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Measuring operational performance of OSH management system – A demonstration of AHP-based selection of leading key performance indicators

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ABSTRACT

Occupational safety and health management systems (OSH MSs) have been implemented in numerous enterprises worldwide since the mid-1980s. While stakeholders still have expectations on better prevention of occupational injuries and diseases, and on improving the working conditions, it suggest that new approaches are now needed to ensure OSH MS effectiveness, including development of new methods that would facilitate measurement of OHS MS operational status aimed at the genuine improvement of OSH management practices. A review of literature on leading pro-active safety performance indicators (PPIs) provided a rationale for a concept to elaborate a relatively small number of key performance indicators (KPIs) for measuring OSH MS operational performance. As a basis for this process an initial set of 109 PPIs was developed, composed of 20 sub-sets assigned respectively to individual OSH MS components. Next, for the selection of KPIs the method of the Analytic Hierarchy Process (AHP) was employed. The ranking and prioritization of leading performance indicators was made in relation to a set of SMART (Specific, Measurable, Achievable, Relevant and Time-bound) criteria.

The objective of this paper is to demonstrate the application of the AHP method for the selection of leading KPIs for measuring OSH MS operational performance. The proposed set of KPIs should be tailored to specific conditions of an enterprise, such as the size, industry sector, types of occurring hazards, or the maturity of OSH management processes.

1. Introduction

1.1. Some remarks on the effectiveness of OSH management systems

Since the mid-1980s, an intensive development of concepts and models of OSH management systems (OSH MSs) has been observed, which is reflected *inter alia* by the adoption and dissemination, at an international level, of normative documents such as the International Labour Organization guidelines ILO-OSH 2001 (ILO, 2001) or the OHSAS 18001 specifications (BSI, 1999, 2007), which provide detailed, but non-mandatory, requirements for designing, implementation and conformity assessment of OSH MSs. The concept of these approaches were developed in response to the needs of enterprises and other stakeholders seeking to manage the OSH area in a more consistent and effective manner. They were ultimately aimed at the reduction of a number of accidents at work, near misses and occupational diseases, and consequently, the reduction of associated economic losses.

However, after over 20 years of the world-wide proliferation of OSH MSs no conclusive and sound evidence has been obtained that such systems are effective in terms of preventing and reducing the number of occupational accidents and diseases. What should be particularly referred to here are the results of a systematic analysis of scientific literature on the OSH MS performance as carried out by the team of the Canadian Institute for Work and Health (Robson et al., 2007), which showed that there was no sufficient evidence confirming the performance of OSH MSs, and that therefore OSH MSs were to be neither recommended nor objected to. A review of literature as conducted for OSH MS performance (e.g. publications by Nielsen, 2000; Zwetsloot, 2000; Drais, 2005; Drais et al., 2008; Calvert, 2009; Rocha, 2010; Granerud and Rocha, 2011; Hohnen and Hasle, 2011; IOSH, 2011; Borys et al., 2012; Gallagher and Underhill, 2012; Zwetsloot, 2013a) indicates that the main reason for such a state of affairs is neither the very concept of systematic OSH management nor the structure of system models, but too formal, and frequently bureaucratic and paperwork-intensive

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approach of numerous enterprises, certification bodies and auditor teams to ensure compliance of such systems with relevant criteria, without taking adequate consideration of the safety and health performance aspect of those systems. Furthermore, despite several attempts to develop and implement advanced tools to support OSH MS auditing (e.g. HSA, 2006; Mughal, 2007; Costella et al., 2009; BSC, 2013), there is still a need for further research regarding the measurement properties of OSH management audits (Robson and Bigelow, 2010; Robson et al., 2012).

According to some studies a low level OSH MS performance is related to auditors' insufficient knowledge and competence in the domain of OSH (Blewett and O'Keeffe, 2011), and to the absence of verification and validation of auditors' competencies (Dellacherie, 2010). It is also claimed that OSH MS auditors focus on checking on the formal compliance of system procedures with relevant criteria, rather than on getting to the core of technical issues, human factors, and the relationships between employees and employers, which actually provide a foundation of actions for the benefit of OSH (Fernández-Muñiz et al., 2012). In particular, with regard to the OSH MS audits, Blewett and O'Keeffe (2011) call straight out for the re-conceptualization of their role, since the main focus should be on the development of healthy and safe working conditions, and not on auditing the system.

Therefore, the above considerations lead to the conclusion that it is necessary to search for new solutions and arrangements that would improve the performance of OSH MS, which would consequently result in a positive contribution to greater acceptance of these systems among employers, employees and other stakeholders.

1.2. The concept of OSH management based on performance measurement

A recommended approach to the development of an instrument demonstrating the effectiveness of OSH MS is the use of measurable or qualitative performance indicators, which should allow for an on-going comparison of the existing performance level with the previously determined target level. This approach is already considered in current OSH MS models, as provided e.g. by ILO-OSH 2001 guidelines or OHSAS 18001 specifications. Although the mentioned documents include certain clauses on establishing and implementing procedures providing for proactive measures for monitoring OSH MS performance, it seems that those clauses are not sufficiently well interpreted or followed by managers, which can be related to a low level of OSH MS effectiveness, as it claimed in Section 1.1.

According to Cambon et al. (2005), three main approaches to the measurement of OSH MS performance may be basically distinguished: (1) result-based approach, (2) compliance-based approach, and (3) process-based approach. In the first, result-based approach, the so-called lagging indicators (also referred to as *outcome* or *negative* indicators) are applied for performance measurement. Whereas, for the two remaining approaches, leading indicators (also referred to as *pro-active*, *positive* or *predictive* indicators) are applied. Leading indicators (further referred to as PPIs[1]) being applied for the evaluation of system compliance with a given specification form a group of *structural performance indicators*, while those applied for the evaluation of effectiveness of internal system processes are referred to as *operational performance indicators*.

In the relevant literature, leading performance indicators are often confronted with lagging indicators, and numerous papers have been dedicated to the selection and functions of various types thereof (e.g. a special edition of Safety Science, issue 4 of 2009, which concerns the subject matter of process safety indicators). The lagging safety indicators usually are based on such data as the frequency of accidents at work and occupational diseases, accident- or sickness-related absence from work, the number of near misses, etc., but the usefulness of their application for the evaluation of OSH MS performance is challenged by numerous scholars (e.g. Mearns et al., 2003; Hollnagel, 2008; Herrera and Hovden, 2008; Juglaret et al., 2011; Pawłowska, 2013; Zwetsloot, 2013b). These indicators are based on data being both historical and delayed in time in relation to the occurrence of reasons affecting the values being measured, which, in practice, renders an appropriately rapid response and the introduction of corrective actions impossible. Moreover, in many enterprises, especially the small ones, accidents do not happen often, therefore no data are available for determining the indicators' values, even though employees may indeed be exposed to adverse working conditions. Whereas, changes in PPIs take place in advance of those in lagging indicators, and thus allow an earlier and efficient intervention in case of either possible non-compliances in the management system (structural performance) or weak points, disturbances or the absence of expected results in the sphere of operational performance, even before negative consequences of that situation, namely accidents at work or harmful exposures of employees, occur.

In the case of structural performance evaluation, the approach in question is not fundamentally different from the classic methods of auditing OSH MSs. This is due to the fact that structural performance indicators are of qualitative nature, and the application thereof comes down *de facto* to either checking as to whether individual components of the system are properly designed or evaluating the extent to which system procedures are implemented and being followed in the enterprise.

In turn, operational performance indicators provide information on the status of individual processes within the management system. As such, when tracked over time, such indicators provide information on progress of change within the management system and assist in forecasting future status and planning. Examples of such indicators include: the number of work stations at which risk assessment has been carried out or updated; percentage of employees trained in OSH in a given period; percentage of safety checks on machines and installations, as compared to the plan, etc.). Monitoring of such indicators' values allows getting a picture of how a given system operates at the shop-floor level, in contrast to the results of structural performance measurement, which actually tend to only indicate what the system consists of Cambon et al. (2006). Therefore, for the purpose of this study, it was assumed that in search of solutions allowing the evaluation of the operation of OSH MSs to be carried out better than before, one should mainly focus on making use of operational PPIs.

The mentioned assumption is fully in line with the recent concepts and methods of *resilience engineering*. According to its foundations, formulated *inter alia* by Hollnagel et al. (2006, 2012), organisational resilience is the "intrinsic ability of an organisation (or system) to adjust its functioning prior to or following changes and disturbances to continue working in the face of continuous stresses or major mishaps". Taking that concept into account the aim of operational PPIs would be to provide early warning signals on any irregularities or faults within OSH MS functioning. Instead of reacting to errors or non-conformities already detected one should in this respect strive to understand normal functioning of the system and to focus on monitoring its changes by means early warning indicators (Herrera and Hovden, 2008; Øien et al., 2011a,b).

The proposed approach does not exclude the need for the discussion and research on roles and potential applications of lagging performance indicators in the domain of OSH. But for the better clarity of concepts and methods presented in this paper a subject

[1] The article assumed that leading performance indicators would be referred to as PPIs (Pro-active Performance Indicators). Referring to them as LPIs (Leading Performance Indicators) would be confusing since the latter abbreviation might also relate to Lagging Performance Indicators.