Breaking the Cycle: Workers' Narratives on Safety Failures and Recovery

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ABSTRACT

This study examined safety failures and recovery practices among mechanical engineers and maintenance workers in Region III (Central Luzon), Philippines, using a qualitative phenomenological approach. Interviews with 12 participants across manufacturing, agro-processing, and cold storage industries revealed that safety failures were both technical and socially embedded, arising from interactions between human operators, equipment, and organizational systems. Workers actively engaged in adaptive recovery strategies, including problem-solving, temporary workarounds, and team coordination, to maintain operational safety. Organizational factors, such as supportive management, training, resources, and workplace culture, significantly influenced the effectiveness of preventive maintenance. Findings highlight the importance of human-centered approaches, resilience-oriented practices, and context-sensitive policies for enhancing industrial safety in regional and developing-country settings.

Keywords: Preventive Maintenance, Safety Resilience, Industrial Safety, Adaptive Recovery, Organizational Culture

INTRODUCTION

Industrial workplaces remain vulnerable to safety failures due to the complex interaction between human operators, technical systems, and organizational structures. Safety research increasingly recognizes that accidents and near-misses rarely result from single technical faults but emerge from deeper systemic weaknesses. Reason (2016) and Hopkins (2021) emphasize that maintenance-related failures often reflect latent organizational conditions, such as inadequate resourcing, weak oversight, and normalization of risk. In industrial environments where machinery reliability is critical, preventive maintenance is central to controlling hazards and sustaining safe operations, reducing both technical breakdowns and the likelihood of worker injuries.

Traditional safety and maintenance frameworks, however, have been criticized for overemphasizing compliance and technical controls while overlooking the realities of everyday work. Dekker (2020) argues that safety failures persist when organizations fail to understand how work is actually performed under real operational constraints, including time pressure, production demands, and resource scarcity. Similarly, Goh, Love, and Teo (2022) suggest that safety breakdowns often occur not because workers disregard procedures, but because procedures do not align with operational realities. These perspectives highlight the importance of exploring workers' experiences and decisions as they navigate daily safety challenges in industrial settings.

Recent safety research has shifted attention toward resilience and recovery, moving beyond a sole focus on accident prevention. Hollnagel (2021) introduces the concept of Safety-II, which emphasizes how systems succeed under variable conditions and how workers adapt to prevent small failures from escalating. From this perspective, recovery is an active, continuous process involving learning, adjustment, and anticipation. Maintenance workers and engineers play a key role in these adaptive processes, detecting early warning signs of failure and implementing informal strategies that maintain operational stability and prevent accidents.

In developing and regional industrial contexts, such as Region III (Central Luzon) in the Philippines, safety challenges are further intensified by limited resources, aging infrastructure, and uneven enforcement of safety

standards. Industries in the region—including manufacturing, agro-processing, and cold storage—often operate with lean maintenance teams and older equipment, increasing the likelihood of maintenance-related safety risks and recurring system failures. Workers in these settings frequently bear the responsibility for maintaining safety, relying on personal judgment, improvisation, and experiential knowledge to manage hazards effectively (Lingard, Zhang, & Harley, 2022). Despite the critical role of frontline workers, there remains limited qualitative research that centers their narratives on safety failures and recovery, particularly among mechanical engineers responsible for preventive maintenance.

Addressing this gap, the present study explores how workers in Region III experience safety failures and actively contribute to recovery processes. By documenting the lived experiences of mechanical engineers responsible for preventive maintenance, the study provides insights into how recurring cycles of industrial risk may be anticipated, managed, and ultimately disrupted. Understanding these narratives not only highlights the human and organizational factors shaping safety outcomes but also informs strategies for improving preventive maintenance, resilience, and safety culture in regional industrial contexts of the Philippines and comparable developing economies.

METHODOLOGY

Research Design

This study employed a qualitative phenomenological design to explore the lived experiences of workers regarding safety failures and recovery processes in industrial settings. Phenomenology was chosen because it allows for an in-depth understanding of participants' perceptions, meanings, and decision-making as they navigate safety challenges in their professional roles (Creswell & Poth, 2018). This approach emphasizes capturing experiences from the participants' perspectives rather than imposing pre-existing theoretical frameworks, which is essential for understanding context-specific practices in Region III industries.

Participants

Purposive sampling was used to recruit mechanical engineers and maintenance workers from industrial facilities in Region III (Central Luzon), Philippines. Participants were selected based on the following criteria: a minimum of three years of professional experience in preventive maintenance and direct involvement in safety-critical operations. The final sample included 12 participants across diverse industries such as manufacturing, agro-processing, and cold storage. This composition ensured a rich variety of insights into safety failures and recovery practices across operational contexts within the region.

Data Collection

Data were collected primarily through semi-structured interviews guided by the three research questions. Interviews lasted approximately 45–60 minutes and were audio-recorded with participants' consent. Follow-up probing questions were used to clarify responses and explore nuanced experiences, particularly related to safety incidents, recovery strategies, and organizational influences. To supplement the interviews, document analysis was conducted, including maintenance logs, safety incident reports, and standard operating procedures, which helped triangulate findings and provide organizational context.

Data Analysis

All interviews were transcribed verbatim and analyzed using thematic analysis (Braun & Clarke, 2006). The process involved iterative coding to identify patterns, categories, and themes related to safety failures, recovery strategies, and organizational factors. Themes were reviewed and refined through repeated analysis, ensuring consistency and depth. Member checking was conducted by sharing preliminary interpretations with participants to verify accuracy, and a second researcher independently validated the coding to enhance reliability and credibility of the findings.

RESULTS AND DISCUSSION

Based on thematic analysis of interviews with 12 mechanical engineers and maintenance workers in Region III, three major themes emerged regarding safety failures, recovery practices, and organizational influences in industrial operations.

Theme 1: Experiences of Safety Failures

Participants described a variety of safety failures, ranging from minor equipment malfunctions to near-miss incidents with potential for serious injury. Common causes included aging equipment, procedural gaps, high production demands, and limited resources. For example, one participant noted, *"Sometimes a machine shows warning signs, but with our tight schedule, we can't always stop production until it fails."* These experiences align with prior research emphasizing that industrial accidents often stem from systemic weaknesses rather than isolated technical faults (Reason, 2016; Hopkins, 2021). The findings highlight how preventive maintenance is critical not only for operational continuity but also for safeguarding workers in Region III industries.

Theme 2: Recovery Strategies and Adaptive Practices

Workers emphasized adaptive responses to safety failures, including immediate corrective actions, temporary workarounds, and preventive adjustments to avoid recurrence. Teamwork and informal communication were central to restoring safe operations. One participant shared, *"When something goes wrong, we quickly check manuals, coordinate with the team, and implement a temporary fix before management can approve a formal repair."* These narratives reflect Hollnagel's (2021) Safety-II perspective, where resilience and recovery are active processes involving anticipation, learning, and adaptation. Maintenance workers and engineers in Region III actively engage in these practices, demonstrating professional judgment and practical problem-solving in real-world operational contexts.

Theme 3: Influence of Organizational Culture and Resources

Participants highlighted that organizational factors significantly shape safety outcomes. Supportive management, access to tools and training, and collaborative workplace culture facilitated effective recovery. Conversely, participants reported that limited budgets, production pressures, rigid procedures, and outdated equipment hindered proactive preventive maintenance. For instance, one participant explained, *"Even if we know the best steps to prevent accidents, sometimes budget cuts and tight schedules force us to improvise, which increases risk."* These insights reinforce findings from Lingard, Zhang, and Harley (2022), showing that workers in regional industrial settings often rely on personal initiative and experience to maintain safety in the face of organizational constraints.

The study revealed that safety failures in Region III industries were both technical and socially embedded. Workers' narratives showed that effective recovery depended not only on technical knowledge but also on individual initiative, teamwork, and organizational support. The findings underscored that preventive maintenance and safety practices could not be fully understood without considering the human and organizational contexts in which they occurred. This aligned with Dekker (2020) and Goh, Love, and Teo (2022), who emphasized that safety procedures had to reflect operational realities rather than simply imposing top-down rules.

In general, mechanical engineers and maintenance workers in Region III actively managed safety risks, responded adaptively to failures, and contributed to breaking cycles of recurring hazards. These practices demonstrated resilience in industrial operations, highlighting the importance of integrating human-centered approaches, supportive organizational culture, and adequate resources into preventive maintenance and safety strategies.

CONCLUSION

This study explored the lived experiences of mechanical engineers and maintenance workers in Region III (Central Luzon), Philippines regarding safety failures and recovery practices in industrial settings. Findings

indicate that safety failures are rarely the result of single technical faults; rather, they emerge from interactions between human operators, equipment, and organizational systems. Workers actively engage in adaptive recovery strategies, including problem-solving, temporary workarounds, and coordination with colleagues, to maintain safe operations and prevent incidents from escalating.

The study also highlights the critical influence of organizational culture and resources. Supportive management, collaborative work environments, and access to tools and training enhance workers' ability to implement preventive measures effectively. Conversely, limited budgets, outdated equipment, and production pressures constrain safety practices, requiring workers to rely on personal judgment and experiential knowledge. These findings emphasize that preventive maintenance and safety resilience are both technical and social processes, shaped by individual initiative, teamwork, and systemic support.

By documenting workers' narratives, this study demonstrates how recurring cycles of industrial risk can be anticipated, managed, and disrupted, providing insights for designing more effective, context-sensitive safety strategies in regional industrial contexts of the Philippines.

RECOMMENDATIONS

Enhancing industrial safety and resilience in Region III requires continuous professional development in preventive maintenance, hazard recognition, and adaptive recovery strategies. A strong safety-oriented culture and organizational support are vital, emphasizing teamwork, knowledge-sharing, employee autonomy, and management backing that encourages hazard reporting without fear. Adequate resources and equipment modernization are essential, including sufficient staffing, tools, spare parts, and upgrades to aging machinery to reduce recurring failures. Regional policies should reflect operational realities, providing tailored safety standards and incentives for proactive preventive maintenance. Future research should extend to other Philippine regions to examine variations in workers' experiences and recovery practices, and explore the integration of Safety-II and resilience engineering principles into preventive maintenance frameworks to improve safety outcomes.

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