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Adoption level of Near-Miss Management Systems in the industrial sector: an exploratory survey

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Near miss events are usually identified as adverse events that could have turned into incidents/injuries, but by chance resulted in a harmless situation. The importance of near-miss analysis lies in the roots of the events since they usually share the same causes of accidents occurring at the workplace. Therefore, they can represent a useful source of information to understand the causes of potential accidents/injuries for applying more effective preventive actions. Despite this, near-miss management systems (NMMSs) are still not so widespread in all industrial sectors, and they are mostly adopted in a few specific sectors, such as construction, mining, chemical, and nuclear industries. This study, carried out in collaboration with the Italian National Institute for Insurance against Accidents at Work (INAIL) by involving a sample of Italian companies in the industrial sector, presents the preliminary results of a survey aiming to understand the current level of adoption of NMMSs. After an introductory section, the survey is composed by two sections: the first addresses companies already adopting NMMSs, while the second considers companies still not analysing near-miss events. The objective is to outline the state of adoption of NMMSs in several industrial sectors: after this analysis, the aim is to outline drivers and barriers identified by companies in adopting the systems as well as possible strategies to support their diffusion in the industrial sector.

Keywords: near-miss events; near-miss management system; accident precursor; survey.

1. Introduction

Near-miss events are an important source for improving the safety performances of companies as they represent a signal from the operational field about actual safety levels at workplaces (Thoroman et al., 2018; Haas and Yorio, 2019).
ILO (2014) defines near-miss as "An event, not necessarily defined under national laws and regulations, that could have caused harm to persons at work or to the public"; more recently ISO 45001 (2018) defined a near-miss as "a work-related incident where no injury or ill health occurs, but which has the potential to cause these." Thus, a near-miss and an accident are occurred events, i.e. incidents: the only difference between them is on gravity as near miss is an incident that did not result in a fatality, injury, illness, or property damage. In addition, near-miss and accidents are characterized by the same causes: thus, preventing near-miss could help to avoid accidents as well as injuries.
Thus, near-miss management systems (NMMSs) are an important source of process continuous improvement in the safety domain (Zhou et al., 2019; Demich et al., 2020; Westreich et al., 2021). NMMSs are usually designed to analyse causes and determinants of negative events, thus supporting the recognition of possible causes of future accidents and the implementation of solutions to prevent them (Bugalia et al., 2021).
Although no standard process has been defined yet, reporting, analysing main causes, and learning from near-misses are the main steps usually characterizing an effective NMMS (Van der Schaaf et al. 2013; Marks et al., 2015). Recently a state of the art analysis of the

application of NMMSs in the industrial sector has been proposed by identifying potential benefits and criticalities (Gnoni et al., 2022). In line with this previous research, this study has been carried out in collaboration with the Italian National Institute for Insurance against Accidents at Work (INAIL, i.e., in Italian, "Istituto Nazionale Assicurazione Infortuni sul Lavoro"), aiming to evaluate the actual level of adoption in the industrial sector. Thus, a survey analysis has been developed to evaluate the level of adoption of NMMSs in Italian companies; the main benefits of adopting these systems as well as the obstacles preventing the adoption. The structure of the paper is the following: section 2 describes the main structure of the survey, which has been provided to several Italian companies in different industrial sectors; section 3 discusses the results gathered from the answers of respondents; finally, section 4 draws the conclusions.

2. Method

The survey is composed of three sections. Section I aims to acquire information about general companies' common features: sector and size ranging from micro companies (less than 9 employees) to small and medium (less than 249 employees) and large ones (more than 250 employees). Other requested information regards the company organizational issues towards safety at work: if standards are applied for safety management (e.g., ISO 45001), how this process is managed inside companies, by an internal representative or an external consultant. The following sections of the questionnaire focus on a specific set of companies: Section II is only filled by companies applying NMMSs while Section III is just for companies not yet applying an NMMS but willing to in the next future. Questions to companies already adopting NMMSs mainly referred to the operative model adopted: which events are collected in the systems (i.e., just near-miss events, or even unsafe acts and conditions) and how events are gathered from the workplace. Furthermore, an evaluation of the main benefits and criticalities due to the NMMS adoption is requested. On the other side, companies not yet applying an NMMS have been asked the reasons that have pushed them not to adopt it and the enabling factors that could instead make them reconsider their decision. The survey has been sent to a sample of Italian companies from different sectors and locations. However, the sample may not be representative of the whole Italian industrial sector, as a specific sample design process has not yet been carried out. Therefore, this first stage of the study has to be intended as an exploratory field analysis.

3. Results discussion

The survey has been sent to more than 1000 Italian companies of different sizes and located in different areas: preliminary results – based on a restricted sample of 157 answers – are discussed in this section.

Section I: The results, regarding the first section of the questionnaire, include all respondents. In Figure 1 information about the company's size is reported: the two largest groups are small and medium companies respectively; lower participation is outlined for the two extremes values, large and micro companies.

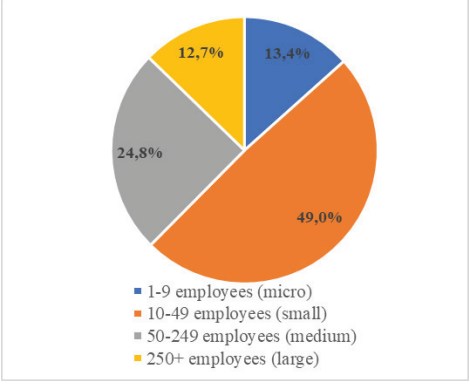


Fig. 1. Company size distribution in the analysed sample

Two other issues have been investigated: the organization type characterizing the health and safety service and the adoption of a safety management system (SMS) in the company. It has to be noted that SMS supports the organization and management of safety throughout the company focusing on different aspects, while a NMMS only supports the management of near-miss events. For the first issue, it has to be noted

that Italian legislation allows organizing the health and safety service with internal resources or with external ones (e.g., consultant firms). Data shows that the sample is almost equally distributed as 52,2 % of the companies organize internally their services. By analysing the second issue, results (depicted in Figure 2) show similar percentage values for companies, which do not have an SMS and ones that have an international certification for their SMSs. It is interesting to highlight that about 16% of the sample adopt Italian guidelines for developing their SMSs; this is a free standard provided by the Italian National Institute for Insurance against Accidents at Work (INAIL, i.e., in Italian, "Istituto Nazionale Assicurazione Infortuni sul Lavoro"). This issue is very important for evaluating the adoption of NMMSs, which is an explicit requirement of international standards (e.g., ISO 45001).

Next, a cross sectional analysis of company size and adoption of a certified SMS has been developed aiming to evaluate whether the company size affects the specific organizational strategy for managing safety at work. It has to be noted that ISO45001 includes a general definition about near miss and non conformity; an analysis is required according to the standard, but a specific methodology is not yet proposed.

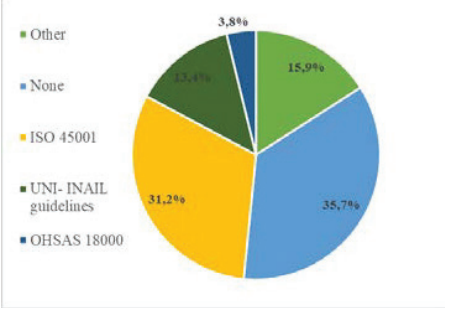


Fig. 2. Adoption level of a SMS in the analysed sample

Table 1 reports the results of the analysis. About 57% of micro companies do not adopt SMSs; a slightly different condition is outlined for small companies where about 35% do not adopt any type of SMS, but more than 46% of the sample applies a specific type of SMS. This is an interesting result that proves the willingness of these companies to adopt more structured approaches to manage safety at work. In addition, more than 50% of medium and large companies in the analysed sample apply SMSs. Furthermore, it is notable that about 30% of these companies do not apply any type of SMS, outlining their tendency towards a less structured approach for managing safety in their organization.

Table 1. Cross sectional analysis between company size and adoption of SMSs

Company size	Other	None	ISO 45001	UNI- INAIL guidelines	OHSAS 18000	Total
Micro	5	12	3	1	0	21
Small	14	27	15	16	5	77
Medium	4	12	18	4	1	39
Large	2	5	13	0	0	20

Data about companies that just apply NMMSs are outlined in Figure 3: the sample is divided almost symmetrically as about 51% of the analysed companies do not apply any NMMS, and, the others, instead, have a working system, 33% from several years and 16% from a few years.

By developing a deeper analysis, information on company size has been combined with data about the adoption level of NMMSs (Figure 4). In the cluster where companies adopt NMMSs for several years, an interesting result is emerging: the two largest groups (in absolute value) are small and medium companies, but it has to be noted that the percentage of large companies in this cluster is more than 70%, which in absolute value is equal to 14 (of 20).

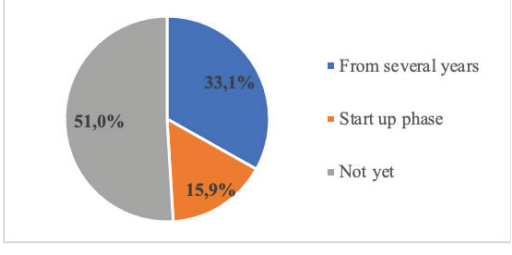


Fig. 3. Diffusion level NMMSs in the analysed sample

This result confirms the trend outlined by several papers and reports: small and micro

companies should be the target to consider when applying an NMMS (Haas et al., 2020).

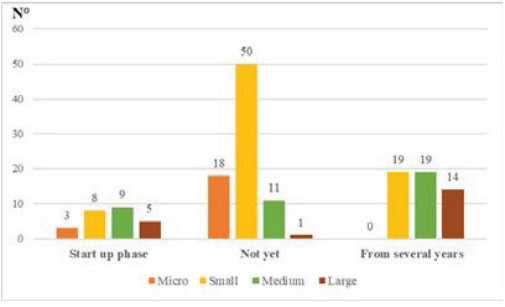


Fig. 4. Cross sectional analysis between company size and adoption of NMMSs

Section III. A more qualitative analysis has been carried out on companies not yet applying an NMMS to investigate the main causes: results are in Figure 5. The most-reported cause by companies refers to the lack of knowledge on the role of near-miss events in safety management and the potential safety level improvements generated by their proper management. This is mainly a cultural issue that prevents companies from adopting efficient strategies to improve the effectiveness of their prevention activities (Asad et al., 2021). Similar considerations could be developed for the second-largest group, which outlines as the adoption of NMMS is not a company priority. The lack of specialized internal resources as well as the cost of the adoption do not represent a high obstacle to overcome.

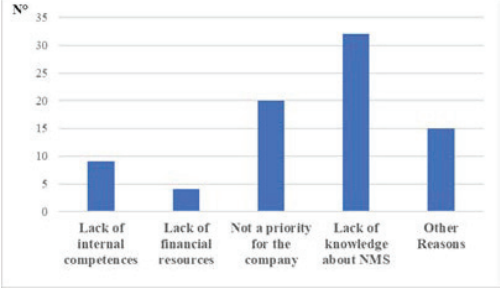


Fig. 5. Motivations from companies not implementing a NMMS

Furthermore, companies that do not currently apply NMMSs, but are willing to do in the next future, have reported their most relevant "enabling factors". The emerging critical factors are the need to improve current safety management processes and the presence of incentives. Less attention has been reported to normative compliance and increased awareness of how NMMS could support the company in preventing injuries.

Table 2. Factors influencing company evaluation for future adoption of NMMSs

Elements supporting a future application of NMMSs	**N° of companies**
Improve injuries analysis/ continuous improvement process	15
Incentives	10
Presence of internal financial resources and competences	8
Increase of injuries/risks	7
Increased awareness of NMMSs and their benefits	5
Normative compliance/ requirement	3
Other issues	14

Section II. Finally, information about companies that already apply a NMMS is analysed. Firstly, the analysis focuses on types of events collected by the analysed sample: it has to be noted that a lack of common near-miss definition is outlined. Usually, NMMSs also collect different type of events also including unsafe acts and conditions and nonconformity, which are antecedents of an adverse event in a different way compared to near-miss. The main difference is on how these events "are close to an incident: near-miss are precursors as they are real occurred events; unsafe acts, conditions and non conformity are antecedents as they represent a potential condition of hazard that could lead to accident. Results are reported in Table 3: an interesting result is that several companies collect different types of events, including unsafe conditions and acts. It has

Table 3. Type of events collected in NMMSs of analysed companies

Collected event types	**N° of companies**
Near-miss	61
Unsafe act	33
Unsafe conditions	32

Not-conformity condition	18
Other	6

Two other interesting results could be outlined for this cluster of companies: obstacles and benefits companies have faced during the application of their NMMS, which are reported in Tables 4 and 5 respectively. The main reported obstacles regard the development of the identification and reporting phase, thus confirming this phase as one of the most critical. Company culture not specifically oriented towards proactivity is also a relevant outlined obstacle. On the other hand, little importance has been given to the information/communication phase.

Table 4. Main obstacles reported by the analysed sample

Critical obstacles	**N° of companies**
Developing identification /reporting phase	17
Cultural factors, workers' reluctance, fear	13
Awareness and participation of the workers	11
Information/communication	4
None	9

Table 5. Main benefits reported by the analysed sample

Critical Benefits	**N° of companies**
Enhanced safety (fewer injuries, more effective risk identification)	37
More awareness and attention among workers	9
Increased Control and improvement of processes and procedures	5
Improved work conditions	4

By analysing perceived benefits (Table 5), the most relevant category refers to the improvement of the overall safety management processes from a strategic point of view.

4. Conclusions

The paper proposes a survey analysis for evaluating the current level of adoption of NMMSs in Italian companies. The survey has involved companies from different territorial areas (from southern to northern Italy) and various industrial sectors (from agricultural to manufacturing and chemicals). Obtained results have confirmed a wide application of NMMSs, especially in large and medium companies; low diffusion was observed in micro and small companies. Interesting feedback has been provided for companies already applying NMMSs as well as for those still without. From one side, results obtained for these last companies highlighted the urgency of establishing new safety culture – more proactive than reactive – as well as supporting activities in introducing NMMSs. On the other side, companies adopting NMMSs for many years highlighted key strategic (e.g., preventing injuries) and operational benefits (e.g., increasing reliability of risk assessment process) of its implementation. Further developments will be oriented to evaluate organizational procedures and tools that could support micro e small companies in adopting NMMS.

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