# An explorative study setting a national supportive system of near-miss management for the Italian industrial sector

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**Abstract**: Initiatives, projects, and programmes for Occupational Safety and Health (OSH) management benefit from supportive systems to develop and properly last over time. National OSH systems were born to enforce the law by applying national regulations. In the last years, most countries have started to take preventative actions to improve workers' health and safety conditions. Assistance initiatives are growing fast, and new roles and profiles are arising to keep up with changes. Nowadays, national OSH actors usually perform both supervisory and supporting activities. This is widely applied in Italy where several bodies promote and support companies in taking part in OSH initiatives. In Italy, a collaborative project for near-miss management is under development by the Italian National Institute for Insurance against Accidents at Work (INAIL, i.e., in Italian, "Istituto Nazionale Assicurazione Infortuni sul Lavoro"). The project aims at increasing awareness of the relevance of near-miss monitoring. This paper studies the environment setting for this project, so bodies that will have an active role in its implementation and daily management. A focus group with INAIL's experts and researchers from two Italian universities has enabled to identify key actors and their role in the project's development and to select the most viable scenarios. This work provides a methodological approach to study other national supportive OSH systems and also detects Italian best practices replicable in other countries.

**Keywords**: Social Network Analysis; Intermediaries; Roles; Tasks

## I. INTRODUCTION

Occupational Safety and Health (OSH) is an issue that cannot be ignored by public and private companies of all sizes and sectors. Critical social reasons and economic implications of unsafe working environments are binding. Thousands of people die every day and, since people's lives are the priority, OSH at the workplace is a leading priority of organisations. Evidence shows that a healthier workforce costs companies less through lower healthcare costs [1,2].

The knowledge in this field is rapidly growing [3], but implementing proper OSH management at an operational level is not always straightforward due to changing technologies and work contexts [4,5]. New methodologies for OSH management and communication are required to keep up with the times [6,7].

Designing effective initiatives, projects, and programmes for OSH management is still difficult, as their success is likely to be dependent on several factors [8]. OSH managers should consider the characteristics of the workplace and the external environment when implementing OSH interventions [9]. Contextual knowledge is, therefore, a key factor in the design, implementation, and proper evaluation of OSH interventions.

Proactive surveillance systems are a promising option to overcome, or at least reduce, several barriers hindering the outcome of interventions [9]. Effective communication in the OSH system between companies and their stakeholders (e.g., assistance external organizations) is essential to disseminate knowledge.

Local networks with different organisations (non-governmental organizations (NGOs) as well as local government units) strongly support sustainable OSH improvements [10]. Figures like employers, bi- and tripartite bodies, professional organisations, unions, etc. are critically important.

An effective national surveillance system would develop standardised approaches and provide to private and public stakeholders consistent and coherent information derived from different sources. It will

represent a reliable source of information to prevent accidents at the workplace. As defined by De Merich et al. [11], *"increasing self-awareness of hazards at the workplace by an aggregate view of occurred accidents"* will be one key benefit of establishing effective national surveillance systems.

In recent years, we have seen a shift in the focus of disciplines related to OSH from "protection" to "prevention". It is widely recognised, as stressed by Su et al. [12] the importance of recognising, forecasting, and controlling hazards in advance before they effectively transform into injuries or illnesses. Instead of eliminating hazards after their detection, strategies for hazard prevention can effectively mitigate health and safety risks [13].

National surveillance systems, as stated by De Merich et al. [11] usually establish *"multi-year plans for work accident prevention"*. The Italian system Infor.Mo, for instance, supports companies in their prevention activities by disseminating extracted knowledge about critical risk factors [11].

In this context, near-miss management increases the global effectiveness of prevention activities, hazard control and risk reduction, by providing knowledge on precursor events of severe events. Near misses are weak signals provided by the day-by-day activity of an organization [14], which could have caused damage, injury or death, but were narrowly avoided as they usually share the same direct causes and/or contributing factors of an accident. Reporting and analysing near misses enable monitoring health and safety hazards before they cause serious accidents [15,16].

A Near-miss Management System (NMS) is needed to collect and analyse information within a specific context. An NMS consists of various processes: from the collection of information on individual events, through the analysis of these events, and finally to the dissemination of knowledge to the stakeholders. NMSs can identify the underlying causes of failures of a system and also for near-miss events the impact of barriers adopted to prevent such failures [17]. Studies have been conducted to identify the common traits and differences of industrial NMSs. It has been observed that automatic tools to detect near misses for a priori well-known events/conditions are possible and effective in industrial contexts with standardised and repetitive operations. The involvement of top management is crucial for both effective data collection and appropriate training of workers. It has also been observed that efforts are currently concentrated on the identification and analysis of collected data rather than on the dissemination of information [17]. However, NMSs are currently low adopted in several industrial sectors and no standardised methodology for their effective design and management is discussed in the literature [17].

Accordingly, this paper explores the potentialities of setting a national supportive NMS for the Italian industrial sector by starting to define its key actors. The following sections are structured as follows. *Section 2* presents the context and the research questions. *Section 3* details the methodology applied to start exploring how to design a national supportive NMS for the Italian industrial sector. *Section 4* shows the findings, detailing a first draft of the Italian supportive NMS. *Section 5* critically presents the results arising from section 4. *Section 6* draws conclusions and proposes future developments.

## II. THE CONTEXT AND RESEARCH QUESTIONS

Through an explorative study, a national supportive system of near-miss management started to be analysed in the Italian context. The Italian national health and safety system is the reference framework to build the NMS. Processes (e.g., detection, local data analysis) and major actors for its management were defined. Although some data are context-dependent (e.g., specific OSH actors of the Italian system), the structure and the processes defined might be useful outside the Italian context, especially in Europe where countries share EU-OSHA guidelines.

The Italian National Institute for Insurance against Accidents at Work (INAIL, i.e., in Italian, "Istituto Nazionale Assicurazione Infortuni sul Lavoro") periodically organizes projects to improve workers' well-being at work. A few years ago, a project, Infor.Mo system, for detection and analysis of serious and fatal injuries, was released by INAIL, in collaboration with universities. It provided a complete tool to collect and analyse data about fatal injuries in Italian workplaces and disseminate knowledge extracted from the analysed data [11]. It started to be applied by several companies and was deemed useful by many of them. Hence, INAIL to develop the potentialities of the Infor.Mo system decided to issue another project, called CONDIVIDO. The CONDIVIDO project stands for "developing an intelligent tool to support virtuous ecosystems for knowledge and sharing management of near misses in industrial sectors" (i.e., in Italian, "sviluppo di un modello intelligente a supporto di eCOsistemi virtuosi per la gestioNe Della conoscenza e della condIVIsione Dei near miss in cOmparti industriali"). It has been developed in collaboration with different actors throughout the Italian territory: two Italian research centres and three Local Health and Safety Departments (LHSDs), which are the centres of public healthcare in Italy under the National Healthcare Service. This new project focuses on improving prevention activities developed by companies, especially SMEs, not only on occurred severe events but also on near misses that often share the same root causes of severe injuries.

Learning from experience, higher coordination between OSH actors improves the effectiveness of the health and safety system, by increasing its level of adoption. This enables the implemented tool to be sustainable and effective in the long run as an ecosystem, preventing "the valley of death" for projects.

Hence, the major objective of this project is to develop a semi-quantitative tool for near-miss detection and analysis, considering the existent tool developed for serious and fatal accidents in Infor.Mo system and leveraging an established network of public and private actors involved along the process of detection, analysis, and follow-up. CONDIVIDO will exploit the so-called "network effect" by aggregating local data from companies, hence enabling more powerful monitoring activities on risk factors for injury and illness prevention.

The project is ongoing, and processes and the related set of actors need to be determined for the NMS under development, before spreading the tool for near-miss detection among companies.

Two main research questions led through the whole analysis in this paper. In particular, we will investigate:

- What are the key players to introduce a Near-miss Management System (NMS)?
- How can a Near-miss Management System (NMS) be effective in leveraging the established network?

## III. Methodology

A focus group was conducted to explore the research questions detailed above, i.e., how to design a national supportive NMS for the Italian industrial sector.

The focus group is a research technique, involving a group of specialists, discussing a given topic defined by the promoters of the activity. This approach is like a structured debate, enabling participants to express themselves in a free-like communication style [18].

Several reasons led to choosing a focus group. Explorative studies, like this work, focus on questions that are not enough developed by practitioners, so experts' knowledge is crucial at this phase to "build knowledge" on the topic. A focus group enables to deepen initial findings from the literature and, through the exchange of ideas, generates finer perspectives and viewpoints. Each participant benefits from the group, as it helps them frame their viewpoint in comparison to other perspectives [19]. Focus groups lay foundations on group interaction of a small number of carefully selected people and include at least one meeting facilitator. The focus group, developed for the above-described purpose, included specialists from two research centres (Politecnico di Milano and Università del Salento) and the INAIL research department. Overall, eight people took part in the focus group with in-depth knowledge of national systems and near-miss management: 2 senior researchers and 1 junior researcher from Politecnico di Milano, 2 senior researchers from Università del Salento, and 3 senior specialists from INAIL research. A researcher from research centres took on alternatively the role of moderator to maximise everyone's contribution.

The focus group consisted of two workshops of 4 hours each. Each session was conducted on Microsoft Teams, by asking for consent to record and transcribe. Miro platform, an online collaborative whiteboard, supported the running of the two online workshops, enabling participants to work on a shared worksheet.

Three main critical issues for the NMS were analysed in detail: processes, scenarios, and involved actors.

1. Processes are actions required for the correct detection, analysis, and knowledge sharing of near misses from companies to the whole network.
2. Scenarios consider different ways for near-miss management, which are situation-dependent.
3. OSH actors are key players of the Italian national system, having a prominent role in processes' execution, previously identified.

Further information is provided in the following *Results* and *Discussion* sections.

Processes, scenarios, and actors were discussed in each workshop. Hence, the first workshop ended up with a preliminary hypothesis of the NMS. Separate-in-time workshops allowed all participants to think about findings after the first meeting and propose new questions and solutions for the second (last) workshop.

In preparation for the workshops, a preliminary analysis of processes, scenarios, and actors was conducted and a list of potential options to be discussed was prepared. The focus group was so structured to reach the intended outcome by optimising time. Starting from scratch would have required much more time and increased the probability to get participants lost in the debate, not reaching a shared point of view.

## IV. Results

Figure 1 and Table I, in the Appendix, summarise the output of the focus group at the end of 8 hours of workshops. Figure 1 details the processes to be considered in different areas of the NMS: *Design & Maintenance*, *Operational Management*, and *Control*. Table I shows two scenarios and identifies the involved actors for the *Operational Management* area of the NMS for the daily use of provided supportive tools. Figure 1 and Table I are deeply explained in the *next section* where the results are critically discussed.

## V. Near-miss management system: critical analysis

The first goal of the workshop was to identify the main processes characterising the NMS and discuss its application in different contexts.

The focus group detected three main strategic areas that should coexist for a sustainable and effective NMS (Figure 1).

The *Design & Maintenance* area allows the first development of the NMS (design) and its spread over time among companies (maintenance). *Research and model upgrade* processes play a major role during the design and first adoption phase of the NMS, while the

*education & training* process for new and old users is considered a recursive process that keeps the NMS increasing its level of use among actors of the system.

The *Control* area ensures that the NMS works properly. It acts as a supervisory detached section that monitors the correct development of the other two areas (*Design & Maintenance* and *Operational Management*). The two main requirements of the NMS are monitored: the level of use of the system (i.e., the number of users, sectors, and geographical areas in which the tool is used) and the impact of its continuous use, which can be measured with Key Performance Indicators (KPIs) reporting the number of near-miss events, preventive and corrective actions, training programmes, awareness campaigns, etc.

The *Operational Management* area includes all the front-end processes for the daily management of near-miss detection, analysis, and dissemination.

Three levels of analysis were considered, i.e., local, territorial (regional and sectoral), and national levels.

- The *local-level* processes cover individual companies where events occur and improving actions are pursued.
- The *territorial-level* processes consider several companies, belonging to the same geographical areas or sectors. This level of aggregation enables the detection of local specificities and the development of specific territorial actions (e.g., training programmes).
- The *national-level* processes aggregate data of all the participating companies in the country. This enables monitoring national trends of near-miss events and making appropriate policy choices for industries throughout the territory.

As shown in Figure 1, five sequential processes, from the near-miss detection to the return of knowledge after data analysis, have been identified and agreed upon by the participants of the focus group.

Near misses must be first detected and related information gathered (phase 1). The person involved in the near-miss event, or the eyewitness of the event, reports how and under what conditions it occurred. Then, information becomes data which starts to be classified and analysed at different levels of aggregation. Companies can collect and analyse their internal data (phase 2) and then territorial associations and committees can collect data from various sources and make aggregate regional and/or sectoral analyses (phase 3). Other evaluations are carried out at the national level (phase 4) as the more near-miss events are collected the more powerful the return of knowledge to local areas and companies will be, so increasing the impact of using a tool for near-miss management. The informative return (phase 5), considered a crucial process for the survival of the NMS, includes activities that may refer to the sharing of sectoral statistical data, evidence-based good practices for specific sectors, proposals of corrective actions, financial incentives, etc.

The workshop focused on the *Operational Management* area because it has the highest number of processes and people who cooperate at different levels. The set of actors for each process should be therefore clarified for the survival and efficiency of the NMS.

The participants of the focus group discussed the roles needed for each process and they ended up identifying three main types of actors:

- the owner, i.e., the contact point and decision-maker of the process;
- the person in charge of operatively developing the process;
- the person in charge of monitoring the correct accomplishment of the process.

The prior selection of actors ensures that the process is properly developed and preserved over time. Any process needs someone to operatively act and monitor developments. The owner can decide to delegate to others these activities. That explains the three types of actors which may coincide under one person (or not) depending on the process and the context considered.

The discussion among the participants on the actors for the processes of the *Operational Management* area led to identifying two operative scenarios for near-miss management. They differ in the first two processes, i.e., *Detection and information gathering* (phase 1) and *Data analysis at the local level* (phase 2).

The first scenario considers the near-miss detection and information gathering and data analysis processes carried out in-house (within the company). In this case, the data collection within the company can be *direct*, if carried out by the protagonist or eyewitness of the event, or *indirect*, if carried out by another person of the company. It should be noted that the *detection* of the event is by nature a direct process in the company because it can be only carried out by the witnesses of the event, while the *information gathering* can be either direct or indirect.

The second scenario allows companies to outsource the first two processes (phases 1 and 2) by delegating external actors (e.g., external assistance figures). Considering this scenario, we allow companies to report and share near-miss events without forcing them to keep track and analyse those events. The choice is up to companies and may depend on several factors, e.g., dimension, sector, and OSH awareness of the company. That was deemed by the participants of the focus group as a true added value for the NMS.

Phases 1 and 2 are therefore developed at the local level either inside or outside companies, while phases 3, 4, and 5, in both scenarios, refer to processes performed at the territorial and national level, thus externally to companies. This implies that actors will change according to the selected scenario just in phases 1 and 2.

The last step of the focus group covered the definition of the actors for the five processes by discussing for each of them the three different roles above explained. The complete list of actors for the two scenarios is included in Table I; a few key aspects are detailed below.

In the first scenario for *Detection and information gathering* (phase 1), the responsible actors are figures legally involved in OSH issues, such as the employer, who is legally responsible for what happens inside the company. In the same phase and scenario, actors operationally involved should see the daily operations of the company, for instance, workers operating in the production site (regardless they are internal or external to the company), internal and external responsible for the OSH service (RSPP), as well as external assistance figures. In particular, technicians from trade associations can provide support to a company without being dedicated consultants. Actors selected to play a supervisory role are internal and external responsible for the OSH service (RSPP), employer's delegates, and external assistance figures. People in charge of *Data analysis at the local level* (phase 2, first scenario) should be figures with supervisory roles already involved in collecting, aggregating, and analysing data for other similar activities.

In the second scenario for *Detection and information gathering* (phase 1) and *Data analysis at the local level* (phase 2), it is not advisable to have an internal manager of the process. The figure in charge of the activity should be an external consultant or a person from an assistance association.

The two scenarios merge for phases 3, 4, and 5, as already explained.

Regarding *Data analysis at the territorial level* (phase 3), the actual figures to play such activity should be already involved in aggregating and monitoring data of a plurality of companies like associations (i.e., joint, bilateral, or participative bodies).

*Data analysis at the national level* (phase 4) includes actors of the above-mentioned associations as well as researchers from INAIL research, which is a section inside INAIL with an active role in accident data analysis at the national level.

*Dissemination and feedback to local areas and companies* (phase 5) is entrusted to assistance associations that disseminate knowledge on the territory through several activities already detailed above. INAIL research, which has a crucial role in phase 4, now plays a supervisory role by monitoring that the evidence gathered through data analysis is effectively returned to local areas and companies.

## VI. Conclusions

The in-depth discussion with the participants of the focus group led to the definition of a first draft of the national supportive NMS for the Italian industrial sector. The main structure was defined by identifying three strategic areas for its correct development and effective retention over time, leveraging the established Italian OSH network.

For each area, the group detailed processes and involved actors. The *Operational Management* area was addressed in detail by defining key players enabling the introduction of the NMS in the Italian context. For each process of that area, the distinction of different figures (the owner, the operational referent, and the controller) ensures that the planned activity is correctly executed and still applied in a long-term perspective.

The NMS has two main long-term objectives. It needs to reach an increasing number of companies to establish itself over time and, at the same time, it must generate a positive impact for companies implementing it. Both perspectives must be retained over time for the survival of the whole NMS.

As said repeatedly, this work is an explorative study introducing an NMS in an existent network. Being a complex subject, not easy to figure out, the built framework is far to be generalised and more theoretical studies, maybe in other contexts, need to be integrated for a broader picture. Therefore, it opens great opportunities for future developments.

First, the developed NMS will be further investigated in the Italian context to have a shared framework applicable in different areas of the territory. Three local health units (ASL, i.e., in Italian, "Azienda Sanitaria Locale"), in the northwest, northeast, and south of Italy, have been already involved in the project and workshops in their competence area will be proposed to deepen the NMS structured by this work.

Following the mentioned workshops, the Italian NMS will have a shape almost defined, and its knowledge will effectively support the development of practical tools (e.g., software prototypes) for near-miss management in the collection, analysis, and sharing processes.

Generalising, once the NMS is defined for the Italian environment, its framework and all the processes that took to its definition might become a reference model for other countries willing to start similar initiatives.

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## Appendix

TABLE I
ACTORS INVOLVED IN THE NEAR-MISS MANAGEMENT SYSTEM: TWO SCENARIOS

| **Operational Management processes** | **ACTORS: Scenario 1** *Internal near-miss detection* | **ACTORS: Scenario 2** *External near-miss detection* |
|---|---|---|
| *Phase 1. Detection and information gathering* | | |
| Who is the owner of the task? | Direct: employer, internal responsible for the OSH service (RSPP), worker in charge, delegate | external assistance figure, assistance association's responsible |
| Who is operationally involved? | Direct: internal employee, workers' representative for OSH (RLS), internal responsible for the OSH service (RSPP), worker in charge<br>Indirect: external employee, external responsible for the OSH service (RSPP), external assistance figure | external assistance figure, assistance association's technician |
| Who is controlling? | Direct: internal responsible for the OSH service (RSPP), delegate<br>Indirect: external responsible for the OSH service (RSPP), external assistance figure | external assistance figure, assistance association's technician |
| *Phase 2. Data analysis at the local level* | | |
| Who is the owner of the task? | Direct: employer, internal responsible for the OSH service (RSPP), delegate<br>Indirect: external responsible for the OSH service (RSPP), territorial workers' representative for OSH (RLST) | external assistance figure, assistance association's responsible |
| Who is operationally involved? | Direct: delegate, internal responsible for the OSH service (RSPP)<br>Indirect: external assistance figure, external responsible for the OSH service (RSPP), territorial workers' representative for OSH (RLST) | external assistance figure, assistance association's technician |
| Who is controlling? | Direct: employer, internal responsible for the OSH service (RSPP), delegate<br>Indirect: external responsible for the OSH service (RSPP), territorial workers' representative for OSH (RLST) | external assistance figure, assistance association's technician |

| | |
|---|---|
| *Phase 3. Data analysis at the territorial level* | |
| Who is the owner of the task? | assistance association's responsible |
| Who is operationally involved? | assistance association's technician |
| Who is controlling? | assistance association, surveillance body, regional committee |
| *Phase 4. Data analysis at the national level* | |
| Who is the owner of the task? | national assistance association, national institute for insurance against accidents at work (INAIL) – research |
| Who is operationally involved? | national assistance association, national institute for insurance against accidents at work (INAIL) – research |
| Who is controlling? | national assistance association, national institute for insurance against accidents at work (INAIL) – research |
| *Phase 5. Dissemination and feedback to local areas and companies* | |
| Who is the owner of the task? | assistance association, regional committee |
| Who is operationally involved? | assistance association, regional committee |
| Who is controlling? | assistance association, regional committee, national institute for insurance against accidents at work (INAIL) – research |

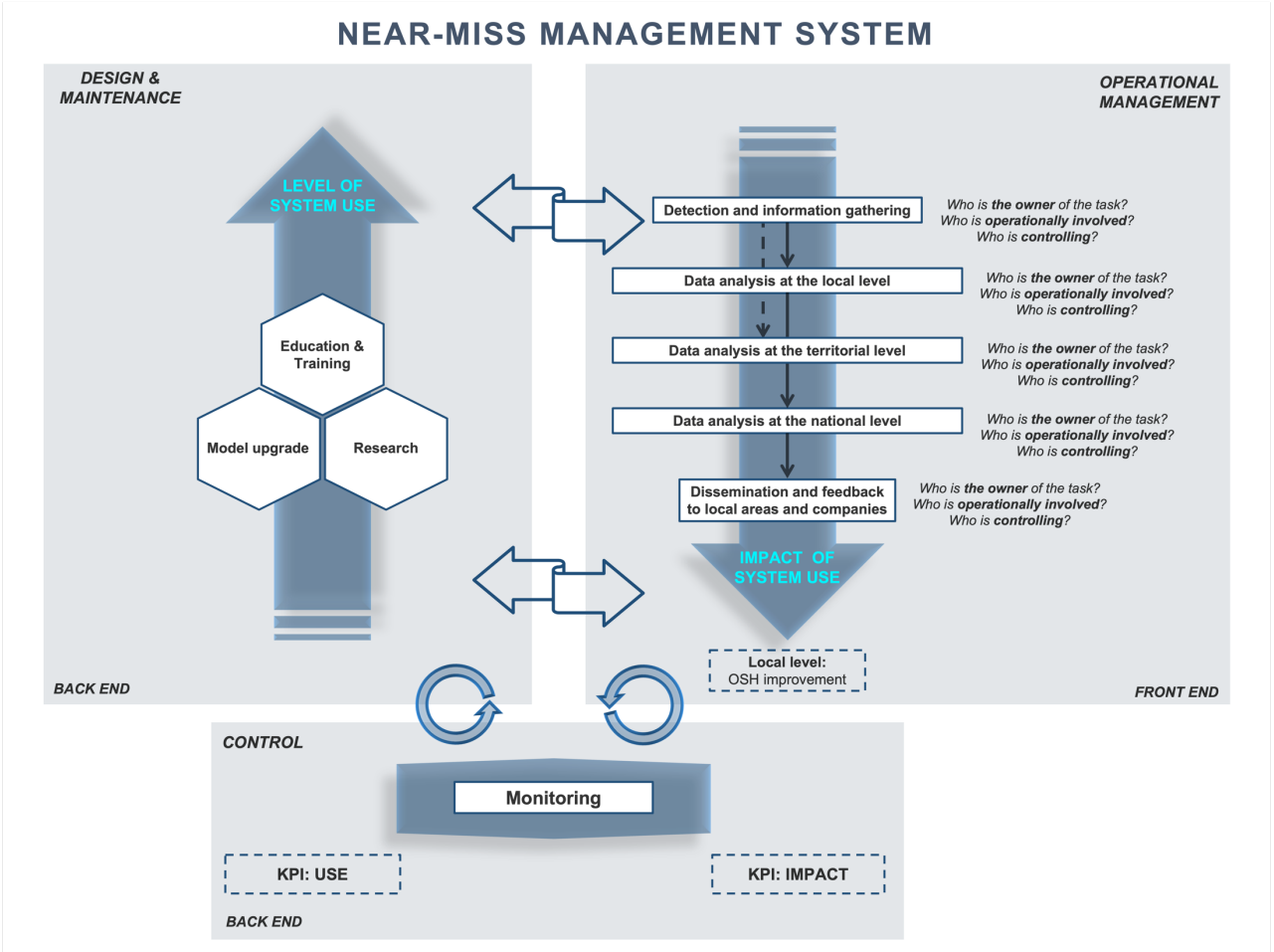


Fig. 1. Designed Near-miss Management System for the Italian industrial sector