated to exceed 3 % of the gross domestic product [2]. With changing demographics, there is a need for prolonged working life to match peoples increased lifespan, which,

in turn, leads to an increased need for sustainable jobs [2]. One important part to achieve such jobs is to reduce the risks of work related injuries.

Different strategies and methods have been used in the attempts to reduce the risks of such injuries. They include using tools to gain relevant data (e.g. via surveys, interviews, work environment group meetings, audits, measurements and assessments [e.g. 3] and tools to identify and to assess risks [e.g. 4, 5]. Further they also include tools for reporting work environment (WE) deviations (such as risk observations, near misses and injuries) and other statistical injury related data (e.g. sick leave days per diagnose) [6, 7]. In addition, they also include tools to develop and implement risk reduction measures (e.g. organisational and technical measures) [5, 85] and to evaluate the effects of the implemented changes (e.g. by follow-ups) [5, 9]. Few methods are aligned to the ISO-standard for systematic risk management process [5, 10].

One approach to reduce the risks is to systematically promote increased risk awareness within organisations. There is no single dominating definition of "Risk Awareness." In the health care sector, for example it is defined as "*the recognition of the potential for hazards, risks, and incidents that occur within the healthcare environment and result in patient harm.*" [11]. Sometimes risk awareness is interpreted as that there is knowledge regarding of risk management within an organisation [12]. This paper uses the definition "*Risk awareness is the raising of understanding within the population of what risks exist, their potential impacts, and how they are managed.*" [13]. In addition, we operationally specify three types of work environment deviations: *risk observations, near misses and injuries*. Here "risk observations" denote that risks in a system (e.g. within an organisation) are identified and observed. Further, "near misses" in this context denotes incidents when no injury happened, but was "close" to happen, (e.g. when a machine accident almost occurred, or an employee was working in a Covid-19 virus high alert area without sufficient personal protective equipment (PPE), but was not infected by the virus). The third type of work environment deviations, "injuries" is composed of accidents and diseases.

In the 1930s, Heinrich [14] established a well-known and widely spread accident prevention theory in the form of a "safety triangle". He concluded that severe occupational safety and health (OSH) incidents are preceded by numerous less severe incidents and near misses. The triangle has since been widely used and updated [15]. For example, in a campaign in Sweden a large employer organisation systematically promoted reporting near misses into the industrial sectors work environment deviation system. This resulted in a considerably larger number of reported near misses and a considerable reduction in accidents [16].

In Sweden the work environment incident reporting system, IA, is used by many companies across many industrial sectors [6]. In the IA system the abovementioned three work environment deviation types are used as input data to the database. In the IA system selected data among an organisations own work environment data can be displayed by the users (the organisations using the system) and compared with other data within the company and the company's industrial sector. The results in the IA system can solely be displayed and extracted at detailed level, e.g. generating reports per unit, organization and company's industrial sector in relation to different causes for the deviations as one example injury risks.

However, for effective risk management, risk data (whether they are risk assessments or work environment (WE) deviation data, or other) need to be available at different level of detail and scope within the different hierarchical levels in the organisation. To be able to decide on and to take relevant measures to reduce the risks close to their sources, details about the risks per se are important, while when the aim is to get *an overview* of the WE deviations and risks, the data need to be analysed and presented at a detailed level but with a larger scope. Such presentation of the data enables a more comprehensive view of the “state of the art” regarding the WE of the whole company and can be used to follow trends over time, as well as in the strategic planning. The communication between different hierarchical levels is important. E.g. Törner et al. found that high-quality interaction between different organizational functions and hierarchical levels stood out as important aspects of safety [17].

At least in Sweden there has been, up until now, no such system or method to display the WE deviation data at an overview level for the top management in a condensed, easy to understand and easy to follow way. A key performance indicator (KPI) that company managements can use to follow the development trend regarding the work environment within the company and also benchmark the own company in relation to others would be an asset. In addition, since it in Sweden is mandatory since the turn of the year 2017/2018 to report non-financial KPI in the sustainability report as part in the company's annual financial report [18]. However, there is no standardized way neither on what companies include in the different WE deviation types, nor on how they report this type of data. A method, preferably a KPI, that enables a standardized, well defined and easy to use way to calculate and present WE deviations has been high on the wish-list for several companies in different industrial sectors in Sweden.

This gap between on the one hand the need for such a method and on the other hand the lack of such a method was identified and clearly articulated by the management of one of Sweden's largest organisations in the health care sector, Praktikertjänst. The company has approximately 6,500 employees and has clinics all over Sweden. Praktikertjänst is owned and operated by experts like doctors, dentists, nurses, psychologists and physiotherapists etc., who are also responsible for managing the clinics. This is a concept that creates great commitment among the managers in the company and therefore the work environment is often prioritized. Based on discussions with several stakeholders, including other companies in different industrial sectors, insurance organisations, authorities and researchers, a project was initiated to develop a method to calculate and visualize a work environment KPI related to the severity of WE deviations, which reflects, at least to some extent, the risk awareness within an organisation.

1.1 Objective

The specific objective of the project is to develop a method for calculating and visualizing a work environment KPI related to the severity of WE deviations. In a larger time perspective, the aim is to disseminate, implement and evaluate the method and to contribute to the development of safer and more sustainable work environments and

jobs. In addition, the aim is to contribute to a work environment reporting standard with a KPI related to the severity of WE deviations.

2 Methods

As a first step to reach the objective a literature study was performed. This was carried out in four parts. The focus on one part of the literature study was on risk management/risk awareness literature, including methods. In another part, the focus was on Heinrich's Safety Triangle method and methods developed from the Safety Triangle [14, 15]. These two parts of the literature study search were in the databases Scopus and PubMed. Combinations of the following search terms were used: In part one: (Risk observation AND deviation), (Risk awareness AND deviation). Here inclusion criteria were research publications written in English, published any time. Exclusion was made manually, and the exclusion criteria were risk awareness in traffic, risk awareness in data protection (Scopus) and risk awareness in catastrophe medicine (PubMed). In part two: ("Herbert Heinrich" OR "safety pyramid" OR "safety triangle"). Here inclusion criteria were research publications written in English.

A third part of the literature study was based on research papers recommended by researches linked to the project and the fourth part was grey literature on current methods and companies' sustainability reports 2019. The latter type of publications were either recommended by practitioners or researches linked to the project or found via internet searches.

The literature study result was used as a base for developing the method for risk awareness KPI and in a user guide development. This was done iteratively in collaboration with several stakeholders and intended users with different competences, including mathematical, systems, product design and work environment competences. Within the health care company initiating the project, an interdisciplinary group with 21 employees from different parts of the company, such as HR, quality, nurses, senior managers and union representatives participated in providing feedback. The project is still ongoing and in the development of the visualization of the method and its results also IT and design specialists are involved. Activities in the iterative development have so far also included usability workshops with Praktikertjänst's top management team.

As part of the work to reach the aim of disseminating the method, discussions with a broad range of stakeholders including stakeholders at different industrial sectors, insurance agencies and authorities have been held, presenting prototypes of the method and inquiring data from different organisations and industrial sectors. In addition, data for illustrating the developed KPI with an example was provided by the IA system. The data used in that example are from Praktikertjänst, the private healthcare sector (26 companies) and the electrical installation sector.

3 Results

Among the results from the literature study, several methods and their basis were studied and used as a base for the development of the KPI and its visualization. Mainly three sources were used in the development. One of them was the HME Index [19], which is an index for Sustainable Employee Engagement. This HME Index displays three areas: motivation, leadership and strategic management on a 0-100 scale, where higher numbers indicate high employee engagement while lower numbers indicate low employee engagement. Further Heinrich's Safety Triangle was studied, as were related articles [14, 15], and these were used as inspiration for the development of visualization of the KPI and its components. In addition, the IA system for work environment deviations management was studied regarding the work environment deviation classification as well as for retrieving data for the example illustrating the developed KPI. Further large companies' sustainability reports for 2019 from different industry sectors were studied, focusing on what types of WE deviations the companies included and how the results were presented.

3.1 The SRA Index

Based on the sources mentioned above and the requirements from Praktikertjänst a new KPI was developed, the Sustainable Risk Awareness Index (SRA Index). The index is the ratio between the number of risk observations divided by the number of work environment deviations during a certain period of time for parts of, or for a whole organisation. This can also be expressed as:

$$SRA\ Index = [No.\ of\ risk\ observations / No.\ of\ work\ environment\ deviations] * 100$$

where the number of work environment deviations are the sum of the risk observations, near misses and injuries (accidents and illnesses) and based on [6, 20] these are explained in Table 1.

Table 1. Expressions used in the SRA Index and their explanations.

<i>Expression</i>	<i>Explanation</i>
Risk observation	means that an employee has identified a risk that could lead to a near miss or an accident/work-related illness.
Near miss	means that something has happened that could lead to an accident, but no injury occurs or a work-related illness, but no sick leave occurs.
Work related accident	means that something has happened at work that caused an injury to a person
Work related illness	means a disease caused by a harmful effect at work.
Injuries	the sum of work related accidents and work related illnesses
Work environment deviations	the sum of risk observations, near misses and injuries

The SRA index is constructed in a way so that its lowest possible value is zero and its highest possible values is 100. A low SRA Index signals low risk awareness while a high SRA Index signal high risk awareness in an organization. The SRA Index shows the percent risk observations in relation to all work environment deviations.

In addition, the Risk Awareness Triangle was developed to visualize the distribution between the three types of work environment deviations, namely risk observations, near misses and injuries. The current prototype version of the Risk Awareness Triangle is illustrated in Fig. 1 with data for year 2020 for the company Praktikertjänst. The Risk Awareness Triangle visualization is still under iterative development, e.g. regarding the layout of the SRA Index. In the triangle, the sections heights are proportional to the number of reported cases in each of the three types of work environment deviations.

The SRA Index and the Risk Awareness Triangle can be calculated and visualized, respectively by using the interactive method version accessible via: www.kth.se/mth/ergonomi/forskning/sustainable-risk-awareness.

In Fig. 1 the WE deviations from Praktikertjänst are visualized in the Risk Awareness Triangle for the time period January 1st to December 31st, 2020. For that time period the SRA Index is 44. Fig. 2 summarizes some features of the index.

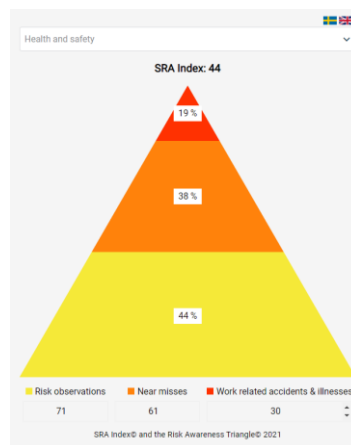


Fig. 1. Illustration of the current version of the SRA Index[®] and the Risk Awareness Triangle[®], available via: www.kth.se/sv/mth/ergonomi/forskning/sustainable-risk-awareness

Regarding the Risk Awareness Triangle, the developers and all in the intended user group found percentage distribution in height of the three types of work environment deviations to be more user-friendly than percentage distribution of the area.

During the development of the SRA Index feedback on it has been collected from the intended users and the initiating health-care company's management. This will be reported more in detail elsewhere. However, in summary the company's management is positive to the SRA Index, partly because the index enables reporting deviations as a KPI to steer towards increased risk awareness. In addition, they perceive that the

SRA Index enables the management to make decisions that can at least to some extent affect the risk awareness within the organisation and its different parts.

3.2 An example illustrating the SRA Index

In 2019 the healthcare industry, including Praktikertjänst, started the implementation of the incident reporting system IA. This enabled easy access to and extraction of the company's WE deviation data. These data were used to calculate the SRA Index. As an illustration of the SRA Index an example is provided in Fig. 2. An analysis comparing the SRA Index between the two years reveals that the index increased slightly for both Praktikertjänst and the private healthcare sector (26 companies) in general from 2019 to 2020, indicating a slight increase in risk awareness. Praktikertjänst's SRA Index increased from 38 in 2019 to 44 in 2020. The corresponding values for the private healthcare sector were 44 and 48, respectively.

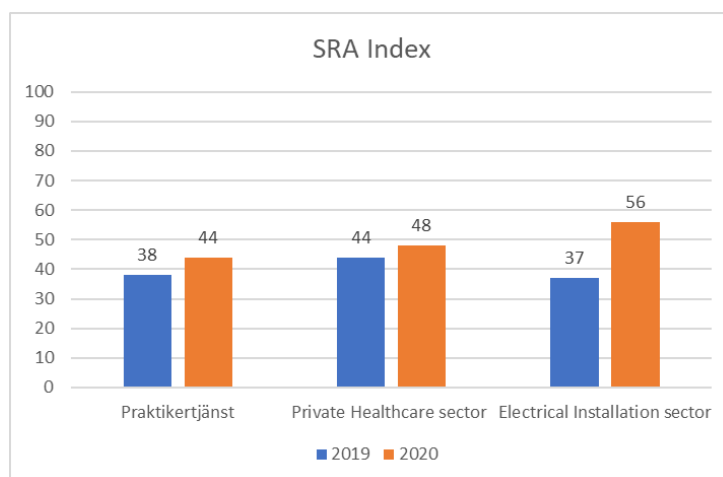


Fig. 2. Illustration of the SRA Index with data from Praktikertjänst, Private Healthcare sector and the Electrical Installation sector. Data for 2019 and 2020.

Fig. 2 shows an illustration of how the SRA Index can be presented, enabling comparisons within the company as well as between industrial sectors over time.

4 Discussion

4.1 Discussion of results

In this, still ongoing, project a method for calculating and visualizing a key performance indicator, the SRA Index, has been developed. It displays the proportion of the least severe type of work environment deviations, the risk observations, in relation to

the sum of the three types of WE deviation often used in deviation report systems, where the other two types are near misses and injuries (accidents and work related illnesses). The SRA Index is intended as a support for management teams to support their informed decision making regarding the WE and its effects on the company. Although risk observations are common to report, as best to our knowledge, there is little or no research support about the effects that reporting risk observation contributes to reduced injuries, in a similar way as reporting near misses does [16]. The literature study resulted in finding risk awareness literature related to traffic safety [22], as well as data protection in the Scopus searches and risk awareness in catastrophe medicine in PubMed. Research on the effect that reporting risk observations has on the frequency of injuries is needed. Follow-up studies of the effects of implementing the SRA Index are suggested.

During the development of the SRA Index examples from different companies show that different companies use different definitions of the term “accident” in their sustainability report. For example, some companies classify only accidents that lead to sick-leave or death as accidents, while others also include accidents with no sick-leave. It is important that the risks and the deviations are “handled” in the same way to make it possible to compare results within the company and also benchmark the own company’s result in relation to others. Greig et al. [22] found that organizations need guidance on assessing and reporting the status of their work environment and identified a need for improved standardization to report WE. The SRA Index provides a standardized way to measure and present the results and enables comparisons between companies regardless of company size and type of sector.

Although the SRA Index is not launched yet, it has received positive feedback from several types of stakeholders in Sweden, including managers and union representatives.

This way of defining and calculating a work environment related KPI and visualizing it could be used for presenting also other results in this type of format. Calculating and presenting different WE KPIs in the same way as the SRA Index could be a way to standardize WE data reporting.

The SRA Index is a KPI related to the severity of WE deviations, which reflects, at least to some extent, the risk awareness within an organisation. However, it should be noted, that although the SRA Index “catches” reported data regarding the three WE deviation types, it does not display all relevant aspects of an organisations risk awareness.

As mentioned in the results section, the health-care company’s management perceives that the SRA-index enables them to make informed decisions that can at least to some extent affect the risk awareness in a positive direction within the organisation. However, to investigate if this is the case, follow-up studies are needed. As mentioned above it should be investigated if there is a relationship between risk observations and the more severe types of work environment deviations.

The choice of including “sustainable” in the index’s name was motivated by several factors. For one, work environment deviation reports are mandatory to include in the sustainability report. Thus, the index name is intended to signal that it can be used in forming these reports. In addition, *if* the SRA Index is implemented at a considera-

ble amount of organisations and *if* evaluations of the effects of using it show that the number of reported risk observations increase and the numbers of injuries decrease the method proposed here may contribute to reduce work related injuries and support the development of sustainable jobs and working lives. Thereby it may also contribute to achieving several of the United Nation Sustainable Development Goal (SDG), such as No. 8, “Decent work and economic growth” and SDG No. 3, “Good health and well-being” [23]. It also then contributes in the work to achieve the goals in the Swedish Government's new work environment strategy 2021 [24].

4.2 Future work

Further development within the current project includes clear instructions and visualisation on how to insert input data regarding time span for which the SRA Index is calculated, as well as the scope of the data (e.g. a work station, a department or a whole company). The next steps in the project include finishing the development of the SRA Index and the Risk Awareness Triangle, and thereafter disseminate the method, support and follow its implementation and thereafter evaluate the results. Validation studies in which the SRA Index is compared with safety culture measures are suggested.

In this project the initiating company's need for a method displaying the WE deviations and their engagement affected the development of the model.

5 Conclusions

The objective of this project is to develop a method for calculating and visualizing a work environment KPI related to the severity of WE deviations. Although the project is still ongoing, such a method has been developed in form of the Sustainable Risk Awareness Index (the SRA Index) and visualized with the Risk Awareness Triangle. Initial feedback from users is positive and there is an articulated interest for the method from stakeholders from different companies and organisations. The management team at the company initializing the project perceive that the method fills the identified gap and provides the management with a usable tool for systematic work environment overview and that it supports their informed decision-making. Once the development is finished and the method launched the dissemination, implementation and evaluation phases will follow. One important research topic is to evaluate what, if any, effects the implementation of the SRA Index has on risk awareness and in a larger perspective, risk management.

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