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FOCUS AREAS FOR IMPROVING OCCUPATIONAL HEALTH AND SAFETY PERFORMANCE: IDENTIFYING KEY PROCESSES

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Abstract: *This study explores the real-world application of safety performance indicators, focusing on the difficulties faced in practice. To investigate these challenges, a case study was conducted in a Hungarian chemical factory, analysing the practical issues associated with safety performance management. The research identified specific corporate areas and processes that require increased managerial attention, while also examining the factors that influence the effectiveness of performance management. Findings indicate that the practical application of KPIs frequently deviates from the theoretical framework, highlighting a critical gap between concept and execution. One of the most significant challenges observed is the preparedness of middle and senior managers to effectively utilize performance indicators in decision-making. This gap suggests the need for further training and organizational adaptation to enhance the efficiency of safety performance management.*

Key words: *OHS performance management, OHS performance monitoring and measurement, KPI*

1. INTRODUCTION

Modern corporate management focuses on systems that define organizational goals, translate them into actionable objectives, and continuously evaluate processes using measurable indicators. Integrated management systems cover multiple areas, including quality management, environmental protection, and occupational health and safety. (OHS). Performance management relies on key performance indicators (KPIs) to provide actionable insights for control and improvement [1; 2]. However, KPIs often fail to enhance organizational effectiveness when corporate-level metrics are misapplied at lower levels, where operational factors differ. This misalignment results in decision-support information that does not meet specific unit needs. Employees often see KPI generation as an unnecessary burden due to a lack of integration with actual business operations [3]. When KPIs do not provide relevant input for decision-making, or their purpose is unclear, they become an added workload rather than a tool for improving performance.

Management's commitment to safety and employee well-being has other positive outcomes beyond improved safety performance and impacts organizational commitment, turnover, and job satisfaction [4; 5]. Successful OHS management contributes to productivity and overall organisational success [6]. The mainstream decision-making in OSH relies on risk assessment [7; 8] but it may not provide sufficient information in a rapidly changing environment [9]. Companies can understand their safety culture and take further steps to develop a more proactive OHS using the maturity concept [10] characterised by an integrated OHS management system, including defining OHS-specific KPIs.

Improving OHS performance may require harmonising different processes across organisational levels, and the challenges of implementing KPIs are also evident in the context of OHS [11; 12]. Standardised management systems conduct situational assessments through hazard identification, opportunity recognition, and risk evaluation [13]. Critical risks and precursor indicators can be identified and potentially linked to specific

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performance metrics [14]. In theory, applying KPIs for OHS purposes is a complex task that requires deriving metrics from corporate goals, defining methods for their measurement, regularly assessing values, and disseminating this information to stakeholders [15], including top management, middle management, and employees who influence the indicators.

2. MATERIALS AND METHODS

2.1. Research procedure

Our case study explored practical challenges in OHS performance management, identifying key corporate areas and processes requiring managerial focus while examining factors influencing performance measurement and management effectiveness.

Case studies are a widely used methodology in qualitative social research, including management studies [16]. They involve empirical investigations of real-world phenomena using diverse data collection methods such as surveys, interviews, observations, and document reviews [17]. While not a data collection method itself, a case study is a research approach that provides in-depth insights over time. The unit of analysis can vary, including individuals, organizations, events, or decisions.

This exploratory [20] case study analysed a Hungarian subsidiary of a Korean-owned multinational company between January 2022 and March 2024. The total number of employees is approximately 320. In the first period of the case study, company processes that require management attention were identified to improve OHS performance. A system was developed to monitor these processes, including KPIs, targets to improve performance, and recommended actions to achieve them. Additionally, a "baseline" survey (staging) was conducted. In the second stage, the KPI system was implemented, and the corporate factors influencing the operation of the performance management system were examined. The research path is presented in Fig 1.

The length of the interviews varied between 35-55 minutes and the content analysis of the reports was used to analyse the interviews [21-23] and systematic text condensation [24] was used to transform the main points of the interviews into short forms and categorise them. The applied qualitative content analysis procedures, deductive and inductive categorisation and coding ensure the scientific nature of the research [25; 26].

The company's risk assessment documentation and OHS internal regulations were examined using document analysis [27] [28] to allow detailed information and reporting on the case or organisation under study [29–31]. The analysis of the risk assessment documentation and the company's OHS regulations resulted in the company's OHS risk map. To identify unmanaged risks, the nature and extent of the injury, the location of occurrence, and the number of typical injuries were analysed through document analysis of reports. The maturity of the company's occupational safety culture was examined using a 28 question four-step Likert scale survey based on Pirhonen [32] through the following themes: communication, training, organisational learning, senior and middle management commitment, and employee commitment and involvement. each item was rated on a scale from “undeveloped” to “sophisticated” safety culture.

Instructions were given that the item higher on the evaluation scale should be selected if they considered that all the aspects described at the lower levels were met. If more than one criterion was included in the description, all conditions must be met to reach the level.

All company employees, including management team members and the CEO, completed the printed, paper-based questionnaire. The evaluation was carried out based on 258 completed questionnaires. The reliability of the questionnaire results was assessed using the Cronbach-alpha method [33].

2.2. Data protection

The manufacturing company that is the subject of the case study agreed to carry out the research but did not disclose its name and business details. The research was conducted while adhering to a confidentiality obligation. Use and documentation of sensitive data for the research was permitted, but not all data could be disclosed when publishing the results.

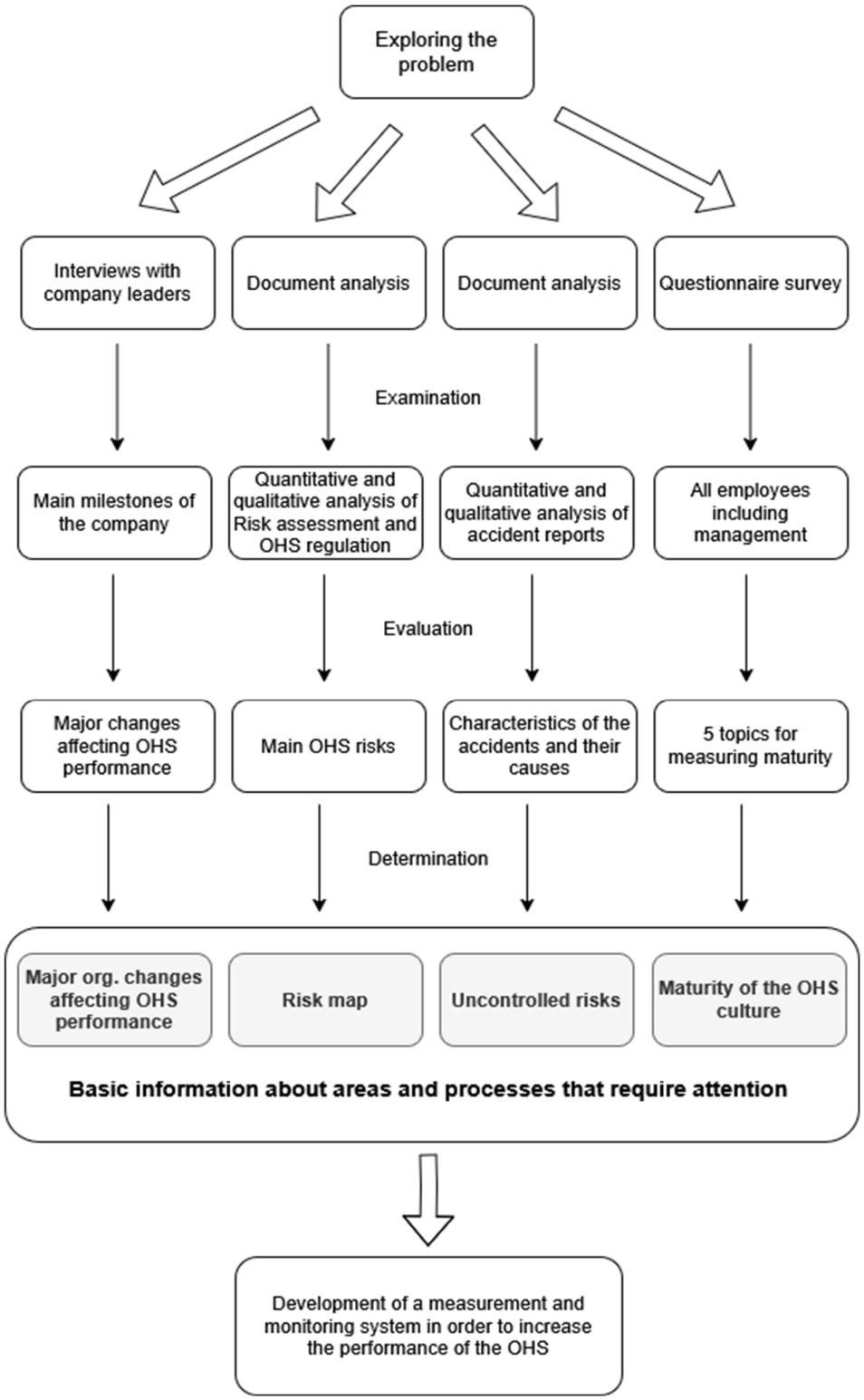

Fig. 1. The process of the first stage of the research.

2.3. Data collection and recording

All steps and relevant information were factually recorded to document the research in detail and for subsequent analysis. All electronic correspondence related to the topic and the tables and graphs created while monitoring and evaluating the processes were also recorded and dated.

2.4. Ethical approval

This research is a non-interventional or medical study and did not study humans (individuals, samples, or data), and neither collect and handle any personal or medical information. The research is not subject to the Declaration of Helsinki, and ethical approval was not required.

3. RESULTS

3.1. Overview of the company's activities and OHS management in Hungary

Six management interviews revealed the most significant milestones regarding the company's OHS management. The organisation was established under the leadership of Korean professionals in the positions of Managing Director (MD), Production Director (PD) and Chief Finance Officer (CFO). The first years, between 2010 and 2015, the plant focused primarily on starting and ramping up production. The company did not yet have an Environmental and Occupational Safety (EHS) department. The principal OHS specialist worked as a direct subordinate of the managing director.

From the beginning, the organisation has been regulating work based on standard operating procedures (SOPs). In the first years, there were frequent changes in the OHS specialist position. The Hungarian specialists had difficulty enduring the Korean MD's determined leadership style. Of the management systems, only a quality management system according to the ISO 9001 standard was in operation at the company, and the management of OHS was typically reactive during this period.

In 2015, to meet the legal requirements for OHS and enhance OHS activities, the company established an EHS department with an environmental and health and safety manager (EHS manager) board of directors member-level position reporting directly to the MD. OHS inspections became regular: daily audits were supplemented by weekly management audits. Monthly OHS training was introduced based on a training plan including accidents from the previous period were discussed, and feedback on workplace safety was requested from employees. Emergency plans were developed and were also taught and practised. Daily "5-minutes" OHS training was introduced. With the introduction of the OHS management system (OHSAS, later ISO 45001), occupational safety performance measurement was also established at the company. The indicators used for monitoring are summarised in Table 1.

The new MD (2017) strongly represented OHS. The 5S system and its regular monitoring were introduced. A shift handover and takeover order was established for shifts. A system was developed and implemented for monitoring, reporting and manage near-misses. OHS developments were included in the performance evaluation goals of the EHS manager.

The MD held part of the OHS training; the information was shared immediately if a serious incident occurred at any of the company group's sites. If shift leaders did not follow the managers' instructions, the MD would react immediately and hold them accountable. A separate trainer was assigned to train newly hired employees. During the training period, the Hungarian company was consistently among the group's most successful plants in terms of OHS.

In 2017, another significant change in the company's life was the start of the design and construction of the second factory at the Hungarian site.

Table 1

Metrics used to monitor, and measure OHS performance (Source: authors edition).

Indicator used for performance measurement	Target
Number of reportable accidents	0
Number of lost working days	0
Number of OHS ideas and suggestions	5/month (minimum)
Number of reported near misses	5/month (minimum)
Number of OHS training courses	12
Number of unacceptable risks	0

Number of legal non-compliances	0

In 2018, employees from the old factory were appointed to middle management positions (without management experience) to start production in the newly built second factory. Newly hired employees arrived in production. Factory 2 started its operation with inexperienced employees in all positions. Persistent organisational tension was identified, indicating sustained internal conflict between the two factories. OHS results deteriorated, tension and stress became continuous, and the number of accidents increased.

The company greatly emphasised combating the coronavirus pandemic from the beginning of 2020 to the end of 2021. During this period, the plant's management focused on protecting employees' health, maintaining the workforce and minimising financial losses.

In 2021, the Korean management was replaced again, with new managers taking on the positions of MD, CFO and PD. The new CEO was not involved in the daily operations, focusing on stabilizing the company's financial situation. Control over shift managers and employees was lost. The number of accidents, near-misses and dangerous situations continued to increase. The main milestones of the company's operations and changes in OHS performance are included in Table 2.

3.2. Risk map

Figure 2 shows the company's risk map, which was prepared using detailed OHS risk assessment documentation processing.

The location of the risks is not shown in the figure because the company can be identified based on the names of the workplaces. he employer's occupational safety regulations and OHSAS procedures cover the management of these risks.

Table 2

Main milestones of the company's operations.

Date	Milestone	OHS performance
2010	Establishment of the Hungarian company, factory construction	-
2010-2015	Starting and improving production	One person (OHS specialist)
2015	OHS management position is established in the company Implementation of OHS management system	OHS manager and other functions (fire safety and ADR experts) OHS department is formed OHS strategy OHS trainings OHS communication Management control Performance measurement
2017	Management change in Korean management positions The new MD strongly represents OHS	New MD focuses on OHS Shift change procedure with OHS focus Information sharing between companies OHS improvements Near miss report system Best OHS performance among the companies
2017	New factory construction	
2018	Production begins in the new factory	Inexperienced leaders Weak labour market, low-skilled workforce OHS performance begins to deteriorate
2020-2021	Coronavirus disease Economic downturn	The main OHS focus is on epidemic prevention
2021	Management change in Korean management positions The new MD did not get involved in the day-to-day business; he focused	Control over middle managers and employees is lost The number of accidents, near misses and dangerous

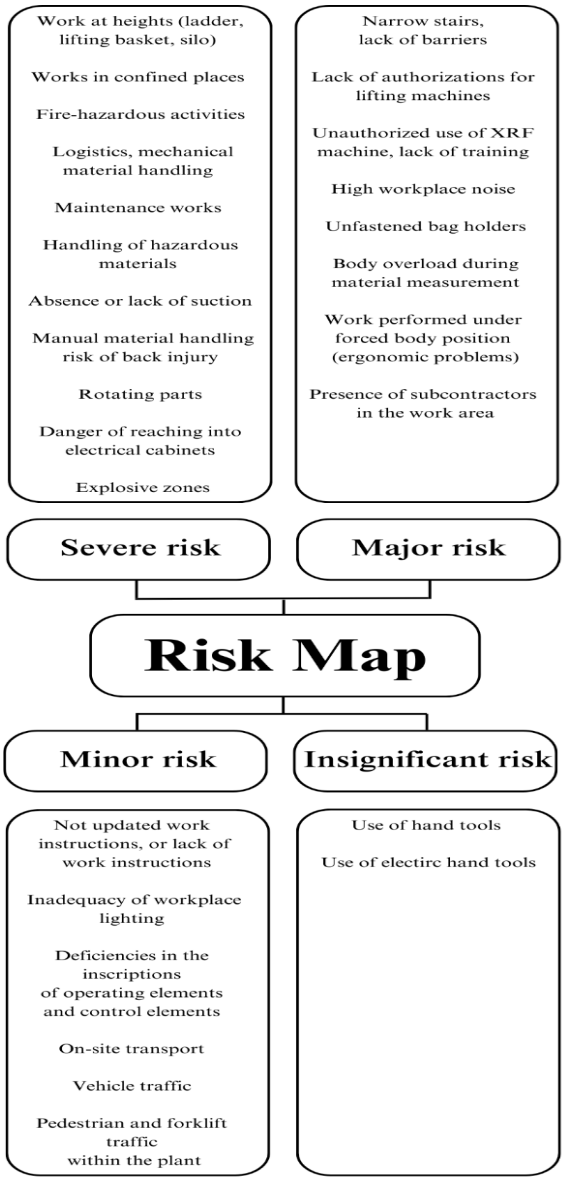

Fig. 2. Risk map.

3.3. Accident analytics, uncontrolled risks

Based on the quantitative and qualitative analysis of the reports of reportable accidents that occurred in the plant:

The accident statistics are illustrated in the graph in Figure 3 and the nature as well as occurrence of injuries is listed in Table 3.

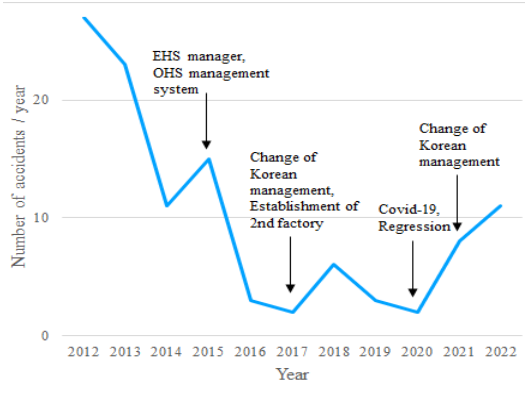

Fig. 3. Trends in reportable accidents at work between 2010 and 2023.

Table 3

Nature and number of injuries at the company.

Nature of injury	Aggregation (2012-2022)
Bruise	29
Stretching, twitching	11
Cut wound	19
Back injury	18
Burn injury	7
Head injury	6
Fracture	4
Eye damage	4
Electric shock	3
Open wound on the hand	3
Facial injury, chemical spillage	2
Finger amputation	1
Abdominal hernia type	1
Foreign material in the ears	1
Open wound on the eyebrow	1
Open wound on the mouth	1
All accidents	**111**

The main causes of reportable accidents are inadequate workplace environment (order, cleanliness), failure to use personal protective equipment (PPE), work performed without observing the requirements set out in work instructions, manual handling (inappropriate lifting of heavy loads), ergonomic problems (repetitive movements or work performed in a forced body position).

Table 4

Results of the questionnaire topics.

Topic	Maturity level
Communication	2,3
Training	1,5
Organizational learning	3,0
Leadership commitment	2,7
Employee engagement and involvement	1,8

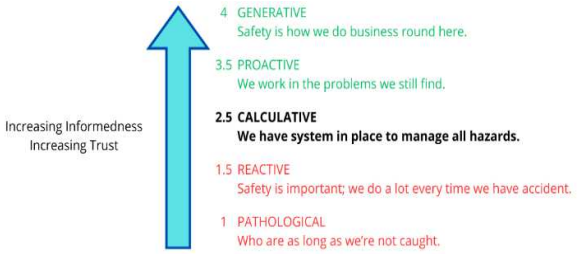

Fig. 4. Determining the maturity level of safety culture (Source: authors edition based on [10] and [36]).

3.4. Determining the level of safety culture maturity

The sample consisted of 258 questionnaires filled out by all company employees. The calculated value of Cronbach-alpha was 0.869, which is considered adequate reliability as a research criterion [33].

The responses received were summarised by question and topic, and the maturity levels of each topic were determined accordingly. The results are shown in Table 4.

The value characterising the occupational safety maturity level was calculated from the average of these values, which was 2.69.

Using the Hudson maturity model [10, 34, 35], the maturity of the company's safety culture was determined according to the "Calculative" level (Figures 4).

At this maturity level - according to the model [10], [36] - there is already an established system for managing risks, a maturing safety management system and risk assessment, active leadership, trained employees, use of leading and lagging metrics characterise the company.

The survey results (Table 4) show that organisational learning and leadership engagement were rated highest. Training and employee engagement were rated low. These indicate the areas where intervention is needed to improve effectiveness.

3.5. Identifying areas and processes requiring attention

The company's OHS activities and processes are fundamentally well-managed, but the OHS performance is unstable, and further development is not achieved. Accidents occur in the company, and the number of accidents sometimes increases – despite the efforts of the local OHS management.

The research suggests that identifiable internal and external factors significantly influence the company's OHS performance. Understanding these factors can help management mitigate adverse impacts.

Among the internal factors, the lack of skilled labour and knowledge management is one of the problems. Middle management employees (shift leader, extruder leader and mixer leader)

typically do not have the necessary leadership skills and experience. A preference for promotions from within characterises Korean corporate culture, which would help the employee's career development and allow the company to utilise the employee's acquired experience further. In Korean culture, employees do everything they can to be competent in their job or position. Thus, the company did not consider it notable to pay special attention to the development of appointed employees. The lack of leadership experience and practice and weak leadership do not adequately support increasing OHS performance.

Insufficient management focus on employees, inadequate communication, and lack of employee involvement affect employee commitment to OHS. Weak employee commitment is reflected in the effectiveness of 5S tasks, lack of order, non-compliance with work instructions, and general workplace discipline. At the time of the survey, an inadequate working environment was the primary source of accident risk.

Personnel changes in the MD position affect the organisation's operation. The management focus changes depending on the aspects the actual MD prioritises in managing the factory. OHS performance noticeably takes a back seat if productivity or profit is prioritised. In such cases, local department management has difficulty controlling OHS performance. Changes in the MD position always generate significant organisational changes and significantly affect the organisation's OHS performance.

Expanding production capacity, establishing a new site, or similar major organisational changes impact OHS performance partly because management attention is divided and partly because of newly hired employees.

External factors like the COVID-19 pandemic significantly increased the company's OHS management workload. Due to shipments from the Far East, foreign policy events affecting the transportation routes, such as the Red Sea conflict or the Russian-Ukrainian crisis, cause significant tension in production.

The research identified weak points that needed attention and improvement. The next phase focused on monitoring, measuring and influencing these points.

3.6. Development of the OHS performance measurement system

A measurement and communication system were developed based on the results of the studies aimed at revealing OHS problems. The goal was for the performance management system to

- Provide the necessary information for decisions resulting in the improvement of OHS performance and
- Establish a two-way communication between management and employees.

Given that the current state – less favourable than the company's previous OHS performance – was caused by several operational problems, we developed a plan for a comprehensive performance measurement and evaluation system according to the original idea. The goal was to pay attention to all areas of the company that could affect OHS performance. Accordingly, the planned performance indicator system extended to manual workers, middle managers, management, processes and the organisation.

For the indicators, the data source, the method, and the frequency of data collection (daily, monthly) were determined. For each indicator, target values have been defined that need to be achieved to improve OHS performance. It was also examined which existing company documentation (e.g., EHS internal audit report, Shift Leader report) needed to be modified to record the data to be measured.

The key performance indicator set thus created included 52 different KPIs: 12 for measuring the OHS performance of production workers (departments), 9 for shift leaders, 4 for measuring the OHS performance of management, 6 for measuring processes, and 21 for measuring organisational performance. (The datasheet containing the KPI set is available on request from the corresponding author, F Faragó. The data are not publicly available.)

Due to the number of changes, implementing this set of metrics in the time affected by COVID would have been difficult. Dealing with the organisation's resistance and dampening effects

would have required significant time and energy. Therefore, it was decided to initiate the operation of the production-related system as a first step.

The company's employees work eight shifts, four of which have been established per factory unit. The shifts rotate in a 12-hour work schedule. The plants operate continuously (day, night, and on weekends).

KPIs were developed for the factors that caused or affected the errors identified during the baseline assessment. The goal was to draw the attention of management and employees to these processes and factors, facilitating their development. Accordingly, a system was prepared for measuring performance, as shown in Table 5.

Table 5

The performance measurement and evaluation system.

Parameter to be measured*	Observed parameter / process	KPI
safe behaviour, following rules, knowledge / competence, communication, state of working environment - 5S	Number of warnings due to unsafe behaviour (PPE, Safety SOP).	USB (Unsafe Behaviour)
	Number of warnings due to serious non-conformities/misdemeanours (in connection with dangerous activities, under the influence of alcohol, etc.)	MSNC (Major Safety Non-Conformity)
	Harm	IH (Intentional Harm)
	Number of trainings (occasion / employee)	ST (Number of Safety Trainings)
	Proportion of employees participating in training	TAR (Training Attendance Rate)
	5S activity / state	5SL (5S Level)
	Reported near miss or dangerous situation	NM (Near Miss)
	Number of occupational safety consultations (with an occupational safety representative)	REP (Consultation with HS Representative
	Absences (sickness) (working day / working hours)	LTI (Lost Time Injury)

*) information collected

The following research phase examined the implementation and effectiveness of a system designed to monitor and measure processes. This research covered the corporate processes and factors influencing the application of the performance measurement system.

4. DISCUSSION

Examining the reportable workplace accidents at the facility provided valuable insights into OHS challenges and their causes.

One surprising finding was the lack of documentation for the facility's first two years of operation. Additionally, it was clear that all reportable accidents occurred in the production areas, with none reported in offices or administrative roles, emphasising the higher risks associated with hands-on industrial tasks.

The types of injuries reported - bruises, cuts, back injuries, strains, burns, and head injuries - show the range of hazards workers face. Notably, no accidents were reported in highly regulated activities like working at heights or confined spaces, suggesting that strict controls in these areas are adequate.

The findings partially support the notion that a proactive approach to OHS management yields positive outcomes at the employee level. The results indicate that organisations with proactive OHS management exhibited higher profit margins and lower accident rates. One critical

application of KPIs is recognising organisational changes. From an OHS perspective, this entails utilising information generated in the safety domain to benefit overall corporate operations and identifying signals that require action in OHS activities. Tappura [1], [37] highlights the challenging nature of OHS management in a dynamic context. OHS leadership faces significant challenges under high economic pressure, efficiency demands, and organisational bureaucracy. Furthermore, external factors contribute to substantial changes impacting organisational functioning alongside internal shifts.

Through quantitative and qualitative analysis of accident reports, unmanaged risks were identified that required immediate attention. This enabled targeted intervention in areas where existing safety measures were inadequate or inconsistently applied. Additionally, the organisation-level safety culture maturity assessment revealed critical areas for improvement. This assessment indicated the need for initiatives to raise safety awareness and promote accountability and responsible work behaviour among employees.

We proposed processes requiring managerial focus to address these challenges and developed a detailed management plan with KPIs. This plan emphasises a continuous implementation, evaluation, and adjustment cycle, ensuring sustainable OHS performance improvement.

These efforts together provide a roadmap for the organisation to transition toward a more proactive, integrated approach to workplace safety, with measurable goals and clear accountability at all levels.

5. CONCLUSION

This study helped identify the corporate areas and processes that require managerial attention to improve OHS performance and understand how OSH KPIs can be used in a multinational corporate environment.

In conclusion, the practical application of KPIs only sometimes aligns with the theoretical framework. Organisations often fail to develop a customised KPI structure that meets their organisational specifics and objectives. Instead, they mechanically apply KPIs required at the top management level across the organisation, ignoring the unique needs of different organisational levels. As a result, KPIs are not designed to provide the input information necessary for decision-making at the respective organisational levels. A significant challenge observed was the need for middle managers to be more prepared to use KPIs effectively in corporate communication, decision-making, and employee consultation. This attitude and lack of skills led to a perception of KPIs as an unproductive and burdensome part of their work. Another issue with using KPIs for OHS purposes is that critical aspects of processes at specific organisational levels remain uncovered. This gap prevents the effective use of the vast amount of available information. Various internal and external factors influencing organisational functioning, including OHS performance, should be addressed.

This study demonstrates that with focused leadership and a commitment to continuous improvement, significant strides can be made in enhancing OHS performance and fostering a safety culture. Consequently, the potential of KPIs to contribute to meaningful improvements in occupational health and safety performance needs to be more utilised.

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Domenii prioritare pentru îmbunătățirea performanței SSM: Identificarea proceselor-cheie – Studiu de caz

Acest studiu explorează aplicarea reală a indicatorilor de performanță în domeniul siguranței, concentrându-se pe dificultățile întâmpinate în practică. Pentru a investiga aceste provocări, a fost realizat un studiu de caz într-o fabrică chimică din Ungaria, analizând problemele practice asociate managementului performanței în siguranță. Cercetarea a identificat domenii și procese specifice din cadrul companiei care necesită o atenție managerială sporită, examinând totodată factorii care influențează eficacitatea managementului performanței. Rezultatele indică faptul că aplicarea practică a KPI-urilor se abate frecvent de la cadrul teoretic, evidențiind un decalaj critic între concept și execuție. Una dintre cele mai mari provocări observate este pregătirea managerilor de nivel mediu și superior pentru a utiliza în mod eficient indicatorii de performanță în procesul decizional. Acest decalaj sugerează necesitatea unor programe suplimentare de formare și adaptare organizațională pentru a îmbunătăți eficiența managementului performanței în siguranță.

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