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OVERCOMING CHALLENGES IN SAFETY MANAGEMENT SYSTEMS TO ENHANCE OPERATIONAL EFFICIENCY IN FUEL STATION OPERATIONS

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Abstract

Effective implementation of Safety Management Systems (SMS) is essential for improving operational efficiency (OE) and reducing risks across modern industries. In particular, the fuel station industry faces heightened safety concerns due to flammable materials, high human traffic, and complex regulatory requirements. Although SMS can decrease faults by 10% to 50% and enhance safety performance, organisations often encounter significant obstacles. These include insufficient leadership commitment, training deficiencies, and cultural barriers that hinder effective SMS deployment. The main problem this study addresses is the persistent gap between SMS design and its actual execution at operational levels within fuel stations. Therefore, the aim of this research is to identify critical implementation challenges in SMS and evaluate their impact on operational efficiency in fuel station operations. This article explores these challenges and presents practical solutions, such as fostering strong leadership engagement, improving training programmes, and implementing structured planning strategies. A qualitative-based methodology was adapted, a narrative review supported by interviews. Key findings revealed that leadership support, employee safety culture, and clear procedural alignment significantly influence SMS success and operational outcomes. By addressing these critical areas, organisations can overcome existing hurdles and create safer, more efficient operations, ultimately achieving sustainable improvements in safety outcomes and operational performance.

Keywords: Fuel station industry, Leadership engagement, OE, Safety culture, SMS.

1. Introduction

A Safety Management System (SMS) is fundamental in fuel station operations to ensure safe operations and mitigate risks [1, 2]. Effective SMS implementation reduces faults by 10% to 50% [3] and significantly enhances operational efficiency (OE). Its importance extends beyond compliance, serving as a cornerstone for sustainable industry practices. However, its deployment within the fuel station sector faces several unresolved challenges. These include inconsistent leadership commitment, inadequate employee training, and a deep-rooted organisational culture that resists change [4, 5].

SMS is pivotal in maintaining operational integrity and reducing workplace incidents across various sectors, with the foundational studies [6, 7]. By systematically identifying, assessing, and mitigating risks, SMS ensures a structured approach to safety [8]. This method safeguards personnel and optimises processes, contributing to long-term sustainability and productivity. In the fuel station context, this structured approach is especially vital due to the unpredictable nature of fuels, high public exposure, and regulatory demands.

Although SMS can potentially improve safety procedures, several challenges must be addressed before successful adoption. These challenges make it difficult to consistently incorporate safety precautions into routine tasks, ultimately undermining the improvement objective. Agus Salim et al. [9] and Hassan et al. [10] stress the significance of resolving these gaps and difficulties to create more successful safety management methods in the sector.

The purpose of this study is to improve fuel station industry safety management procedures. It aims to successfully incorporate safety measures into the operating framework by evaluating the difficulties and offering pertinent suggestions. Specifically, this paper focuses on fuel station operations in Malaysia and investigates the effectiveness of SMS in overcoming known challenges to boost OE. Ultimately, this strategy will provide an industrial setting that is safer and more effective [11]. As a result, companies may maximise operating efficiency and enhance safety results.

The next section of this article provides a detailed analysis of operational practices and their implementation in SMS. It begins with a review of the development of SMS. Following this, the study identifies the challenges faced in safety management implementation and offers targeted recommendations for enhancing operational effectiveness and efficiency. The conclusion summarises the key takeaways and emphasises the importance of bridging the gap between theory and practice in safety management.

2. Literature

The drive for enhanced OE has underscored the imperative of adopting SMS. This viewpoint finds validation by Misra et al. [12], which sustains the idea that SMS implementation strengthens employee and customer satisfaction and enhances OE.

This categorisation emphasises the interconnectedness of leadership, training, and cultural challenges in implementing SMS [13], supported by relevant studies and insights and synthesised into the conceptual framework shown in Fig. 1.

Fig. 1. Interconnectedness of leadership, training, and cultural challenges in implementing SMS.

2.1. Leadership commitment

Leadership commitment plays a central role in the successful implementation of SMS. It shapes safety behaviours, motivates compliance, and drives the organisation's overall safety culture. This section discusses how leadership influences operational planning, stakeholder trust, and regulatory adherence in the context of fuel station operations.

2.1.1. Better operational planning and decision-making

Strong leadership is essential for aligning safety priorities with operational decisions. In fuel stations, where safety risks are high, leadership drives the integration of risk assessments into day-to-day planning. Effective decision-making relies on strong leadership to implement structured safety protocols and allocate resources efficiently. Organisations may fail to prioritise risk assessments and safety planning without committed leadership. Zhang et al. [14] highlight the need for leadership involvement in integrating SMS into all aspects of decision-making. For example, clear delegation of safety responsibilities by supervisors ensures timely equipment checks and immediate reporting of hazards.

2.1.2. Enhanced reputation and stakeholder trust

A visible commitment to safety by leadership builds stakeholder confidence and reinforces an organisation's reputation. This is particularly important in the fuel retail sector, which is highly regulated. Leadership commitment to safety directly influences stakeholder trust and organisational reputation. Demonstrating safety responsibility fosters external confidence. Misuri and Cozzani [15] and Machfudiyanto et al. [16], emphasise the role of leadership in maintaining stakeholder trust through robust SMS implementation. When safety is treated as a leadership priority, it sends a strong message to employees, regulators, and customers that the organisation values human life and operational integrity.

2.1.3. Improved compliance and regulatory adherence

Consistent leadership engagement improves adherence to regulations and internal standards. At fuel stations, this means ensuring all safety checks, audits, and reporting processes are completed on schedule. Strong leadership ensures compliance with regulations by implementing clear safety protocols and conducting regular audits. Regulatory adherence is highlighted by Zhang et al. [17], linking leadership commitment to achieving and surpassing industry standards. According to Chen et al. [18] culture prioritising safety has effects, including increased employee engagement, productivity, and organisational performance. For instance, routine safety audits led by senior managers increase accountability and reduce non-compliance rates.

2.2. Training gaps

Addressing training gaps is essential for ensuring that all operational staff at fuel stations possess the knowledge and competence to implement safety procedures correctly. Poorly trained personnel can unintentionally compromise SMS, making training a cornerstone of effective system implementation. This section discusses keyways training influences SMS effectiveness.

2.2.1. Improved training and development

Effective SMS relies on continuous workforce development and addressing training gaps. Organisations need to design programmes that evolve with new safety challenges. Companies must invest in training programmes to maintain safety standards, as noted by Wibowo et al. [19]. For instance, Malaysian fuel stations have adopted scenario-based training and safety drills simulating leakages and fire emergencies, equipping staff with both procedural knowledge and decision-making capabilities.

2.2.2. Increased efficiency in incident response

Incident response improves with proper training, enabling employees to analyse incidents and implement corrective actions. Efficient incident analysis and response require well-trained personnel, as highlighted by Smoczyński et al. [20]. Staff familiar with standard operating procedures (SOPs) and emergency reporting protocols can act decisively during crises, minimising harm and downtime.

2.2.3. Increased employee engagement and morale

Training contributes to a positive safety culture, enhancing employee engagement and morale. Organisations fostering a strong safety culture through training improve stakeholder perceptions, according to Goerlandt et al. [21]. When employees feel equipped and valued, their commitment to enforcing SMS protocols and reporting unsafe conditions increases.

2.3. Cultural barriers

Cultural resistance remains a subtle but powerful barrier in SMS implementation. In fuel stations, attitudes such as 'taking shortcuts', overconfidence, or normalising

risky practices hinder the adoption of safety protocols. This section elaborates on how cultural transformation can reduce such resistance.

2.3.1. Enhanced risk management

A proactive safety culture, supported by systematic risk assessment, helps overcome cultural barriers that may otherwise tolerate unsafe practices. Kwon et al. [22] stress that building a culture of vigilance is essential for successful SMS implementation. This includes cultivating attitudes that view near-miss reporting as preventive rather than punitive, especially among junior staff.

2.3.2. Reduction in faults

Creating a culture prioritising hazard identification and prevention can significantly reduce faults. Sattari et al. [23] and Mihai et al [24] show how cultural shifts lead to measurable improvements, reducing faults by up to 10% to 50%. These results are particularly relevant to high-risk environments such as fuel stations, where cultural awareness directly impacts operational safety.

3. Method

The methodology provides a more detailed outline of the narrative review-based literature selection process. In addition to the narrative review, this study adapted a qualitative case study methodology to examine the implementation challenges of SMS in the Malaysian fuel station industry. Thematic analyses were employed to identify recurring patterns and challenges in leadership engagement, training practices, and organisational safety culture. This hybrid method allowed triangulation between literature findings and real-world practices, ensuring greater reliability and contextual depth.

3.1. Interview protocol and sample selection criteria

The research involved semi-structured interviews with safety managers, operational supervisors, and technicians across five fuel stations, as shown in Table 1.

Table 1. Interview participant.

Fuel Station (FS)	Name	Position of Participant
FS1	#1 and #2	Safety managers and Technicians
FS2	#3 and #4	Safety managers and Operational supervisors
FS3	#5 and #6	Operational supervisors and Technicians
FS4	#7 and #8	Safety managers and Technicians
FS5	#9 and #10	Operational supervisors and Technicians

The selection of participating fuel stations was based on purposeful sampling to ensure representation of diverse operational contexts within Malaysia. Selection criteria included station type (company-owned vs. dealer-operated), geographic location (urban vs. suburban), and customer volume, ensuring a balanced view of different operational scales. Within each selected station, interviewees were chosen based on a minimum of three years' operational

experience and direct involvement in SMS-related activities, such as hazard reporting, safety briefings, or equipment inspections.

Prior to data collection, an interview guide was developed, informed by the core themes identified in the narrative review (leadership commitment, training practices, and organisational culture). The guide included open-ended questions such as: "How are safety policies communicated and enforced in daily operations?" and "What challenges have you faced in implementing SMS protocols?" This ensured consistency across interviews while allowing for flexibility to explore emerging topics. Interviews were conducted face-to-face where feasible, or via secure video conferencing, each lasting between 45–60 minutes. All interviews were audio-recorded with participant consent, transcribed verbatim, and anonymised to maintain confidentiality. Ethical clearance was obtained from the University authority.

3.2. Coding and analysis

Thematic analysis was carried out following Braun and Clarke six-step approach: familiarisation with data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report [25, 26], as outlined in *Appendix A*. Both inductive (emerging from the data) and deductive (driven by the review themes) coding strategies were employed. Coding was performed manually and cross-checked by a second researcher to enhance reliability. Discrepancies were discussed and resolved collaboratively. NVivo software was used to organise coded data, allowing for efficient retrieval and comparison of excerpts across themes.

3.3. Narrative review

For the narrative review component, a structured protocol was used as illustrated in Fig. 2. The process included database searches, screening for relevance, and applying inclusion and exclusion criteria. Keywords used were grouped by core themes (leadership, training, and cultural challenges), and search strings were structured using Boolean operators ("SMS" AND "operational efficiency" AND "leadership engagement" AND "fuel station" OR "petrol station").

4. Triangulation and Validation of Findings

To strengthen the validity of conclusions, this study employed methodological triangulation, integrating evidence from the narrative literature review and qualitative interviews. For each core theme leadership commitment, training gaps, and cultural barriers are patterns identified in the literature were compared with operational realities described by interview participants as obtained from Fig. A-1 *(Appendix A).*

The literature consistently highlighted the role of leadership visibility in enforcing SMS compliance [14, 15, 17] a finding mirrored in 80% of interview responses where managers' active involvement was linked to improved hazard reporting rates. In contrast, literature suggested that cultural resistance often manifests as underreporting [22, 23] which was only partially supported in the interviews and some stations had already implemented peer-led correction mechanisms.

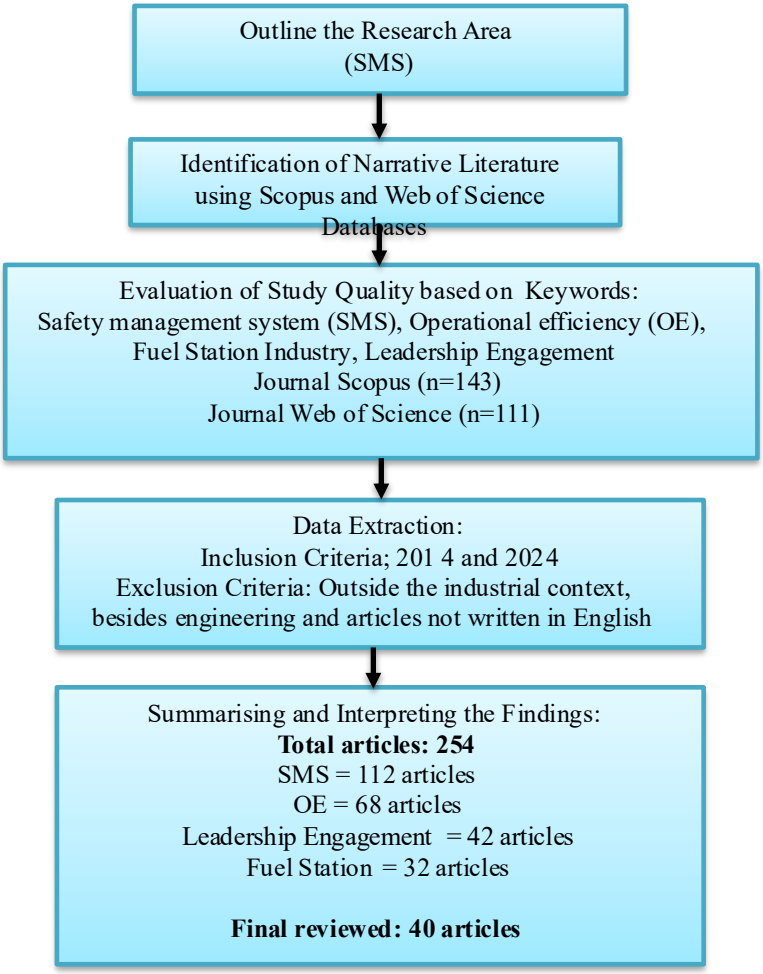

Fig. 2. Methodology for carrying out a narrative review.

5. Results and Discussion

Integrating SMS has greatly enhanced OE, according to numerous studies. However, the continuous integration of SMS into OE practices that requires careful attention. Understanding direction, outcome, and strategic resolution is needed for each challenge such as regulatory complexities, organisational adaptation, and the details of process integration, forming an integral part of the SMS integration landscape.

Thematic analysis of interviews with fuel station staff confirmed that the main obstacles to effective SMS integration with literature are summarised in Table 2.

These findings reveal a persistent gap between policy and practice. While literature discusses SMS benefits and barriers generally, this study offers specific insights from real operational contexts. The results suggest that targeted interventions like regular SMS training, management workshops, and peer accountability systems can effectively address the identified issues.

Table 2. The challenges of SMS implementation.

Main Point	Authors/ Field Insight	Results of Challenges
Lack of leadership commitment	[14-18, 27, 28]	The successful implementation of SMS becomes easier with a strong commitment from leadership.
	[29-34]	Limited financial resources, time, and personnel can hinder the effective implementation of SMS.
	Interview Safety managers #1, #3 and #7	Supervisors lacked awareness of SMS protocols; decisions often prioritised speed over safety.
Inadequate training and education	[19-21, 35-38]	More training and education on SMS practices can result in effective implementation due to misunderstandings and misinterpretations of the importance of safety procedures.
	[39-44]	Resistance from employees and management to adopt new safety practices can stem from a reluctance to disrupt established routines or a lack of understanding about the benefits of SMS.
	Interview Operational supervisors #4, #5 and #9	Frontline workers had not received refresher training in over 12 months; safety briefings were informal and undocumented.
Cultural barriers	[22-24, 45-48]	Implementing SMS may be hindered by organisational cultures that do not prioritise safety or tolerate shortcuts.
	[49-55]	The need for data-driven insights hampers the organisation's ability to monitor progress and demonstrate the effectiveness of safety management efforts.
	Interview Technicians #2, #6, #8 and #10	Some staff viewed SMS as paperwork, with low commitment to incident reporting or peer-to-peer correction of unsafe acts.

Based on the results, several findings and recommendations for future agendas will address the implementation challenges organisations face when implementing SMS. Table 3 outlines the three steps for a successful SMS procedure. These steps are further discussed below with a focus on application in the fuel station industry.

While Table 3 presents a structured framework, its application in real-world contexts such as fuel stations demands adaptation. Post-project evaluation is crucial. For example, one fuel station conducted a post-training survey that revealed 30% of staff still misunderstood hazard classes, prompting follow-up micro-training sessions.

Table 3. The three steps for a successful SMS procedure.

Step 1 Management, Leaders hip, and Employee Participation	Step 2 Planning SMS	Step 3 Implementing and Operating SMS
Management leadership: - Establish a safety policy - Provide resources - Delegate roles, responsibilities, accountability, and authority - Integrate the systems and processes - Provide tangible support (time allocations, and direct involvement in safety briefings) **Employee Participation:** - Provide time, resources, and means necessary - Give employees relevant information and processes - Identify and remove barriers - Local insights from frontline staff	- Identify SMS issues, such as hazards (customer and worker), risks (spillage, static electricity discharge), lack of management system, and opportunities for improvement - Prioritise those issues identified - Establish clear objectives to improve SMS and reduce risks - Input from floor-level staff - Include SMART objectives for improving signage, updating SOPs, and conducting risk prioritisation using tools like HAZOP or bowtie analysis	- Implement a reporting system in digitalise, such as mobile-based hazard logs - Train workers how to identify and control hazards i.e. fire suppression system use, and customer interaction protocols - Conduct regular inspections and feedback loops are necessary to sustain the system - Collect and implement hazard control ideas - Address/anticipate workplace emergencies such as emergency shutdowns - Seek input on workplace, layout or operational changes i.e. pump rearrangements

5.1. Management leadership and employee participation

Step one suggests that leadership and worker management are essential in SMS implementations. Management leadership is crucial in establishing and maintaining SMS within an organisation. To achieve this, management should (1) develop and implement a safety policy at the workplace; (2) ensure that adequate resources are available for the SMS; (3) assign roles, responsibilities, accountability and authority for the SMS, and (4) integrate the SMS into the organisation's other systems and processes.

However, the practical application of these measures varies across industries. In fuel station environments, for instance, safety leadership is not just about written policies but active presence at ground level. During our site visits, two station managers demonstrated effective leadership by conducting daily briefings and assigning shift-based safety responsibilities. One station also allocated specific weekly hours for safety review sessions.

Commitment was further evident where leadership embedded SMS metrics in business KPIs. For example, Station A included the number of safety drills conducted per month as a target in their performance review cycle. This integration signalled to employees that safety was a strategic, not peripheral, priority.

On the employee side, effective participation was visible where workers had a platform to suggest hazard control ideas, such as adjusting pump area signage to reduce trip hazards. The feedback mechanism, facilitated through a digital checklist app, encouraged engagement and was reported to improve morale and accountability.

The involvement and commitment of top management can be measured by various factors, such as the inclusion of the SMS in the organisation's business plan, the time dedicated to safety, visible participation in safety, and the number of safety management tasks performed.

For a safety program to be effective, it is crucial to involve workers and their representatives actively. Workers stand to gain the most from a successful program and bear the most significant risk if the program fails. They also possess valuable knowledge about potential job-related hazards. A successful program leverages this knowledge base. The certified companies performed better in training, management commitment, communication, rules and procedures, promotion policies, and worker involvement in safety [56]. To ensure employee participation in the SMS program, (1) allocate the necessary time, resources, and means to employees, (2) provide timely access to relevant information, and (3) identify and remove any barriers that hinder employee participation in the SMS.

5.2. Planning SMS

Planning is not a one-time event but a recurring process that requires continuous attention in the second step. It involves an initial review and periodic reviews. The planning process comprises four tasks: (1) gathering and reviewing relevant information to identify SMS issues, (2) prioritising the SMS issues identified during the review mentioned above, (3) developing objectives for the SMS as well as for risk-control based on the prioritised SMS issues, and (4) creating an implementation plan to accomplish the prioritised objectives [57].

Within the fuel station context, the planning process must focus on high-risk operational areas such as fuel transfer, nozzle integrity, underground tank monitoring, and vehicle-pedestrian interaction zones. Interviews conducted with safety officers from five stations revealed inconsistent hazard logging procedures during site assessments. Additionally, while SOPs were available, they were often outdated and not tailored to actual risk hotspots.

One successful planning practice involved the use of a risk matrix workshop, where workers and supervisors ranked potential hazards by frequency and severity. This helped prioritise maintenance scheduling for leak-prone valves and instigated a review of training content for handling spill response kits. Such planning strategies should be embedded in routine reviews at least quarterly, supported by digital records and feedback from post-incident debriefs.

These four interrelated tasks collectively constitute the planning phase in SMS implementation, underscoring this critical process's iterative and multifaceted nature. As emphasised by Dallat et al. [58], this dynamic approach to planning is

essential for organisations seeking to proactively manage safety risks and continually enhance their safety management practice.

5.3. Implementing and operating SMS

After completing the initial preparation, the last step is implementing the plan. Step three involves identifying, assessing, preventing, and controlling hazards. This includes setting up a reporting system, training workers to identify and control hazards, conducting regular inspections, gathering ideas for hazard control, implementing those ideas, preparing for workplace emergencies, and seeking input from workers on any changes that can be made to improve the work environment. By following these fundamental practices, we can efficiently manage workplace hazards and ensure a safe working environment for all.

In the studied fuel stations, implementation began with training staff on hazard identification. For example, frontline attendants were trained to use colour-coded checklists to monitor visible faults like hose cracks, loose nozzles, and sensor malfunctions. Additionally, emergency preparedness drills (such as mock fire responses and spill containment) were introduced on a monthly basis.

To ensure sustained operation, digital tools, AI and IoT, within SMS frameworks, i.e. QR code-based feedback forms, were trialled at two sites, allowing staff to report minor hazards anonymously [57, 58]. Supervisors then collated the data weekly for safety meetings, ensuring rapid follow-up.

The identification of hazardous conditions in an organisation can be done through the analysis of processes. To tackle this challenge, it is essential to conduct specialised workshops and training sessions [59]. It's important to stay proactive in identifying these issues before they arise to prevent more significant problems. Examining the current system and its processes makes it possible to detect any potential weak points or areas requiring improvement. This predictive approach can help prevent future problems and ensure the system functions optimally.

In this study, it was observed that sites that actively involved attendants in hazard reporting had lower incident rates over a 3-month trial period. One station noted a 40% increase in near-miss reporting following a peer-led “safety voice” campaign. Ultimately, implementation is not just procedural but behavioural. Strong follow-through, monitoring, and reinforcement are essential to ensure SMS becomes part of the station’s operating culture.

5.4. Safety key performance indicators

An additional step in ensuring safety in the workplace is the use of safety key performance indicators (KPIs) or performance metrics. These KPIs help track a company's specific safety efforts. By monitoring these KPIs, a business can evaluate the safety of the work environment for the employees and whether the company is meeting regulatory compliance requirements. This tracking process helps companies identify which safety standards they are successfully meeting, and which may require more resources.

According to Crivellari et al. [60], effective KPIs in high-risk sectors must be measurable, relevant, and integrated into daily operational reviews. These include leading indicators such as training hours per employee, safety observations logged

and lagging indicators, i.e. number of incidents and severity rates. Mkrtchyan et al. [61] further highlight the role of safety climate surveys as a KPI proxy, assessing workforce perception of management's safety commitment.

In the context of fuel stations, our case data revealed that most sites tracked only basic lagging metrics (incident frequency and downtime). However, proactive indicators such as "number of hazards reported per week" or "percentage of staff trained quarterly" were not used systematically.

One station successfully implemented a dashboard showing near-miss reports, equipment downtime, and corrective action closure rates. Over a 3-month period, the visibility of these metrics contributed to a 25% increase in reporting behaviour and a 30% reduction in downtime incidents.

Furthermore, it is also advisable to incorporate safety metrics into the organisation's KPIs [62]. By integrating safety performance indicators with other business objectives, leadership reinforces the importance of safety in achieving overall organisational success, including reported incidents, equipment breakdowns, corrective actions, average resolution time, and employee training.

This can be achieved by aligning SMS outcomes with strategic objectives such as uptime, customer satisfaction, and cost savings. For example, training completion rates can be directly linked to a reduction in nozzle malfunction reports, thus strengthening the business case for sustained SMS investment.

Literature supports this integration approach, as noted by Shankar et al. [63], who argue that KPI alignment enhances SMS ownership at both managerial and operational levels.

6. Conclusions

Future studies explore integrating emerging technologies, such as AI and IoT, within SMS frameworks to address evolving safety challenges. For example, AI-driven predictive analytics can forecast equipment failures using CMMS (Computerised Maintenance Management System) data, while IoT sensors can monitor real-time fuel leakage, tank pressure, and temperature at fuel stations. These technologies enhance hazard detection, response times, and decision-making.

This comparative process allowed for convergence (where literature and interviews aligned) and divergence (where practical observations differed), both of which informed the recommendations. The triangulation process thus ensured that the proposed SMS improvement framework (Table 3) was grounded in both scholarly evidence and real-world operational data.

Additionally, research into industry-specific adaptations of SMS provides tailored solutions for sectors with unique safety requirements. The practical implications of this research extend beyond the industrial sector, where safety management is critical. Organisations across various sectors can improve safety outcomes and optimise operational efficiency by adopting the recommendations outlined. In the fuel station industry, this means aligning SMS protocols with daily operations, digitising incident reporting, and embedding safety into staff routines. Overall conclusions from the reviews are as follows:

- These include fostering leadership commitment, promoting employee engagement, educating a culture of safety, planning procedures, and

implementing and optimising data management. This can be achieved through regular leadership walkabouts, employee safety suggestion schemes, quarterly training audits, and systematised planning frameworks with clear KPIs.

- Organisations can reinforce safety practices and pave the way for improved OE and long-term sustainability. For instance, one case study in this study reduced unscheduled downtime by 20% after implementing structured SMS tracking and linking it to OE metrics like equipment availability and task completion time.
- The path to a safer industrial future begins with a commitment to robust SMS implementation using new KPIs. These may include leading indicators such as 'near-miss reporting rate per shift' and 'corrective action closure within 48 hours', which proactively reflect system performance.

Abbreviations

AI	Artificial Intelligent
CMMS	Computerised Maintenance Management System
FS	Fuel Station
IoT	Internet of Things
KPIs	Key Performance Indicators
OE	Operational Efficiency
RIEC	Research, Innovation and Enterprise Centre
SMS	Safety Management System

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Appendix A

Step of Thematic Analysis

A. 1. Introduction

We conducted a thematic analysis following the 6 steps of coding proposed by Braun and Clarke [25] to explore the major themes regarding the potential of online value cocreation for health care organizations. Thematic analysis is a technique that is commonly used to identify, analyse, and report patterns (themes) within data. This technique is an inductive approach and involves coding all sections of findings, discussion, and conclusion of all selected participants (N=10). Applying this method needs careful record and transcribe of the data to identify the explicit and implicit meaning embedded within the text.

The 6 steps of thematic analysis process defined by Braun and Clarke [25] are collecting data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and writing the report as Fig A-1. We used NVivo 12 (a qualitative data analysis software), and all coding was manually performed.

A. 2. Thematic analysis steps

Interview fuel station staff about safety culture, thematic analysis reveal themes with 6 steps is shown in Fig. A-1.

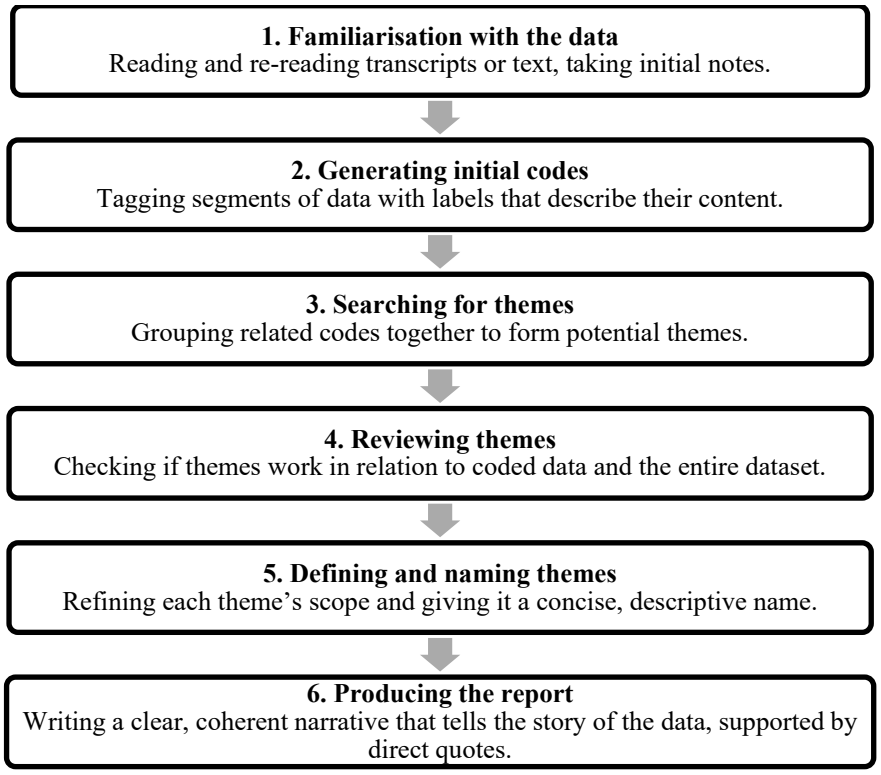

Fig. A-1. Thematic analysis steps adapted from Braun and Clarke.