

A new model proposal for occupational health and safety management in small and medium enterprises

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Abstract: Small and medium size enterprises (SMEs) represent a strength in the European economy, involving more than half of the overall workforce and including key resources for innovation and growth. However, SMEs currently present a higher overall accident rate than large enterprises (LEs), both for fatal and non-fatal injuries, and suffer from far bigger impacts when incidents happen. With these premises, implementing effective occupational health and safety (OHS) systems for SMEs is crucial to guarantee their long-term benefits and economic success. Despite this, few tools are currently available to evaluate the performance of (OHS) specifically in SMEs, while the vast majority of researchers focus on the needs of large enterprises. While tools developed for LEs cannot simply be adopted by SMEs, these latter have also a more limited access to economic, technological and human resources to deal with OHS. This issue is acknowledged by the European Commission that included in the Strategic Framework on Health and Safety at Work (2014–2020) the objective of improving risk prevention measures in SMEs. The main objective of this paper is to provide a new model for OHS management in SMEs. First, a literature review about OHS management in SMEs helps framing the problem and the main findings outlined by researchers. Then, an analysis of the currently available OHS software solutions in the Italian market for SMEs is presented, highlighting the main features and functionalities provided. Finally, starting from the needs identified and considering the specific characteristics of SMEs, a new model for OHS management is presented.

Keywords: Occupational health and safety (OHS); Small and medium enterprises (SMEs); risk prevention; safety management; performance evaluation.

1.Introduction

Small and medium size enterprises (SMEs, <250 employees) are a major force in the European economy, since they employ 67% of the total workforce of the industrial and service sectors. This percentage increases in Italy (80%), where SMEs represent 99.9% of the companies of the sector (European Commission, 2014). Therefore, effective occupational health and safety (OHS) management in SMEs is necessary to ensure both a social and economic sustainability of European companies. Despite their importance, several studies have shown that OHS management is often more effective in large enterprises (LEs), while it is still poor in SMEs. Non-fatal injuries are 50% more likely to occur in SMEs, while fatal accidents are up to eight times more frequent than in LEs (Tremblay and Badri, 2018a). Such is the relevance of this problem that the European Commission included it in the Strategic framework on health and safety at work 2014–2020, recognizing the urgency of investing in effective prevention in OHS management in SMEs. The causes of this phenomenon are multiple. First, SMEs usually can rely on fewer resources and time than LEs to invest in safety and prevention. Consequently, also the internal

knowledge related to OHS is more limited, as the awareness of the main safety problems and regulations. As a consequence, OHS is not a top priority in SMEs, which tend to focus more on the economical outcome of their business, neglecting safety and health issues. On the other side, most of the existing tools for OHS management and performance evaluation are designed for LEs, which remain the main users, while methods and tools customized for SMEs are missing (Masi and Cagno, 2015; Tremblay and Badri, 2018a; Walters et al., 2016). The main tendency in SMEs is still to adopt informal OHS management systems (OHSMS) rather than systematic ones (Arocena and Nunez, 2010; Hasle et al., 2009). In Italy, the current legislation about OHS outlines a simplified procedure for developing the risk assessment document – named “Documento di Valutazione dei Rischi”, DVR in Italian – by small enterprises (with less than 50 employees), following a standardized procedure. This exception has the aim to support small companies in OHS management, since they usually have less competences and resources to invest in this process. However, the counterpart of avoiding a customized analysis is the risk of underestimating safety issues and overlooking OHS. The objective of this study is to

propose a simplified model for OHS assessment and management specifically studied for the context of SMEs. This work is preliminary to the design and development of a free-access OHS management software, which is the ultimate goal of the research. The innovation of the study lies mainly in two points: (i) the combined literature and market analysis helps framing the problem of OHS management in SMEs both from a scientific and operative perspective; (ii) this is the first attempt, to our knowledge, to propose a OHS model specific for SMEs that integrates safety evaluation processes with management and prevention activities.

The paper is structured as follows: the proposed methodology is described in section 2. Sections 3 and 4 illustrate results from the literature review, while section 5 shows the main available tools for OHS management on the market. The new framework is proposed and discussed in section 6, while conclusions are presented in section 7.

2. The proposed design methodology

The study has been performed following a methodology in three steps (Fig. 1). In the first step, a literature review has been conducted to understand how research has been dealing with OHS in SMEs in the last years, highlighting criticalities and opportunities and identifying the main gaps. In a second step, a review of the main commercial tools currently available for OHS management in SMEs is presented: this phase has the aim to provide a picture of the possibilities that SMEs have today to manage safety, focusing in particular on the functions provided. Based on the outputs of the first two phases, results have been elaborated through focus groups and interviews to companies, and an integrated model for SMEs is finally proposed.

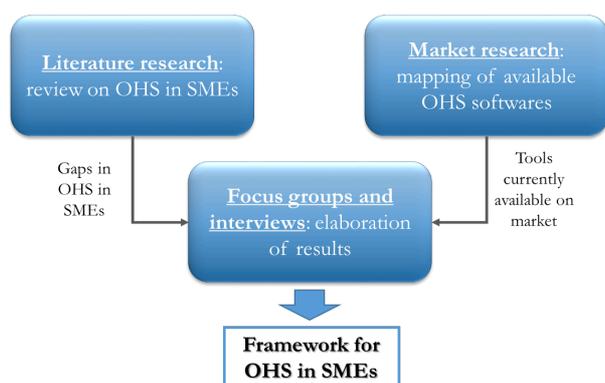


Figure 1. Methodology (steps and outputs)

3. Literature review

In the last 15 years, the problem in analysis has been acknowledged by the academic sector, as researchers have focused on understanding the peculiarities of SMEs that influence the health and safety management processes. A review of the literature addressing this issue has been performed, using the databases Web of science and Scopus and keywords “occupational health and safety” and “small and medium enterprises”. Only works related

to the industrial and service sectors have been included, and a selection of the papers focusing on OHS systems, OHS performance and OHS assessment has been done. This resulted in a total of 28 articles selected and reviewed that can be classified into two main categories: the first includes research on the state of the art of OHS in SMEs, while the second collects articles proposing new models for managing OHS in SMEs.

In the first category, a few literature reviews define features and challenges of OHS in SMEs. Hasle and Limborg (2006) underline the importance of elaborating cost-effective preventive approaches to improve OHS in SMEs, while MacEachen et al. (2010) analyze qualitative literature, concluding that the informal workplace environment often present in small businesses can limit the apprehension of risk, and the common practice of chains of subcontracting can complicate OHS responsibilities. Floyde et al. (2013) summarize the main challenges to face, underlining the role and potential benefits of knowledge management and e-learning in the knowledge-sharing process between workers and managers, necessary for safety improvement. Legg et al. (2015) highlight that most of the current policy and legislation on OHS is based on large enterprises, while modern OHS interventions should take into account the peculiar features of SMEs. Similarly, Tremblay and Badri (2018a) highlight the lack of specific OHS performance evaluation tools for SMEs, encouraging further research on this topic. Several other papers in this group analyse OHS systems, practices and effectiveness in SMEs in specific regions or states, resulting in descriptive works that help framing the main problems and characteristics in this sector. The relationship between firm size and accident frequency is examined in Italy by Fabiano et al. (2004), who confirm the trend for which this frequency increases for small businesses, especially for fatal accidents. Similarly, Micheli and Cagno (2010) show that accident frequency grows for smaller companies, with micro enterprises (MiEs) performing worse than SMEs. Lehtinen (2006) explores the potential contribution of information in OHS in SMEs, illustrating some examples from the Finnish environment and underlining the importance of networking of small enterprises to support progress in safety. Arocena and Nunez (2010) analyse the Spanish case, demonstrating how companies with OHSMS perform measurably better than others in preventing accidents. Similarly, a study by Gopang et al. (2017) on SMEs in Pakistan confirms that implementation of OHSMS can improve the safety performance when properly managed. The adoption of OHSMS in SMEs has been also studied by Santos et al. (2013) in the Portuguese context, where only 26% of the companies interviewed that adopt a OHSMS choose a certified one (OHSAS 18001), due to high costs and internal difficulties in leading the change: these companies reported having improved their working conditions and internal communication on safety. Cagno et al. (2013) focused on the economic evaluation of OHS, performing a literature review: they also confirm that SMEs in particular need to perceive the economic advantages given by an effective OHSMS. Hasle et al. (2009) analyze accident attribution in

Danish SMEs from the metal and construction sectors through a survey, revealing that in most cases the causes of the accidents were attributed to unforeseeable events, thus refusing to recognize the role and responsibility of management and workers in accident prevention. Cagno et al. (2011) study the factors related to OHS in SMEs in Italy and their interactions, analyzing also their impact on OHS performance through a literature review and a database analysis. Champoux and Brun (2003) analyze OHS in SMEs in Quebec, pointing out that encouraging employees’ participation in safety management can have a positive impact on its effectiveness. Studying SMEs in the UK, Diugwu (2011) shows that a good OHS management improves the image and the competitiveness of a company in the supply chain, contributing to lower costs. Sinclair et al. (2013) underline the key role of intermediaries (e.g. chambers of commerce, business development centers, etc.) as facilitators for the effective implementation of OHS in SMEs, studying the US context. Boustras et al. (2015) explore the factors influencing safety performance in MiEs in Cyprus, showing that this is increased by the introduction of a safety policy and the willingness of workers to use personal protection equipment. Bonafede et al. (2016) analyse the perception of employers about OHS implementation according to the firms’ size in Italy. Their results confirm that in micro and small enterprises OHS is mostly seen as a law duty with the relative economic burden, while its value is not perceived by workers.

Finally, a few efforts focus on barriers and drivers for the adoption of OHS interventions in SMEs: Masi and Cagno (2015) confirm that the lack of resources (economic and time) and ineffective information represent critical factors. In particular, the unsuitability of guidelines to the peculiar needs of SMEs has been outlined in their work. Similar findings on barriers are presented in Masi et al. (2015), where the authors also underline that the OHS intervention process in SMEs is mostly qualitative and experience driven. Unnikrishnan et al. (2015) address this issue in the Indian region, where the authors identify the main obstacles in the lack of resources and awareness of safety issues, together with an internal resistance to change, while the main drivers identified are competition between SMEs, better efficiency, improved safety and external regulations. An analogous study is conducted by Garnica and Barriga (2018) in Brazil, pointing out that while managers tend to blame workers for lack of OHS awareness and wrong behavior, external stakeholders identify the ineffective management and resource allocation as the main barriers. The lack of information and communication is also underlined.

The second category, collecting works with proposals of new OHS models, includes only 5 papers. Walker and Tait (2004) tested an intervention model on a sample of UK small enterprises, based on low-cost and low-time demanding approach, showing how this helped most of the involved companies in OHS implementation. Cagno et al. (2014) present an intervention-oriented model for safety performance designed for SMEs, aiming at responding to the lack of safety management tools in this context. The impact of preventive interventions has been

studied by Farina et al. (2015) for MiEs of the metalworking sector. They present a safety intervention program adopted in a project in Italy and describe its results, showing its effectiveness in improving the workplace environment safety. Two other efforts focus on OHS performance evaluation: Bianchini et al. (2017) introduce the efficacy index, a methodology to assess the effectiveness of a OHSMS, as a way to guarantee the exemption of responsibility for virtuous companies when unpredictable accidents occur. Another tool is presented by Tremblay and Badri (2018b), with the aim to assess an OHS system, identify deficiencies and prioritize corrective actions.

4. Lessons from literature

Some relevant outcomes from this review of scientific literature can be summarized to better frame the problem.

- There is a wide acknowledgement in the academic sector of the poor OHS management in SMEs in several regions of the world (mainly Europe, but also Asia and North America), but while this problem has been raised by many researchers, only a few attempt to propose new models for OHS evaluation and management exist.

- The main barriers to OHS effective implementation in SMEs are identified in the lack of resources and time to dedicate to safety issues, ineffective information, insufficient awareness, internal resistance to change. Moreover, most of the existing tools and methods for OHS management are designed for LEs and do not fit the needs of SMEs.

- There are also some drivers that can foster the diffusion of effective OHS in SMEs: the legislative pressure in several countries, competitiveness with other companies, the aim to reach better efficiency and improved safety.

- The adoption of OHSMS in SMEs can improve safety conditions and support better information sharing in the company, and employees’ participation in safety management can also increase effectiveness.

- Cost-effectiveness is a critical factor for the adoption of OHSMS in SMEs, and companies need to perceive the economic advantages entailed in this choice.

5. State of the art about commercial software tools for OHS

In this second step, a research on the tools currently commercialized for OHS management in SMEs has been conducted. Several tools are currently available on market, and selecting the most appropriate for the company can be a challenging activity (Marciano et al., 2016; Trapani et al., 2017). Referring to the Italian context, the focus has been in particular on tools that can support the production of a DVR, the risk assessment document required by law. The research has been limited to commercial tools. 18 solutions have been identified.

Information about the costs of these solutions are not discussed here, since the software houses usually negotiate

the price with their clients. However, all the solutions considered, are available upon payment.

Only one of the tools falls in the “service” category, offering customers the possibility to pay for the production of a DVR, full or simplified for small enterprises, without owning or managing any software.

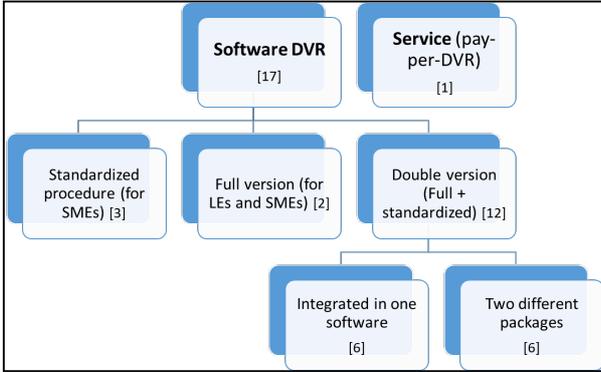


Figure 2. Classification of commercial tools for OHS management in SMEs

The remaining 17 are applications that the user can download or use through a browser (web-based) and can be classified in three categories: (1) applications that manage exclusively the standardized procedure designed for SMEs; (2) applications that manage only the full version of DVR, thus can be used both from LEs and SMEs; (3) applications that provide two versions, one for the full DVR and one for the standardized procedure (either in two different software packages or in one integrated version).

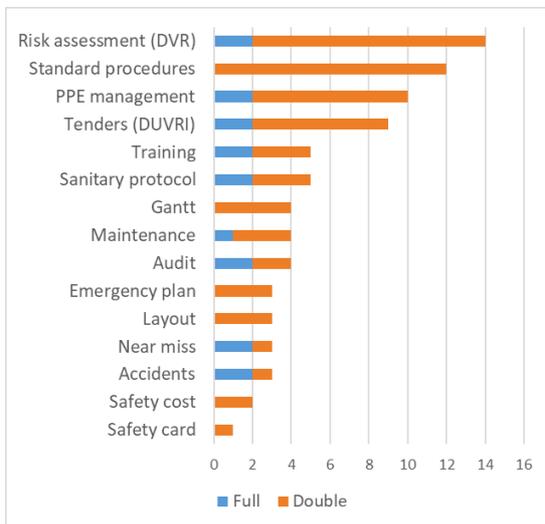


Figure 3. Frequency of functions in the commercial tools analysed (from categories 2 and 3)

The applications that manage standardize procedures are three, and they do not offer any additional function to the user: they are agile tools designed for companies that need to fulfil the legal requirement of a DVR, without extending the support to other processes or activities. On the contrary, the 14 solutions from the other two groups (full and double version) offer to customers several additional functions beyond risk assessment and DVR

production (also through standard procedures in applications of the third group). The most common is the management of personal protective equipment (PEE), followed by the management of tenders and consequent production of the relative interference risk assessment document (named “Documento Unico di Valutazione Rischi da Interferenze”, DUVRI in Italian). Other functions proposed by 5 of the 14 tools are the management of the sanitary protocol in the company and of a training program for the employees, which can be useful if the business seeks to improve the participation and the awareness of its workers. 4 applications include in their offer the management of audit, of maintenance for the machinery, and the integration of a Gantt to plan all the activities related to OHS. A module for managing the emergency plan is provided by three tools, as the possibility to include the plant layout. Modules to manage accidents and near misses are not that common in the commercial tools analysed, despite the huge importance of such functions in safety management. Finally, two solutions provide a module to estimate the total costs of OHS, while only one provides a specific informative tool for workers, named safety card. The frequency of these functions in the tools analysed is summarized in Fig. 3. A few observations can be done after the market research on tools for OHS diffused in Italy. The first is that almost all the solutions provide a module (or are designed) for the production of the simplified DVR for SMEs. This reflects the abundance of SMEs in the EU market and the criticality of safety management in this sector, showing that service companies are considering the needs of small businesses and trying to give them an answer. The second point to outline is that there are several functions that an application can provide for OHS management, that can support not only DVR production, but all the processes and activities related to safety management in a company. On the other side, these functions are provided only by tools designed for LEs (or for LEs and SMEs), while solutions designed specifically for SMEs are exclusively focused on the production of simplified DVR. This confirms that SMEs are often guided in OHS decisions by regulatory requirements, more than moral or efficiency reasons. Moreover, even the solutions designed for LEs can have important functional gaps, since only 16% of the tools considered include a module for managing accidents and near misses, which is a critical function when a company is truly committed to increase its safety level.

6. The model proposed

The third step of the methodology aimed at designing a logical framework and a model for OHS that can be later implemented in a solution for SMEs. For this purpose, companies and field experts have been involved: first, a survey has been submitted to SMEs located throughout Italy, collecting 118 answers from companies of the metalworking, wood and paper production sectors. Questions were all focused on knowledge and accessibility of OHSMS and OHS software tools. Then, a focus group of safety experts took place in Lecco (Italy), with representatives of companies with and without experience in the implementation of OHSMS, discussing the possible

application of a simplified OHSMS and its use to support MiSEs in OHS management. More details on the methodology are provided in Micheli et al. (2018). Finally, the results of the survey and of the focus group were elaborated, serving as the base to build the model, together with results from the literature review and market research.

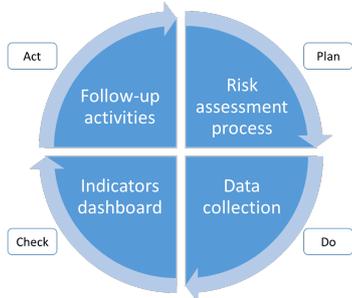


Figure 4. The logic framework proposed

The analysis of results from this phase confirmed that there is a lack of interest from Italian SMEs in OHS issues, probably caused by little understanding of the benefits and a lack of resources to invest in safety. Most companies deal with safety regulation contracting the production of the risk assessment document to external consultancy firms, neglecting the internal analysis of accidents. The potential adoption of an OHSMS for internal management of safety related processes can be a way to improve awareness and competence in a SME. Detailed results from the survey and focus groups are discussed in (Micheli et al., 2018). Thus, a logic framework (see Fig. 4) is proposed. Unlike current practices, the risk assessment process is not the only activity planned, but it is a first step for the implementation of an integrated OHS system for SMEs. A following phase of internal monitoring and data collection on safety has to be carried out, especially regarding accidents and near-misses. Data collected can be used through a dashboard of indicators to describe the actual safety level in the company, and these results eventually contribute to review current practices, in a continuous improvement perspective. Based on this logic framework, a model for OHS management in SMEs is proposed in Fig. 5. Our proposal is to provide an intuitive tool to support not only the production of the DVR, but also OHS-related activities that can help the company improving workplace safety. The model consists of two modules, one focused on risk assessment and the other on safety management. In the initialization phase, the user selects its profile, allowing the tool to retrieve information on the sector from institutional databases (e.g. Infor.MO from INAIL, the Italian Workers' Compensation Authority) (De Merich and Pellicci, 2015; Campo et al., 2015; Campo et al., 2017). These data, together with the ones collected from the same company in the use phase, are the base on which criticalities, determinants and risks are evaluated to elaborate the risk assessment document, following the standardized procedure.

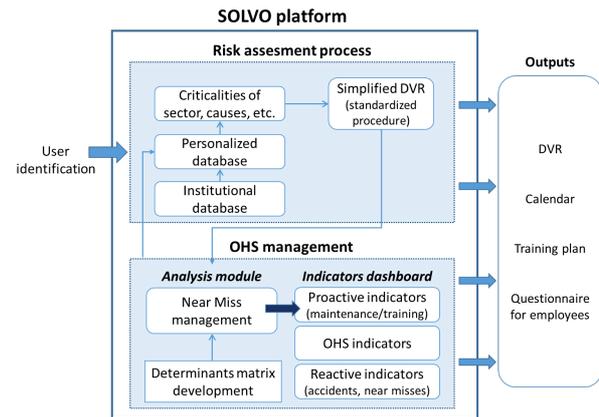


Figure 5. The OHS management model for SMEs

The information contained in the DVR, regarding risk factors, exposed workers, evaluation of risks probability and effects and prevention measures identified, are then used in the OHS management module as input for the analysis phase. The most critical processes and activities are monitored, with particular attention on near misses. These can be a pivotal tool to learn from the experience and prevent accidents, improving the safety level of the workplace (Gnoni and Saleh, 2017). The OHS management module provides also a dashboard of indicators on safety, aiming at supporting the management in decision-making, through preventive and reactive measures. This can result in the production of other outputs, according to the needs of the company, such as training plans, calendar planning, focused questionnaires for workers. At the same time, results from the analysis phase are useful as feedbacks for the risk assessment process, concurring to fill the personalized database on which the DVR is based.

With the application of this model, even a company with little experience and resources devoted to safety management, can be supported in the elaboration of a purposeful DVR, which, in turn, becomes a practical tool to improve the OHS level thanks to its connection with the OHS management module, leading to an effective development of a safety culture, as well as an increase in economic and social benefits for the company and the workers.

Comparing this proposal with the commercial tools analyzed, the model would thus implement 7 of the 15 functions identified, adding to the most common ones (risk assessment through standardized procedures, training and sanitary protocol planning, calendar planning, PPE management) the possibility to manage near misses and accidents, unlike most of the tools available on market.

7. Discussion and conclusion

The relevance of SMEs in the European market and the difficulties for these companies to implement effective OHS models has been pointed out by policy, researchers and practitioners. The considerable economic potential of this sector is opposed to a systematic weakness of the safety management processes. To face this issue, a few efforts in literature have proposed new ways to address

OHS in SMEs, but a dedicated OHSMS for SMEs is still missing, as commercial tools available are usually designed for LEs, providing specific support to SMEs only for the risk assessment phase. This work is an attempt to fill this gap, providing a framework for OHS implementation in SMEs and a model on which a software solution for safety management will be based.

The main innovative features of the proposed model are two:

- it provides to SMEs a tool designed for their needs, which can support them not only in the production of the DVR, but also in other safety management activities, contributing to improve awareness, share information and enhancing prevention and safety conditions in the workplace.
- the ease of use of the tool, which will provide a high degree of flexibility to companies, as it can be adopted either for the risk assessment process only, or for the daily management of the health and safety issues as well.

The use of the Infor.MO – dealing with fatalities – as the institutional database will represent a value added feature, as it is currently the most updated and easy to use official database available in Italy in the OHS field, and its significant in-depth is more than appropriate for the scope. It will provide, in a very effective way, an updated “picture” of hazards characterizing specific industrial sectors as well as activities.

Future developments might be oriented to include further institutional databases, such as MALPROF, which reports data about professional diseases: this feature would increase the “knowledge sharing process”, which in turn would contribute to prevent in a more effective way risks at work in SMEs.

Finally, the next steps of the research include the design, testing and implementation of a consistent software tool.

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