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Total Safety Management: Principles, processes and methods

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ABSTRACT

Safety management systems (SMS) are changing from a prescriptive style to a more 'self-regulatory' and 'performance oriented' model that is more proactive, participative and better integrated with business activities. So far, the integration of safety with other management systems (e.g., quality, environment and productivity) has been addressed either at a strategic level or a standardization level (e.g., cross referencing across ISO 9001, ISO 14000, OSHA 18001). This article looks at the coordination between business processes that are common to these management systems and proposes several principles of Total Safety Management on the basis of earlier studies and a three-year experience with a European project (Total Operations management of Safety Critical Activities). To realize the TSM principles, four safety processes are proposed that are compatible to ISO 31000 and CCPS (2008) standards. The TSM principles and processes are furnished with practical methods and tools to demonstrate their values to the organization. Although the TSM approach takes a system view of safety, other approaches relying on complexity theory can be mapped onto TSM and provide a basis for further developments.

1. Introduction

Over the recent past, the incidence of major mishaps, crises and accidents have made it clear that organisations must still improve their capabilities to address safety through the application of a systematic and proactive approach. Whereas traditional safety programs were mostly reactive and implemented on the basis of incident investigations, or as a result of enforcement, new integrated and proactive approaches have been endorsed by safety advisory and regulatory bodies. Safety management systems (SMS) are changing from a prescriptive style to a more 'self-regulatory' and 'performance oriented' model (Frick and Wren, 2000; Bluff, 2003) that is more proactive, participative and better integrated with business activities. To this end, several proposals have been made in safety management systems (e.g., Strategic Safety Management and Integral Health Management) and international standards (e.g., ISO 31000).

For many years, the Total Quality Management principles have provided a basis for developing several health and safety systems. Building on TQM, Goetsch (1998) introduced the concept of Total Safety Management (TSM) as a performance-oriented approach that gives organisations a sustainable advantage in the marketplace by establishing a safe work environment that is conducive to peak performance and continual improvement. The fundamental elements of TSM include a strategic approach to safety, emphasis on performance assessment, employee empowerment, reliance upon robust methods of risk analysis, and continual improvement. However, more specific and practical organizational processes for total safety have been proposed by the Strategic Safety Management (SSM) approach that emphasized an integration of safety into the corporate strategy and the demonstration of a business value of safety (Rahimi, 1995; Zou and Sunindijo, 2015). In a total safety approach, business processes are integrated with safety engineering techniques within a continuous improvement culture that affects all levels in the organization. In the SSM approach, the safety target becomes the analysis of 'work processes' rather than the analysis of isolated safety-critical activities. A work process is a complex web of interdependencies between physical entities, information, communication and knowledge channels and decision-making activities. Hence, by analyzing what is wrong with a work process, safety practitioners can evaluate the entire system and cater for safety, quality and productivity. The SSM is deeply ingrained with participative safety management in the form of self-managed teams as advocated by TQM approaches. To exploit operational feedback, the SSM relies on performance measures that relate to work processes rather than work outputs (e.g., incident and injury rates). These SSM principles have been applied by Zou and Sunindijo (2015) in the development of safety programs for the construction industry.

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In the Integral Health System (IHM), the value of health is seen as a key element of corporate policy in addition to the reduction of incidents and their associated costs (Zwetsloot, 2003; Zwetsloot and van Scheppingen, 2007). The IHM principles have been based on earlier TQM approaches and Business Excellence Models which provide a good basis for integrating safety with quality and other business processes. The IHM approach requires a shift from solving safety problems and reducing risks to the positive business values that safety can bring to the organization. The focus is no longer on risk reduction, medical problems or product safety but on a combination of them and their relationships to organizational and business development. In this sense, health and safety is associated with business values which increases its strategic role.

The integration of safety with quality, environment and productivity can be done at different levels, according to Jorgensen et al. (2006):

- *Strategic and cultural integration* in order to enhance learning, continuous performance improvement, stakeholder involvement and participative management;
- *Coordination of common business processes* between safety, quality and environment (e.g., policy, planning, procedures, audits, control of non-compliance, preventive and corrective actions and management reviews);
- *Correspondence of different standards* (e.g., ISO 9001; ISO 14000; OHSAS 18001) with cross-references and possibly a common information system.

The earlier SSM and IHM approaches have mainly addressed the strategic and cultural integration and, to a lesser extent, the coordination of common business processes. In general, total safety would include an adaptive interaction of safety culture and SMS in order to respond to the uncertainties of the work environment. The correspondence of standards usually falls outside the remit of safety advisory bodies but has been taken on board by many safety consulting firms aiming to develop informational systems that facilitate transfer of data and analysis of compliance across standards. In addition, there are a growing number of studies focusing on conceptual frameworks and methods to map standards of safety, quality and environment in an Integrated Management System (e.g., Santos et al., 2011; Hamidi et al., 2012; Bragatto et al., 2007).

In fact, a great deal of literature has addressed many topics on the matter of Integrated Management Systems (IMSs) and several reference publications are available. The most compelling reasons to implement IMSs include promotion of synergies among standards, elimination of conflicts, avoidance of redundant procedures, and reduction of third-party audits (Bernardo et al., 2015; Zeng et al., 2011; Almeida et al., 2014). Their common management philosophy (Plan, Do, Check & Act cycle) has provided a useful basis for integration of their management standards. The major obstacles and difficulties in implementing IMSs usually concern, resources limitation, lack of relevant expertise to cover all system requirements, optimization of resources to a specific area and the traditional philosophy of having competing staff to handle the industrial management areas (Simon et al., 2012; Karapetrovic and Casadesus, 2009; Zutshi and Sohal, 2005). A growing body of research has focused on new methodologies for overcoming these obstacles in the integration of management standards (Domingues et al., 2016; Rebelo et al., 2016).

Building on the advances in strategic and cultural integration, further studies are now needed to examine the coordination of common processes to support the integration of safety with other business activities and demonstrate the benefits of Total Safety Management. Therefore, the aim of this paper is to consider the principles of TSM and examine how safety can be integrated with other business processes that may be used for quality, productivity and design. The first part presents the five principles of TSM whilst the second part describes an integration of safety processes. The third part presents an overview of the results of a European project (Total Operations management of Safety Critical Activities) that developed specific tools to manage a Total Safety Management approach. Detailed descriptions of some of the TSM tools of the TOSCA project are presented in a number of papers published in this special issue of Safety Science.

2. Principles of Total Safety Management

Over the past two decades, a number of risk management (RM) standards have been developed to meet new demands from industry and higher expectations from regulators for managing risks (e.g., AS/NZS 4360; FERMA; COSO; ISO 31000). Most RM standards share common principles and processes as they require systematic methods in safety oversight, understanding of acceptable risk tolerances (ALARP), formal risk assessment, risk mitigation, communication of risks and review of safety investments.

The new ISO 31000:2009 standard offers principles and guidelines for risk management (RM) and remains widely applicable to industry. It also serves to unite risk management processes with existing standards of quality and environmental management and offers a common approach to address risks without leading to a process of certification. The standard can be used by any public, private or community enterprise, association, group or individual.

ISO 31000 provides general principles for risk management and proposes management processes for implementing a system for managing risks. It can be applied to both industrial safety and project risk management which provides a good basis for elaborating the principles of Total Safety Management. In particular, the principles of effective risk management in ISO 31000 are as follows:

1. Risk management should create and protect business values;
2. RM should be central to the organization's processes;
3. All decision making within the organization involves the explicit consideration of risks and the application of risk management to some appropriate degree;
4. RM should be based on best available information;
5. Continual communication with external and internal stakeholders, including comprehensive reporting of safety performance;
6. RM should be comprehensive and clear about accountability for risks, controls, and risk treatment processes;
7. It should be systematic, structured, and timely applied to critical activities;
8. It should take into account human and cultural factors;
9. It must be dynamic, iterative, and responsive to change;
10. It must facilitate continual improvement of the organization.

The first three principles refer to what has been termed the 'business value of safety' (CCPS, 2008) where all decision making and organizational processes should involve the explicit consideration of risks while risk management provides a capability for creating value for business. The fourth principle suggests that RM should be based on best available information about hazards, available methods and safety measures that have been implemented. This principle on the use of best available risk information is elaborated by the NORSOK Standard Z-013 which proposes an inventory of risk information about hazards, risk acceptance criteria, risk contributing factors, risk assessment tools, and uncertainties or assumptions related to such information. The fifth principle refers to the involvement of external and internal stakeholders in

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