



## Assessing and developing safety management competences

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### Article History

Received 13 June 2017  
Accepted 23 October 2017  
Published 23 March 2018

### Keywords

safety management  
safety leadership  
safety competence  
competence  
development

### DOI:

[10.24840/2184-0954\\_002.001\\_0002](https://doi.org/10.24840/2184-0954_002.001_0002)

### ISSN:

2184-0954

### Type:

Research Article

 Open Access

 Peer Reviewed

 CC BY

### Abstract

Introduction: Assessing and developing managers' safety competence is one method for achieving high safety performance in the organisations. Objectives: The aim of this study is to construct a safety management competence development framework to help organisations in safety promotion. Materials and methods: This study comprises a theory-based construction of the safety management competence development framework and an empirical study in a case organisation. Results: The framework consists of definition of safety management competence requirements, self-assessment of the competence, definition of development needs, and implementation of competence development activities. Conclusions: The framework provides the means for systematically improving managers' safety management competence as an integral part of general management competence development procedures in organisations.

## 1. INTRODUCTION

In recent decades, the organisation, management, and nature of work have changed, and managerial work is further challenged by larger organisational sizes, constant changes, uncertainty, fragmentation of work, and increasing cost pressure (e.g. FIOH, 2013; Viitala, 2005; White et al., 1996). Due to these changes, novel occupational health and safety risks such as psychosocial risks have emerged, and the mental and emotional demands of work have increased (Leka et al., 2011). At all organisational levels, managers have an essential role when organisations develop safety (e.g. Hale et al., 2010; Griffin & Hu, 2013; Rundmo & Hale, 2003; Simola, 2005). Managers' resources, competence, and commitment are important in establishing successful organisational safety and procedures (Conchie et al., 2013; Fruhen et al., 2013; Hale et al., 2010; Hardison et al., 2014; Simola, 2005; Tappura et al., 2017). Managers' commitment to safety can be induced by enhancing the managers' own understanding of their safety tasks and supporting their resources such as competence (Tappura et al., 2017). Due to insufficient safety competence, managers may not be aware of their responsibilities or the organisation's safety policy, procedures, and tools. In addition, managers need leadership skills to maintain safe performance in the workplace. (Carder & Ragan, 2005; Mullen et al., 2017; Tappura & Nenonen, 2016; Tengvall et al., 2017)

To remain aligned with the dynamic needs of the business environment, organisations need to ensure up-to-date competencies (Suikki et al., 2006). Competence is the ability to transform knowledge and skills into practice in a qualified way and to achieve the required level of performance (Boyatzis, 1982; Dreier, 2000; Königová et al., 2012).

In the broadest sense, competence refers to the specific knowledge, experience, abilities, skills, traits, values, attitudes, and behaviour that are necessary for achieving the required level of performance (e.g. Boyatzis, 1982; Königová et al., 2012; Rothwell & Lindholm, 1999). In this study, safety management competence refers to managers' ability to perform safety-related management activities and behaving appropriately for the required safety performance.

Since safety and related demands are increasingly an integrated part of business (EU-OSHA, 2011; Veltri et al., 2013), managers' safety competence should be developed accordingly. Current work life presumes managers have different types of safety management and leadership competencies for ensuring employees' safety at work (Conchie et al., 2013; Hale et al., 2010; Tappura & Nenonen, 2016). In organisations in which safety considerations are vital for the companies' strategy, related objectives should be set (Kaplan & Norton, 2001), and competence requirements should be defined as a part of identifying core competencies (Pralhad & Hamel, 1990; Rothwell & Lindholm, 1999). However, in all organisations, safety management and leadership are part of managing other business activities, and should be closely integrated in general business management in organisations (e.g. EU-OSHA, 2010; Hale, 2003; Simola, 2005; Veltri et al., 2013). Moreover, safety management competence contributes to better safety performance, and, therefore, to business performance (Blair, 2003; Clarke, 2013; Köper et al., 2009; Michael et al., 2006; Wu et al., 2008).

Occupational health and safety (OHS) regulations (in Europe, D 89/391/EEC) provide the foundation for safety management competence requirements, and managers at all levels should be aware of these requirements. The definitions of an effective OHS management system (Frick et al., 2000; Gallagher et al., 2001) and voluntary OHS management systems (such as OHSAS 18001:2007) form another perspective on managers' safety competence needs.

In addition, Biggs & Biggs (2013) developed a safety competency framework for safety critical positions in the construction sector, which included identifying the knowledge, skills, and behaviours required for safety management tasks. Hardison et al. (2014) defined the most important knowledge-based competences of safety management also in the construction the sector. Tappura & Hämäläinen (2012) constructed an outline for safety management training based on literature and two safety management training cases. IOSH (2010) defined the main themes of managing safety training as follows: (1) management accountability for safety, (2) assessing risks, (3) controlling risks, (4) understanding safety responsibilities, (5) identifying hazards, (6) investigating accidents, (7) measuring performance, and (8) protecting the environment. Moreover, the effective safety leadership competencies relating to safety performance were identified in Tappura & Nenonen's (2016) review and Tengvall et al's (2017) study. Furthermore, Tappura et al. (2016) defined safety management tasks at different organisational levels.

Identifying and developing competences are critical strategic factors that ensure organisations' competitiveness (e.g. Königová et al., 2012; Suikki et al., 2006; Viitala, 2005). According to Viitala's (2005) study, in organisations where management development was well organised and connected to strategic management, managers were more aware of their development needs. Therefore, organisations should provide conditions to ensure sufficient competence development (Senge, 1994; Viitala, 2005)

Much of the earlier research concentrated on management and leadership competence development (e.g. Crawford, 2005; Fong & Chan, 2004; Rose et al., 2007; Suikki et al., 2006; White et al., 1996). For example, Suikki et al. (2006) introduced a framework for systematic project management competence development that provided tools for learning as well as a process for developing competences. A few earlier studies focus on leadership training and coaching as a means of developing safety performance (Kaskutas et al., 2013; Kelloway & Barling, 2010; Kines et al., 2010; von Thiele-Schwarz et al., 2016). However, only a few studies have examined safety management and leadership competences (Biggs & Biggs, 2013; Hale et al., 2010; Hardison et al., 2014), and safety management perspective is generally absent in management and HR studies and literature (Zanko & Dawson, 2012)

Competencies can be managed with competency models (Königová et al., 2012; Rothwell & Lindholm, 1999). According to Lucia & Lepsinger (1999), a competency model is a descriptive tool for identifying the knowledge, skills, abilities, and behaviour needed to perform effectively in an organisation. Competency models can serve as tools for helping managers in self-reflection, identifying development needs, and developing and building collective comprehension concerning management in a company (Viitala, 2005). In this study, the competence development framework is used as a broader concept that includes competence requirement identification, competence assessment, and development activities.

Competence development can be defined as the general development of knowledge, understanding, and cognition for a specific domain in a person (Hyland, 1994), here, safety management competencies. Competence development typically involves formal and informal learning, and is not related to specific types of learning activities (Schoonenboom et al., 2007).

Management competencies are generally learned through formal training, induction, and work experience (Suikki et al., 2006), and training is emphasised in high-performance management practices (Pfeffer, 1998). According to Fong & Chan (2004), on-the-job experience, on-the-job training, and experiential learning are considered to be the most effective methods for developing managers' competence. Tappura & Hämäläinen (2011) suggested that effective safety training for managers includes joint discussions with colleagues, demonstrations, and hands-on techniques to strengthen managers' commitment to safety procedures. Fruhen et al. (2013) proposed that senior managers' training and guidance should focus on their problem-solving abilities and perception of others in order to support them in demonstrating safety commitment. However, leadership skill development needs to go beyond training and self-directed learning since it involves a complex mix of behavioural, cognitive, and social skills that require different learning experiences (Lord & Hall, 2005).

Management development studies have suggested that improving self-knowledge is the basis for all true management development (Pedler et al., 1986; Viitala, 2005), and managers' own interpretation of their competence development needs should be supported in organisations (Viitala, 2005). A competence assessment is used to communicate goals and expectations, to give feedback on the current competence level, and to identify development needs (Bergman & Moisio, 1999). Thus, the competence assessment is a basis for the competence development activities. The competence assessment concept is based on cognitive learning theories, in which the student is seen as an active participant sharing responsibility for the learning process and practices self-evaluation (Baartman et al., 2007; Birenbaum, 1996). Relevant competence assessment methods include behavioural assessment, simulations, and self-assessment. However, organisational support, reflection, and mentoring must accompany the development of assessment programs (Epstein & Hundert, 2002).

These observations led to the proposition that safety management competences must be taken into account in general management competence development in organisations. The main target of this study is to construct a safety management competence development framework to help organisations in safety promotion. The framework, based on previous studies and validated in a case organisation, provides the means for systematically improving managers' safety management competence as an integral part of general management competence development procedures.

## 2. MATERIALS AND METHODS

This study comprises a theory-based construction of the safety management competence development framework and empirical reflections. Thus, the study is located in the normative area of business studies. The study uses the qualitative approach (Denzin & Lincoln, 2011) since it is interpretative. The study is descriptive and does not state an explicit hypothesis. The theoretical part of the study was conducted as a review of the relevant literature to chart the general competence development models and their applicability to safety management as well as the safety management competence requirements.

The empirical part of the study was conducted in a Finnish technical safety service organisation of about 200 employees. The employees work in varying and demanding environments, including office and customer sites in almost all industrial sectors. Thus, the safety management competence requirements for the managers are extensive. The motivation of the study in the case organisation arises from the need to increase line managers' safety management competence, to systematically assess it, to discover individual and organisational competence development needs, and to integrate safety issues into general competence development

The framework was constructed based on the existing knowledge and the heuristic research process. First, a preliminary list of general safety management competence areas was produced based on the occupational safety regulations and previous literature by the researcher (see Tappura & Hämäläinen, 2011). Second, the OHS and human resource professionals in the organisation (OHS committee) were interviewed (n = 7), and the list was completed based on this focus group interview.

Third, a self-assessment of ten line managers (a total of 18 line managers) was conducted using the agreed 17 competence areas. An assessment form was produced for the self-assessment. Managers were asked how well they knew each matter in question with four statements: (1) I know well, (2) I know fairly well, (3) I don't know, and (4) This doesn't apply. In addition, they answered an open-ended question about their safety management competence development needs. The self-assessment is used as an assessment method in this study due to its reflective nature.

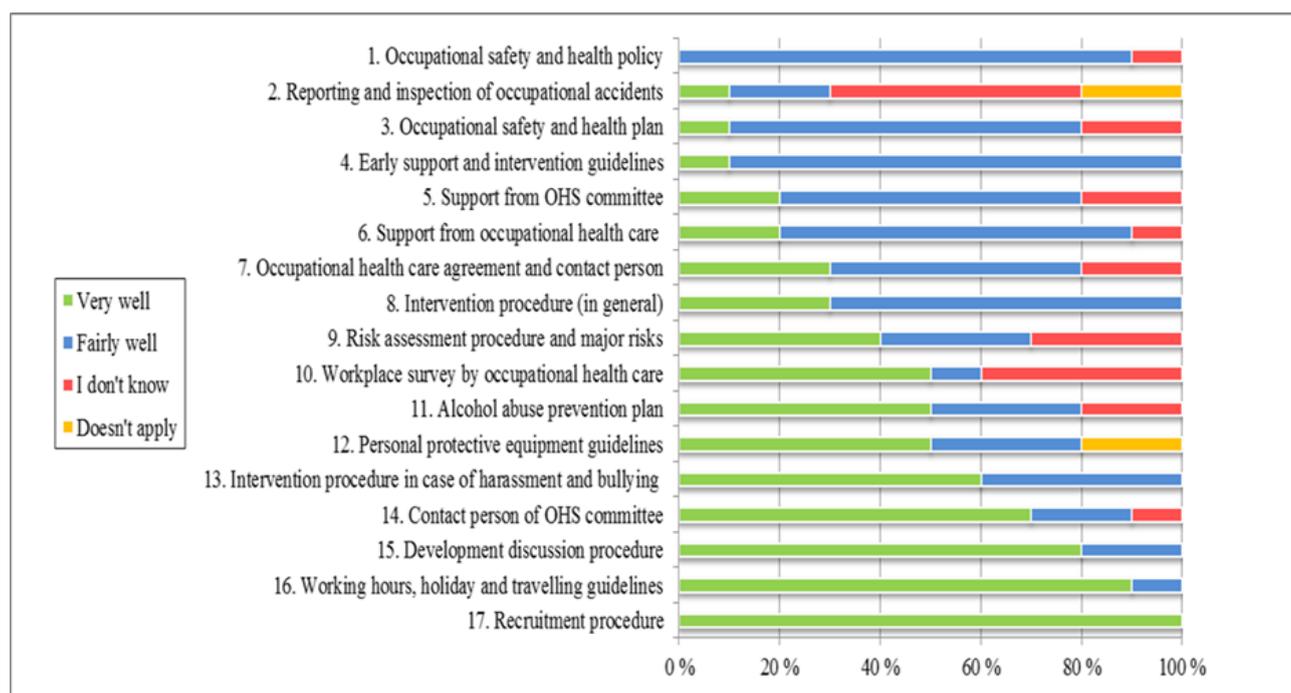
The self-assessment communicates the safety management goals and competence requirements, as well as provides feedback on the current safety management competence level and development needs (Bergman & Moisiö 1999). In addition, self-assessment and reflection encourage managers to discover their individual development needs and engage them in the development process.

Based on the self-assessment, the main safety management competence development needs were identified and presented to the management team of the organisation. The safety management competence development activities and further competence evaluation were the responsibility of the case organisation and, thus, are not available for this study.

### 3. A FRAMEWORK FOR ASSESSING AND DEVELOPING MANAGERS' SAFETY COMPETENCE

First, a preliminary list of 13 general safety management competence areas was defined based on the employers' regulatory OHS requirements and previous literature. The following issues were identified based on the literature (Tappura & Hämäläinen, 2012): (1) OHS regulations, (2) OHS organisation, (3) occupational health care organisation, (4) OHS and cooperation policies and procedures, (5) monitoring the physical and psychosocial work environment, (6) physical and psychosocial hazard identification and risk assessment, (7) occupational injuries and near-miss reporting, investigation, and subsequent learning, (8) measures for remedying harassment or other inappropriate treatment, (9) intervention procedure in OHS violations, (10) safety measurement and follow-up, (11) safety communication, (12) early support model, and (13) management support (e.g., orientation, working instruction, training, peer support).

Second, the preliminary list was presented to the OHS and human resource professionals (OHS committee) of the case organisation. The competence areas were discussed and supplemented in the committee. A final version of 17 safety competence areas (see Figure 1) was accepted.



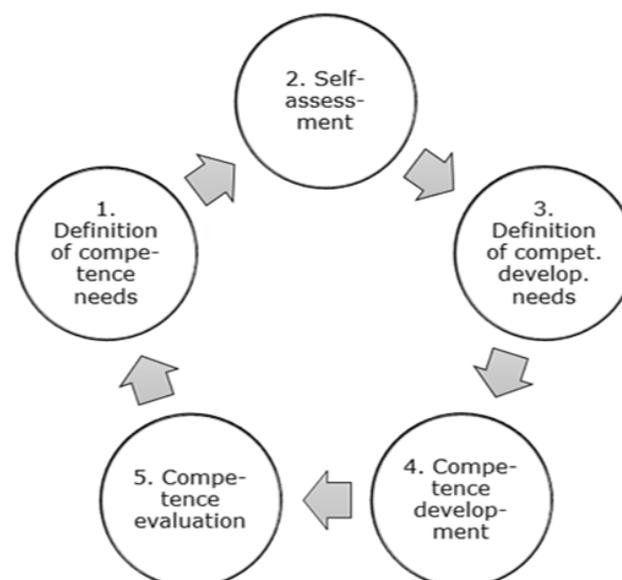
**Figure 1.** The safety competence areas and results of the managers' safety competence self-assessment in relation to the question: "How well do you know the matter in question?" (n = 10).

Third, a self-assessment was carried out with ten line managers. The percentages of each competence area were calculated based on the assessment whether the managers knew each competence area very well, fairly well or not at all. According to the results, the major organisational development needs are related to the OHS policy (100 % did not know very well), reporting and inspection of occupational accidents (90 % did not know very well), OHS plan (90 % did not know very well), early support and intervention guidelines (90 % did not know very well) and support from OHS committee and occupational health care (80 % did not know very well) (see Figure 1).

During the self-assessment, the managers reflected on and identified individual development needs, and, thus, started the learning process. The self-assessment identified the main individual and organisational competence development needs. The results were presented and discussed in the management group. Based on the results, appropriate individual and organisational competence development actions were planned and integrated into the general competence development activities, for example, planning the general management training.

Based on the results, appropriate individual and organisational competence development actions were planned and integrated into the general competence development activities and management training. The competence development activities, however, were not studied in this study.

Based on the previous phases, the framework was constructed to increase managers' safety management competence and to integrate safety issues into managers' general competence identification, assessment, and development. The framework is based on the previous literature and consists of the following phases (see Figure 2): (1) definition of safety management competence requirements and needs, (2) managers' self-assessment of their safety competence, (3) definition of organisational and individual safety competence development needs and focus areas, (4) planning and implementation of related safety competence development activities, and (5) evaluation of the managers' safety competence.



**Figure 2.** A framework for assessing and developing managers' safety competence.

Identifying safety management competence requirements was chosen as the basis for the framework. In the first phase, general and organisational safety competence requirements are defined. In the second and third phases, the relevant issues are self-assessed to define the major development needs at the organisational and individual levels. When the assessment is carried out as a self-assessment, the managers reflect on their development needs directly. Moreover, the self-assessment is a good way of improving the managers' commitment to competence development activities. In the fourth phase, safety management competence development activities are planned based on the development needs at the individual and organisational levels. When possible, the development activities are integrated in the general management competence development activities.

In the fifth phase, the evaluation of the adequacy of managers' safety competence is also integrated in the general management competence evaluation. Safety competence can be evaluated, for example, in annual development discussions or work climate surveys. Managers' safety competence needs should be evaluated and updated according to the changing regulatory and organisational safety requirements and procedures.

#### 4. DISCUSSION

In this study, general safety management competencies were defined, and a framework for assessing and developing managers' safety management competence was constructed. The framework provides a basis for managers' safety management competence identification, assessment, and development as an integrated part of managers' general competence development. Moreover, it can be utilised in organisational-specific competence models. The framework takes the general development activities into account and complements existing activities with relevant safety issues. For example, identifying managers' safety competence could be part of competency models (Königová et al., 2012) and identifying core competencies (Pralhad & Hamel, 1990; Viitala, 2005). Self-assessment could be part of the general development discussion, where safety objectives, related competence requirements, and development needs could be discussed as part of other management responsibilities.

The managers' own interpretation of their safety competence needs should be taken into consideration since it reflects their motivation to develop as well as deficiencies in competence development procedures (Viitala, 2005).

Managers' safety competencies clearly overlap with the existing conception of "good" management behaviour and therefore should be integrated into the overall management practices (HSE, 2007). However, the OHS management perspective is generally absent in management and HR studies and literature (Zanko & Dawson, 2012). Thus, safety competence development activities should be an integral part of general management competence development activities and their content (Schoonenboom et al., 2007; Suikki et al., 2006). Moreover, managers' leadership skills should be emphasised to improve safety performance (Mullen et al., 2017; Tappura & Nenonen, 2016; Tengvall et al., 2017).

This study exploited only one case organisation and limited number of informants. Hence, the results were based on relatively small data set and strong conclusions cannot be drawn from the data. In the future, more extensive studies on the subject would be valuable in order to generalise the findings.

Safety management competence requirements for the managers are extensive, and well applicable to managerial work in many industrial sectors. However, the emphasis on physical and psychosocial aspects of the work environment as well as industrial-specific safety requirements varies between organisations. Thus, organisational and industrial-specific competence requirements should be considered when the framework is applied. For example, in the construction sector such requirements have been defined (Biggs & Biggs, 2013; Hardison et al., 2014). In the future, the framework and its applicability to other industrial sectors should be evaluated.

After the competence development activities, safety management competence should be evaluated on a regular basis, for example, in annual development discussions or work climate surveys. Managers' safety competence needs should be evaluated and updated according to the changing regulatory and organisational OHS requirements and procedures.

The safety literature and practical experiences provide the foundation for the framework. However, such a framework requires continuous evaluation and reflection to develop competence effectively (Suikki et al., 2006) and to be utilised in competence models.

#### 5. CONCLUSION

Safety management is an integral part of management activities in organisations and safety management competencies should be developed accordingly. This article suggests a framework for assessing and developing managers' safety management competence in different industrial sectors. The framework provides the means for systematically improve safety management competence as an integral part of managers' general competence development in organisations.

The suggested framework enables better organisational support for managers when developing their safety management competencies and commitment to safety. Moreover, the assessment and development activities influence managers' perceptions of and attitudes toward safety and encourages their commitment to safety.

## REFERENCES

- Baartman, L.K.J., Bastiaens, T.J., Kirschner, P.A. & van der Vleuten, C.P.M. (2007). *Evaluating assessment quality in competence-based education: A qualitative comparison of two frameworks*. *Educational Research Review* 2(2), 114-129.
- Bergman, T. & Moisio, E. (1999). *Käytännön kokemuksia osaamisen hallinnan kehittämisestä* (in Finnish). *Työn Tuuli* 2/1999.
- Biggs, H.C. & Biggs, S.E. (2013). *Interlocked projects in safety competency and safety effectiveness indicators in the construction sector*. *Safety Science* 52, 37-42.
- Birenbaum, M. (1996). *Assessment 2000: Towards a pluralistic approach to assessment*. In M. Birenbaum, M. & Dochy, F.J.R.C. *Alternatives in assessment of achievement, learning processes and prior knowledge*, 3-29. Boston: Kluwer Academic Publishers.
- Blair, E. (2003). *Culture & leadership: Seven key points for improved safety performance*. *Professional Safety* 48(6), 18-22.
- Boyatzis, A.R. (1982). *The Competent Manager: A Model for Effective Performance*. New York: J. Wiley.
- Carder, B. & Ragan, P. (2005). *Measurement matters. How effective assessment drives business and safety performance*. Milwaukee, Wisconsin: ASQ Quality Press.
- Clarke, S. (2013). *Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours*. *Journal of Occupational and Organizational Psychology* 86, 22-49.
- Conchie, S.M., Moon, S. & Duncan, M. (2013). *Supervisors' engagement in safety leadership: Factors that help and hinder*. *Safety Science* 51, 109-117.
- Crawford, L. (2005). *Senior management perceptions of project management competence*. *International Journal of Project Management* 23, 7-16.
- D 89/391/EEC. *Council directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work*.
- Denzin, N.K. & Lincoln, Y.S. (2011). *Introduction: the discipline and practice of qualitative research*. In Denzin, N.K. & Lincoln, Y.S. *The SAGE handbook of qualitative research*, 1-19. Thousand Oaks: SAGE Publications Inc.
- Dreier, A. (2000). *Organizational learning and competence development*. *The Learning Organization* 7(4), 52-61.
- Epstein, R.M. & Hundert, E.M. (2002). *Defining and assessing professional competence*. *Journal of the American Medical Association* 287(2), 226-235.
- EU-OSHA (European Agency for Safety and Health at Work) (2010). *Mainstreaming OSH into business management*. Luxembourg: Office for Official Publications of the European Communities.
- EU-OSHA (European Agency for Safety and Health at Work) (2011). *Healthy workplaces. Working together for risk prevention*. Luxembourg: Publications Office of the European Union.
- FIOH (Finnish Institute of Occupational Health) (2013). *Työ ja terveys Suomessa 2012. Seurantatietoa työoloista ja työhyvinvoinnista* (in Finnish). Tampere: Tammerprint Oy.
- Fong, P.S.W. & Chan, C. (2004). *Learning behaviours of project managers*. *Proceeding of the IRNOP VI, Turku, Finland*, 200-219.
- Frick, K., Jensen, P., Quinlan, M. & Wilthagen, T. (2000). *Systematic Occupational Health and Safety Management - An Introduction to a New Strategy for Occupational Safety, Health and Well-being*. In Frick, K. et al. *Systematic OHS Management: Perspectives on an International Development*, 1-14. Amsterdam: Elsevier.
- Fruhen, L.S., Mearns, K.J., Flin, R. & Kirwan, B. (2013). *Skills, knowledge and senior managers' demonstrations of safety commitment*. *Safety Science* 69, 29-36.
- Gallagher, C., Underhill, E. & Rimmer, M. (2001). *Occupational Health and Safety Management Systems: A Review of their Effectiveness in Securing Healthy and Safe Workplaces*. Sydney: National OHS Commission.
- Griffin, M.A. & Hu, X. (2013). *How leaders differentially motivate safety compliance and safety participation: The role of monitoring, inspiring, and learning*. *Safety Science* 60, 196-202.
- Hale, A.R. (2003). *Safety Management in Production*. *Human Factors and Ergonomics in Manufacturing* 13, 185-201.
- Hale, A.R., Guldenmund, R.F., van Loenhout, P.L.C.H. & Oh, J.I.H. (2010). *Evaluating safety management and culture interventions to improve safety: Effective intervention strategies*. *Safety Science* 48(8), 1026-1035.

- Hardison, D., Behm, M., Hallowell, M.R. & Fonooni, H. (2014). *Identifying construction supervisor competencies for effective site safety*. *Safety Science* 65, 45-53.
- HSE (Health and Safety Executive) (2007). *Management competencies for preventing and reducing stress at work. Identifying and developing the management behaviours necessary to implement the HSE Management Standards*. London: Health and Safety Executive.
- Hyland, T. (1994). *Competence, Education and NVQs: Dissenting Perspectives*. London: Cassell.
- IOSH (Institute of Occupational Safety and Health) (2010). *Managing safely. Don't just train... inspire! UK*: IOSH Services Ltd.
- Kaplan, R.S. & Norton, D.P. (2001). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*. Boston, MA: Harvard Business School Press.
- Kaskutas, V., Dale, A.M., Lipscomb, H. & Evanoff, B. (2013). *Fall prevention and safety communication training for foremen: Report of a pilot project designed to improve residential construction safety*. *Journal of Safety Research* 44, 111–118.
- Kelloway, E.K. & Barling, J. (2010). *Leadership development as an intervention in occupational health psychology*. *Work Stress* 24, 260–279.
- Kines, P., Andersen, L.P.S., Spangenberg, S., Mikkelsen, K.L., Dyreborg, J. & Zohar, D. (2010). *Improving construction site safety through leader-based verbal safety communication*. *Journal of Safety Research* 41, 399–406.
- Königová, M., Urbancová, H. & Fejfar, J. (2012). *Identification of Managerial Competencies in Knowledge-based Organizations*. *Journal of Competitiveness* 4(1), 129-142.
- Köper, B., Möller, K. & Zwetsloot, G. (2009). *The Occupational Safety and Health Scorecard – a business case example for strategic management*. *Scandinavian Journal of Work, environment & Health* 35(6), 413-420.
- Leka, S., Jain, A., Widerszal-Bazyl, M., Zolnierczyk-Zreda, D. & Zwetsloot, G. (2011). *Developing a standard for psychosocial risk management: PAS 1010*. *Safety Science* 49, 1047–1057.
- Lord, R. G. & Hall R. J. (2005). *Identity, deep structure and the development of leadership skill*. *The Leadership quarterly* 16, 591-615.
- Lucia, A.D. & Lepsinger, R. (1999). *The Art and Science of Competency Models*. San Francisco, CA: Jossey-Bass.
- Michael, J.H., Guo, Z.G., Wiedenbeck, J.K. & Ray, C.D. (2006). *Production supervisor impacts on subordinates' safety outcomes: An investigation of leader-member exchange and safety communication*. *Journal of Safety Research* 37, 469-477.
- Mullen, J., Kelloway, E.K. & Teed, M. (2017). *Employer safety obligations, transformational leadership and their interactive effects on employee safety performance*. *Safety Science* 91, 405-412.
- OHSAS 18001:2007 *Occupational health and safety management systems – Requirements*. London: OHSAS Project Group BSI.
- Pedler, M., Burgoyne, J. & Boydell, T. (1986). *A Manager's Guide to Self-development*. London: McGraw-Hill.
- Pfeffer, J. (1998). *Seven practices of successful organizations*. *California Management Review* 40(2), 96–124.
- Prahalad, C.K. & Hamel, G. (1990). *The Core Competence of the Corporation*. *Harvard Business Review* 8(3), 79-91.
- Rose, J., Pedersen, K., Hosbond, J.H. & Kræmmergaard, P. (2007). *Management competences, not tools and techniques: A grounded examination of software project management at WM-data*. *Information and Software Technology* 49, 605-624.
- Rothwell, W.J. & Lindholm, J.E. (1999). *Competency Identification Modelling and Assessment in the USA*. *International Journal of Training and Development* 3(2), 90-105.
- Rundmo, T. & Hale, A. (2003). *Managers' attitudes towards safety and accident prevention*. *Safety Science* 41, 557–574.
- Schoonenboom, J., Tattersall, C., Miao, Y., Stefanov, K. & Aleksieva-Petrova, A. (2007). *A four-stage model for lifelong competence development*. *Proceedings of the 2nd TENCompetence Open Workshop, Manchester, UK*, 131-136.
- Senge, P. (1994). *The Fifth Discipline Fieldbook—Strategies and Tools for Building a Learning Organization*. London: Nicholas Brealey Publishing.
- Simola, A. (2005). *Turvallisuuden johtaminen esimiestyönä. Tapaustutkimus pitkäkestoisen kehittämishankkeen läpiviennistä teräksen jatkojalostustehtaassa* (in Finnish), Doctoral dissertation. Oulu: University of Oulu.
- Suikki, R., Tromstedt, R. & Haapasalo, H. (2006). *Project management competence development framework in turbulent business environment*. *Technovation* 26, 723-738.
- Tappura, S., Nenonen, N. & Kivistö-Rahnasto. (2017). *Managers' viewpoint on factors influencing their commitment to safety: an empirical investigation in five Finnish industrial organisations*. *Safety Science* 96, 52-61.
- Tappura, S. & Hämäläinen, P. (2011). *Promoting occupational health, safety and well-being by training line managers*. In

Lindfors, J. et al. Proceedings of the Nordic Ergonomics Society Conference, Oulu, 295-300.

- Tappura, S. & Hämäläinen, P. (2012). *The occupational health and safety training outline for the managers*. In Vink, P. Advances in Social and Organizational Factors, Advances in Human Factors and Ergonomics Series 9, 356-365. Boca Raton: CRC Press.
- Tappura, S. & Nenonen, N. (2016) *Categorization of Effective Safety Leadership Facets*. In Arezes, P. & Carvalho, P. Ergonomics and Human Factors in Safety Management, 367-383. Boca Raton: CRC Press.
- Tappura, S., Teperi, A.-M. & Kivistö-Rahnasto, J. (2016). *Safety management tasks at different management levels*. In Kantola, J. et al. Advances in Human Factors, Business Management, Training and Education. Proceedings of the AHFE 2016 International Conference on Human Factors, Business Management and Society, Florida, USA, 1147-1157. Florida: Springer.
- Tengvall, R., Tappura, S. & Kivistö-Rahnasto, J. (2017). *A Concept for Developing Safety Leadership Competencies of the Managers*. In Bernatik, A. et al. Prevention of Accidents at Work: Proceedings of the 9th International Conference on the Prevention of Accidents at Work (WOS 2017), Prague, Czech Republic, 333-338. London: CRC Press/Balkema.
- Thiele-Schwarz, von, U., Hansson, H. & Tafvelin, S. (2016). *Leadership training as an occupational health intervention: Improved safety and sustained productivity*. Safety Science 81, 35–45.
- Veltri, A., Pagell, M., Johnston, D., Tompa, E., Robson, L., Amick III, B.C., Hogg-Johnson, S. & Macdonald, S. (2013). *Understanding safety in the context of business operations: An exploratory study using case studies*. Safety Science 55, 119-134.
- Viitala, R. (2005). *Perceived development needs of managers compared to an integrated management competency model*. Journal of Workplace Learning 17(7), 436-451.
- White, R., Hodgson, P. & Crainer, S. (1996). *The Future of Leadership. Riding the Corporate Rapids into the 21st Century*. Lanham, Md.: Pitman.
- Wu, T.-C., Chen, C.-H. & Li, C.-C. (2008). *A correlation among safety leadership, safety climate and safety performance*. Journal of Loss Prevention in the Process Industries 21, 307-318.
- Zanko, M. & Dawson, P. (2012). *Occupational Health and Safety Management in Organizations: A Review*. International Journal of Management Reviews 14, 328–344.