

Analysis of The Effectiveness of HSE Committees in Occupational Health and Safety Implementation on Infrastructure Projects

Ponang Pamungkas^{1✉}, Bagus Hario Setiadji², Ferry Hermawan³

(1,2,3) Department of Civil Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia

Abstrak: The construction industry remains one of the most hazardous sectors due to the complexity of project activities, changing work locations, and the need for consistent safety supervision across diverse operational settings. This study aims to analyse the effectiveness of the Health, Safety, and Environment Committee in supporting occupational health and safety implementation in infrastructure projects managed by Infrastructure 1 Division of PT. X. A qualitative case study approach was employed through in-depth interviews with three project managers, supported by document analysis and field observation. The findings show that the committee played an important role in strengthening safety implementation through leadership support, regular audits, risk assessment, communication, training, and continuous monitoring. The committee also contributed to stronger safety culture, reduced incidents and near misses, and improved regulatory compliance across project sites. The study concludes that the effectiveness of the committee depends on the integration of institutional commitment, operational implementation, and ongoing evaluation. Strengthening committee capacity, cross functional coordination, and digital monitoring is essential to support sustainable safety performance in large scale infrastructure projects.

Article history:

Received: 28 April 2026

Revised: 17 May 2026

Accepted: 11 June 2026

Published: 15 June 2026

Keyword:

HSE Committee, Occupational Health and Safety, Infrastructure Projects, Safety Culture, Regulatory Compliance.

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How to cite: Pamungkas, P., Setiadji, B. H., & Hermawan, F. (2026). Analysis of The Effectiveness of HSE Committees in Occupational Health and Safety Implementation on Infrastructure Projects. *Jurnal Ekonomi, Manajemen, dan Bisnis*, 4(2), 169–190. <https://doi.org/10.70716/emis.v4i2.496>

INTRODUCTION

The construction services industry is recognised as one of the sectors with the highest risk of workplace accidents. The operational complexity across various types of construction projects, which are often open-air, frequently change locations, depend on weather conditions, and are largely staffed by untrained workers, makes the management of occupational health and safety (OHS) highly crucial (Rahmat et al., 2023; Zhang et al., 2023). Failure to implement a comprehensive OHS management system does not only increase the likelihood of work accidents, but also results in financial loss, environmental damage, and reputational harm for the company (Boudreau, 2024; Yuliana, 2021). From an organisational management perspective, these consequences extend beyond the physical dimension of safety: workplace accidents disrupt project scheduling, inflate operational costs, erode workforce productivity, and undermine the organisational reputation required to secure future contracts. For these reasons, OHS management systems that are not merely administrative but also subject to effective institutional evaluation represent a strategic organisational investment, not only a regulatory obligation, in the successful delivery of infrastructure projects.

A systematic and theoretically grounded approach to safety management is offered by the Safety Management System (SMS) framework, which is widely recognised as a comprehensive method for managing workplace health and safety (Carolino et al., 2023; Suwaini & Iskandar, 2022).

✉ Corresponding author: ponangpamungkas@students.undip.ac.id

SMS is designed to identify hazards, assess risks, and implement ongoing control measures to prevent workplace accidents. While the SMS framework is strongly rooted in aviation practice through the ICAO, its adoption in construction and infrastructure projects is increasingly justified by the similarly high levels of risk, operational complexity, and the critical need for systematic safety management in both sectors. In this study, the SMS model was adapted to provide a structured and comprehensive analytical lens for evaluating OHS governance within infrastructure projects. Each component of the SMS was operationally mapped to HSE Committee functions and the coding scheme: safety policy and objectives correspond to the committee's involvement in developing and reviewing OHS policies and SOPs; safety risk management is reflected in the committee's leadership of risk assessments, hazard identification, and technical inspections; safety assurance is captured by regular audits, incident and near miss reviews, and ongoing performance monitoring; and safety promotion is embedded in continuous training, communication, and cross-functional education facilitated by the committee.

By translating these established SMS components into the practical actions and coded activities of the HSE Committee, the framework enables a robust evaluation of how international safety management principles are realised within the complex realities of large-scale infrastructure environments. This cyclical system not only ensures that safety is continuously improved but also embeds a proactive safety culture throughout the organisation. In practice, the role of management commitment is critical in setting safety policy and objectives, while risk management and assurance processes demand collaboration between field teams and internal supervisory bodies, particularly the HSE Committee (Kurniawan et al., 2024; Nuruzzaman, 2023).

At the beginning of 2023, PT. X underwent a structural reorganisation of Directorate of Operations 1, merging three departments into two large divisions: Infrastructure 1 Division and Infrastructure 2 Division (PT. X, 2024). The Infrastructure 1 Division is now responsible for major projects spread across Sumatra, Jabodetabek, West Java, Central Java, East Java, and Bali. This restructuring introduced significant managerial challenges: the expanded supervisory scope required adjustments to human resource allocation, oversight mechanisms, and cross-divisional coordination systems. Consequently, the OHS supervision system must be able to cover a wide operational area and diverse types of work, ranging from roads and bridges to water supply systems (SPAM) (Alhammadi et al., 2022). The capacity to manage these challenges effectively has direct implications for project efficiency, as inconsistent safety governance across dispersed sites increases the risk of cost overruns, workforce turnover, and delays attributable to preventable incidents.

During the period from January to December 2023, a total of 352 near miss incidents were recorded from 37 active projects managed by Infrastructure 1 Division (PT. X, 2024). In this study, a near miss refers to an unsafe condition or event that did not cause harm but had the potential to do so. Reports are submitted by workers and supervisors to the HSE officer and verified during audits. Some incidents may go unreported, especially minor cases. Seasonal trends are noted, but no formal statistical testing was done. The data show that at the beginning of the year, coinciding with the rainy season (January to April), the number of near miss incidents gradually decreased, from 28 cases in January to 19 in April. Entering the dry season (May to October), the trend reversed, with a significant increase in near miss cases. The surge began in June with 38 incidents, then rose sharply in July and August, reaching 46 and 50 cases respectively. Following this peak, the number of near miss incidents gradually decreased to 11 cases in December, as the rainy season returned. The distribution of near miss incidents in 2023 was found across all projects under Infrastructure 1

Division management, though the number varied from project to project. This indicates that near miss risk is an issue encountered at almost every worksite, requiring consistent monitoring and intervention in all project areas.

The observed fluctuation in near miss incidents also finds a conceptual foundation in Heinrich's Accident Pyramid theory, which illustrates that for every single major accident there are numerous minor incidents and near misses that act as early indicators of system weaknesses (Calveti et al., 2024; Majumdar et al., 2022). This model underscores the importance of proactively managing near miss events, as controlling them can prevent more serious accidents from occurring. In this context, the continuous evaluation of near miss data by the HSE Committee is essential. Their role is to identify patterns, adjust policies, and develop targeted strategies that align with both operational realities and established SMS principles.

Within complex project management systems, the HSE Committee plays a strategic role as an internal institutional entity formed to ensure the effectiveness of OHS management systems and environmental management. This committee has a formal mandate to direct policy, evaluate the implementation of safety standards, and instil a culture of safety at work through mechanisms such as safety audits, socialisation, risk reporting, and regular inspections (Sia et al., 2024). The effectiveness of this committee, however, is highly dependent on the quality of function execution, as well as organisational support such as top management commitment, the competency of its members, and inter-line communication systems (Rahmat et al., 2023; Zhang et al., 2023). In practice, there are still gaps between the formal functions of the committee and the effectiveness of their implementation on the ground, especially in geographically dispersed and structurally complex projects. These gaps carry direct managerial consequences: when committee oversight is inconsistent, safety violations go unaddressed, training gaps accumulate, and the costs associated with incident response, regulatory non-compliance, and workforce replacement rise accordingly.

The effectiveness of the HSE Committee has emerged as a central factor in determining the success of occupational health and safety management systems within construction projects, particularly those with high complexity such as national infrastructure projects. The HSE Committee is responsible for ensuring, verifying, and evaluating the ongoing execution of OHS programmes in line with both internal standards and national regulations, including SMK3 and ISO 45001. When functioning optimally through cross-division coordination, regular audits, incident reporting, and safety campaigns, the committee enables OHS implementation to go beyond formal compliance and to respond flexibly to dynamic project risks. Numerous recent studies reinforce the argument that the effectiveness of HSE Committees directly influences the quality of workplace safety outcomes. Rahmat et al. (2023) emphasise that both active oversight and passive resource provision by management significantly improve committee performance. This is consistent with Boudreau (2024), who finds that systematic institutional strengthening of committees leads to lower accident rates without compromising productivity. These findings underscore that committee effectiveness is not a standalone entity but depends heavily on organisational support structures, and that its improvement carries measurable returns in terms of project performance and operational efficiency.

In large-scale projects such as those managed by the Infrastructure 1 Division of PT. X, the synergy between management and the committee is frequently cited as a critical success factor for OHS systems. The growing discourse around digital and data-driven management is also relevant, as Sia et al. (2024) and Triyanto et al. (2024) demonstrate that leveraging artificial intelligence and digital reporting enhances the accuracy of hazard detection and the timeliness of intervention, thus

increasing committee preparedness for incident prevention. Beyond technology, the literature highlights the importance of early stakeholder engagement. Alhammadi et al. (2022) stress that contractor and consultant involvement from the tender stage is essential for embedding safety standards and ensuring that HSE Committees can operate within an environment of collaborative compliance.

Worker participation is another core element, with Zhang et al. (2023) and Putra et al. (2021) documenting that active worker engagement in hazard reporting and job safety analysis (JSA) reduces risk and boosts overall safety performance. Field communication is reinforced by Pakpahan et al. (2023) and Larasati & Yosalli (2024), who show that continuous dialogue between management and field staff supports risk control and safety behaviour. On the procedural side, Arumsari & Nugroho (2023), Farida et al. (2024), and Kolot (2021) show that adherence to standard operating procedures and national regulatory systems like SMK3 enhances consistency and reliability in OHS implementation, while Handayani et al. (2024) demonstrate that strong safety cultures and continuous training are foundational for long-term system effectiveness.

Practical implementation challenges, such as increased training and equipment costs for sustainable projects, have also been observed (Ali et al., 2023). Nonetheless, research indicates that active and adaptive HSE Committees play a key role in rapid incident mitigation and risk escalation prevention (Ningsih et al., 2024). The technical proficiency of committees, particularly in the execution of detailed risk assessments and JSAs, is highlighted by Magfirona et al. (2025) and Putra et al. (2021), who note that technically skilled committees achieve higher levels of adaptability and safety compliance. Comprehensive reviews such as those by Triyanto et al. (2024) illustrate the importance of integrating ISO 45001, digital reporting systems, and the reinforcement of culture and training to create resilient OHS management. Thus, the accumulated evidence across these studies substantiates the argument that HSE Committee effectiveness is fundamentally linked to both the structural and operational success of OHS implementation in large-scale infrastructure projects, with direct consequences for organisational governance, human resource management, and project delivery efficiency.

Reflecting on these issues, this research focuses on the effectiveness of the HSE Committee in implementing OHS policies within infrastructure projects, particularly under the conditions of organisational restructuring and the management of geographically dispersed sites. Existing studies have examined OHS management systems and the general role of safety committees in construction contexts (Rahmat et al., 2023; Zhang et al., 2023; Boudreau, 2024); however, two critical gaps remain insufficiently addressed in the literature. First, from an empirical standpoint, no study has systematically examined how HSE Committee effectiveness is maintained, disrupted, or adapted when an organisation undergoes structural reorganisation that expands its supervisory scope across multiple divisions and regions. Second, from a contextual standpoint, the specific challenges of sustaining consistent OHS governance across geographically dispersed, multi-type infrastructure projects remain underexplored, particularly in developing-country construction environments where institutional capacity and field compliance vary considerably across sites.

This study addresses both gaps by investigating HSE Committee functions within a real-world post-restructuring context, across diverse project environments spanning multiple regions of Indonesia. The novelty of this research lies in its examination of HSE Committee effectiveness as an adaptive governance process, one that is not fixed by formal mandate but continuously reshaped by organisational change, cross-site complexity, and the dynamic demands of large-scale infrastructure delivery. Accordingly, this study is guided by the following research questions: (1)

What are the key dimensions of HSE Committee effectiveness in OHS implementation under restructuring? (2) How are OHS implementation mechanisms enacted and sustained by the committee in multi-site project settings? (3) What barriers are encountered in ensuring consistent OHS outcomes across geographically dispersed infrastructure projects?

RESEARCH METHOD

Research Design

This study employed a qualitative approach with a case study design to analyse the effectiveness of the Health, Safety, and Environment Committee in supporting occupational health and safety implementation in infrastructure projects managed by Infrastructure 1 Division of PT. X. This approach was selected because the study aimed to understand institutional roles, field level practices, implementation mechanisms, and operational challenges in depth within a real organisational setting. The case study design was particularly relevant because the research was conducted in a post restructuring context, where the company had to supervise infrastructure projects distributed across multiple regions with different work characteristics and safety risk profiles.

The qualitative case study design enabled the researcher to examine HSE Committee effectiveness as a contextual and process based phenomenon rather than as a purely numerical performance indicator. The research design followed a multi phase process consisting of mapping organisational restructuring and near miss trends, selecting information rich project cases, conducting in depth interviews, analysing internal documents, carrying out field observations, coding empirical data, validating the findings, and linking the emerging themes with the conceptual framework. This staged design allowed the study to build a comprehensive understanding of committee performance from both institutional and operational perspectives (Figure 1).

Research Context and Informants

The research was conducted in Infrastructure 1 Division of PT. X, which, following organisational restructuring, became responsible for a broad range of infrastructure projects distributed across several regions in Indonesia. This context is central to the study because the geographical spread and diversity of project types created substantial challenges for maintaining consistent occupational health and safety supervision. The unit of analysis in this research was infrastructure projects managed under the division, with particular attention to the role and effectiveness of the HSE Committee in supporting occupational health and safety practices.

The sampling technique used in this study was purposive sampling. This technique was considered appropriate because the study required informants and project cases that could provide rich, relevant, and direct information about HSE Committee implementation. The selected projects were required to meet several criteria, namely being under the management of Infrastructure 1 Division, not being joint operation projects unless PT. X acted as the lead party, having shown improvement in HSE Committee effectiveness scores, and representing diverse types of infrastructure work. These criteria were intended to ensure that the chosen cases reflected a broad range of operational contexts while still providing relevant insight into institutional effectiveness and implementation challenges.

The key informants in this study were three project managers who had direct responsibility for the planning, implementation, and evaluation of occupational health and safety systems at their respective project sites. Project managers were prioritised because they occupied strategic

positions in coordinating safety practices, implementing committee recommendations, and facilitating communication between the project team and the HSE Committee. The first informant was ER, who managed Project A in Medan, the second was RM, who led Project B, and the third was NRA, who oversaw Project C. All three informants were selected not only because of their formal managerial roles but also because the projects under their leadership experienced notable improvement in HSE Committee assessment scores during the study period. Their experience provided varied empirical contexts for understanding differences in implementation strategies, follow up mechanisms, and site specific challenges.

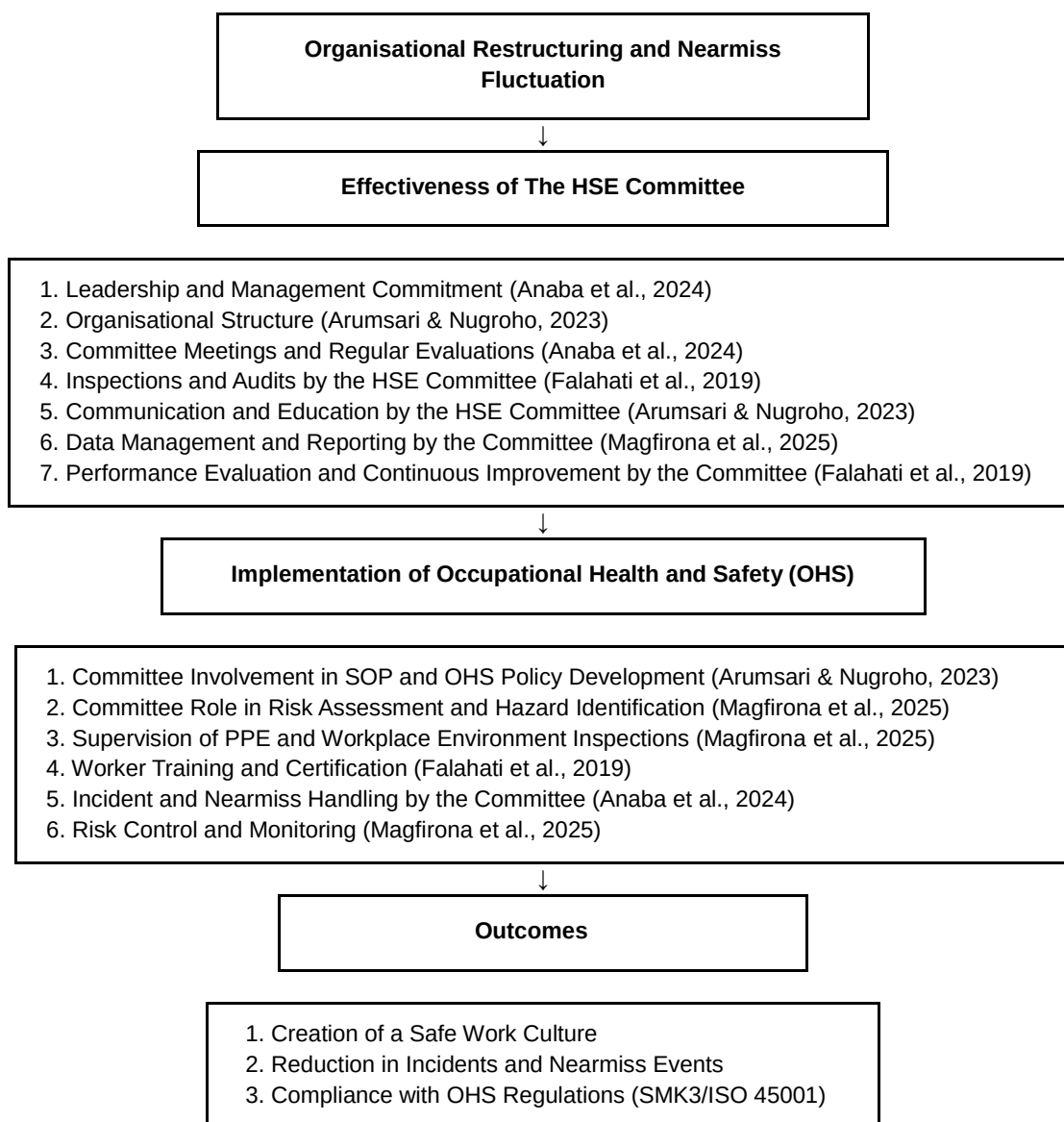


Figure 1. Conceptual framework linking organisational restructuring, HSE Committee effectiveness, OHS implementation, and project safety outcomes (adapted from Anaba et al., 2024; Arumsari & Nugroho, 2023; Falahati et al., 2019; Magfirona et al., 2025).

Data Collection Procedure

Data were collected through three main techniques, namely in depth interviews, document analysis, and field observation. In depth interviews were carried out with the three selected project

managers to capture their experiences, evaluations, and perceptions regarding the committee's institutional role, supervisory practices, communication patterns, implementation mechanisms, and barriers in occupational health and safety governance. The interviews were semi structured, allowing the researcher to use guiding questions while also giving informants the opportunity to explain field realities, specific incidents, follow up practices, and contextual challenges in greater detail.

Document analysis was conducted to strengthen and validate the interview findings. The documents reviewed included internal audit reports, HSE Committee meeting minutes, near miss logs, safety evaluation forms, inspection records, follow up reports, and supporting project safety documents. These materials provided written evidence of committee activities, audit findings, corrective actions, training records, reporting procedures, and safety performance trends across project sites. Field observation was also undertaken during committee meetings, safety audits, and toolbox talks on selected project sites. This enabled the researcher to compare formal procedures with actual practices in the field and to gain a richer contextual understanding of how occupational health and safety governance was enacted in daily project operations.

The combination of interviews, document analysis, and observation enabled methodological triangulation. Interview data provided managerial interpretation and experiential evidence, document data provided formal and administrative evidence, while observation data provided behavioural and contextual evidence. By comparing these three sources, the study was able to reduce dependence on a single type of evidence and strengthen the credibility of the findings.

Operational Criteria of Effectiveness

Although this study did not use variables in the quantitative sense, the concept of HSE Committee effectiveness was operationally translated into a set of empirical indicators to support consistent coding and interpretation. These indicators were derived from the conceptual framework and reflected the relationship between HSE Committee effectiveness, OHS implementation, and project safety outcomes. The first group of indicators represented committee effectiveness, including leadership and management commitment, committee structure, regular meetings and evaluations, inspections and audits, communication and education, data management and reporting, and performance evaluation with continuous improvement.

The second group of indicators represented the implementation of HSE Committee functions in occupational health and safety. These included committee involvement in SOP and OHS policy development, risk assessment and hazard identification, supervision of personal protective equipment and workplace conditions, worker training and certification, incident and near miss handling, and risk control and monitoring. The third group of indicators represented the impact of committee performance, including the creation of safe work culture, reduction in incidents and near misses, and compliance with OHS regulations.

These empirical indicators were linked to the Safety Management System framework and Heinrich's Accident Pyramid theory. The indicators related to SOP and policy development were connected with safety policy and objectives. The indicators related to risk assessment, hazard identification, PPE supervision, and workplace inspection were connected with safety risk management. The indicators related to audit, reporting, incident handling, and continuous monitoring were connected with safety assurance. The indicators related to training, communication, toolbox talks, and safety education were connected with safety promotion. Meanwhile, near miss

indicators were interpreted through Heinrich's Accident Pyramid theory as early signals of potential system weaknesses that require preventive intervention before more serious incidents occur.

Trustworthiness of Data

To strengthen the trustworthiness and rigour of the research, several verification procedures were applied. Credibility was strengthened through triangulation, member checking, and comparison across interviews, internal documents, and field observations. Member checking was conducted by sharing interview summaries and key thematic interpretations with the informants to ensure that the researcher's interpretation remained consistent with the participants' intended meanings. Triangulation was conducted by comparing informant statements with audit reports, meeting minutes, near miss records, safety evaluation forms, and observed field practices.

Dependability was maintained through an audit trail that documented the stages of data collection, coding decisions, theme development, and interpretation. This audit trail helped ensure that the analytical process could be traced transparently from raw data to final themes. Confirmability was strengthened by maintaining consistency between empirical evidence, coding results, and conceptual interpretation. The researcher avoided drawing conclusions from isolated statements unless they were supported by repeated patterns, documentary evidence, or observational confirmation. Transferability was supported by providing a detailed description of the organisational context, informant roles, project characteristics, data sources, and implementation setting, allowing readers to assess the relevance of the findings to other large scale infrastructure contexts.

Data Saturation

Data saturation was assessed during the coding and interpretation process. Saturation was considered to have been reached when the interviews, documents, and observations no longer produced substantially new categories beyond the three main analytical dimensions, namely HSE Committee effectiveness, implementation of HSE Committee functions, and impact of HSE Committee performance. Although the number of key informants was limited to three project managers, the saturation assessment was strengthened by the use of multiple data sources. The interview findings were repeatedly compared with internal audit reports, meeting minutes, near miss logs, safety evaluation forms, and field observations.

The recurring themes across these sources indicated that the major patterns had become stable. These included leadership commitment, committee structure, audit and inspection practices, communication and education, reporting consistency, SOP refinement, risk assessment, PPE supervision, training and certification, incident and near miss handling, risk monitoring, safety culture, incident reduction, and regulatory compliance. No major new theme emerged during the final stage of document review and field observation. Therefore, the data were considered sufficient to support analytical depth within the boundaries of this qualitative case study.

Data Analysis Technique

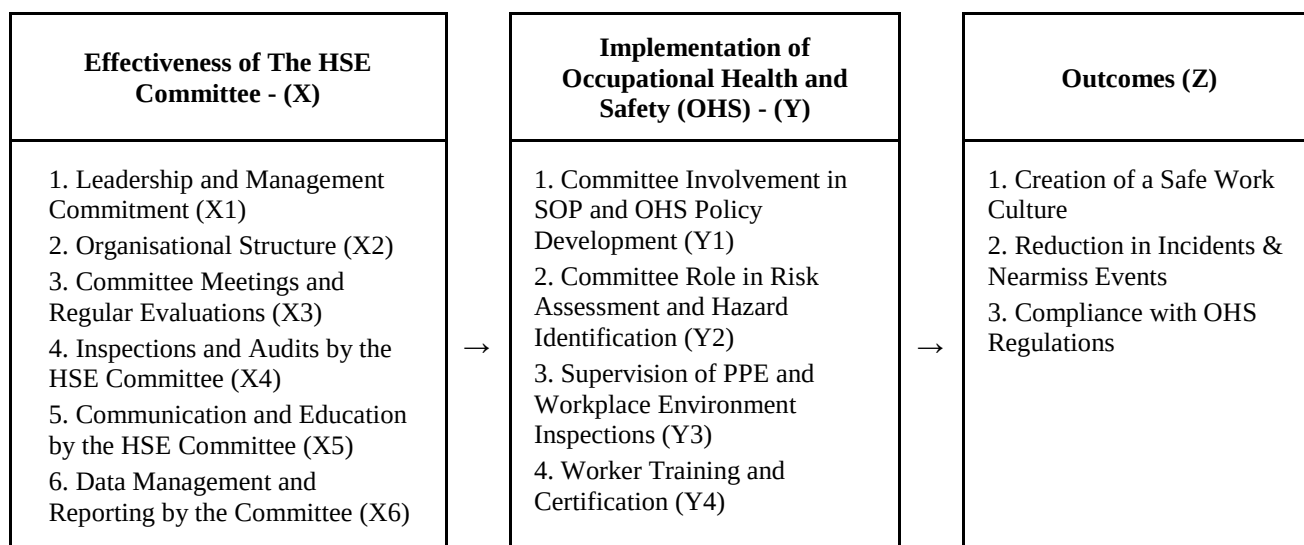
The qualitative data analysis was conducted through thematic analysis supported by ATLAS.ti software. The analysis began with data preparation, including organising interview notes, internal documents, observation records, audit reports, near miss logs, and project safety evaluation forms. The researcher then conducted open coding to identify meaningful units of information related to HSE Committee roles, committee activities, implementation mechanisms, safety practices, barriers,

and outcomes. Each segment of data was coded based on its substantive meaning rather than merely on the frequency of words.

After open coding, related codes were grouped through axial coding into three parent analytical dimensions derived from the research framework. The first dimension was the effectiveness of the HSE Committee, the second was the implementation of HSE Committee functions in occupational health and safety, and the third was the impact of HSE Committee performance. Each parent dimension was then elaborated into more specific empirical indicators. The first dimension included leadership and management commitment, committee structure, regular evaluations, inspection and audit, communication and education, data management and reporting, and performance evaluation with continuous improvement. The second dimension included SOP development, risk assessment and hazard identification, PPE and workplace supervision, worker training and certification, incident and near miss handling, and risk control and monitoring. The third dimension included safe work culture, reduction in incidents and near misses, and regulatory compliance.

The next stage involved selective coding, in which the researcher examined the relationships among themes and identified how committee effectiveness influenced OHS implementation and how implementation mechanisms contributed to safety outcomes. ATLAS.ti was used to organise codes, examine groundedness and density, and visualise connections among themes. Groundedness was used to identify how often a theme appeared in the empirical data, while density was used to understand how strongly a theme was connected with other themes. These outputs were not treated as statistical tests, but as qualitative indicators that helped the researcher interpret thematic prominence and conceptual interconnection (Figure 2).

The analysis was guided by the Safety Management System framework and Heinrich's Accident Pyramid theory. The Safety Management System perspective was used to interpret committee practices related to policy, risk management, assurance, and safety promotion. Heinrich's Accident Pyramid theory was used to interpret near miss incidents as early indicators of broader weaknesses in the safety system. By combining thematic coding with these conceptual lenses, the study was able to explain how HSE Committee effectiveness contributed to occupational health and safety implementation and how this implementation influenced safety culture, incident reduction, and regulatory compliance in large scale infrastructure projects.



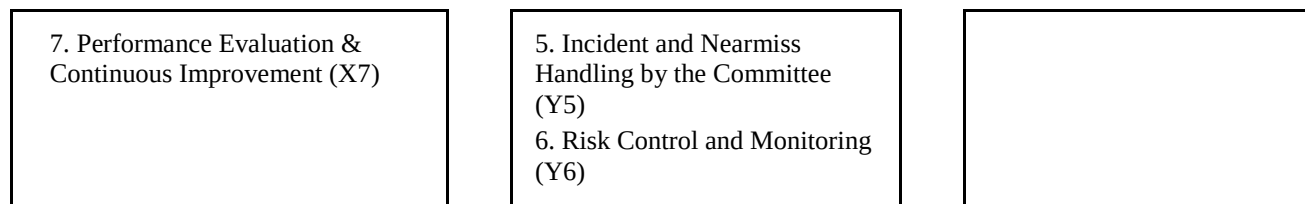


Figure 2. Coding.

RESULTS AND DISCUSSION

The findings indicate that the HSE Committee played a substantial role in supporting occupational health and safety implementation across infrastructure projects managed by Infrastructure 1 Division of PT. X. The empirical evidence shows that committee effectiveness was reflected not only in formal supervision, but also in the way the committee influenced managerial commitment, field practices, safety behaviour, and project compliance. In this sense, the committee functioned as an institutional mechanism that connected organisational control with daily operational safety practices. The following discussion is organised around three analytical dimensions derived from the coding framework: HSE Committee effectiveness as a governance foundation, the implementation of committee functions in project operations, and the impact of committee performance on safety culture, incident reduction, and regulatory compliance.

HSE Committee Effectiveness as the Foundation of OHS Governance

The findings show that the effectiveness of the HSE Committee was built through the interaction of several institutional dimensions, namely leadership and management commitment, committee structure, regular meetings and evaluations, inspections and audits, communication and education, data management and reporting, and performance evaluation with continuous improvement. Among these, leadership and management commitment (groundedness = 14) and performance evaluation and continuous improvement (groundedness = 13) emerged as the two most prominent dimensions, indicating that participants consistently identified these as the central drivers of committee effectiveness. This pattern is theoretically significant: it suggests that committee governance was sustained not by structural completeness alone, but by the ongoing exercise of leadership and the institutionalisation of learning and improvement cycles.

Table 1. Groundedness and Density of “EFFECTIVENESS OF THE HSE COMMITTEE (X)”

Groups	Code	Groundedness	Density
EFFECTIVENESS OF THE HSE COMMITTEE (X)	● X1. Leadership and Management Commitment	14	2
	○ Committee support for SMK3L implementation	3	2
	○ Low compliance with PPE by workers	1	2
	○ Routine OHS implementation without special preparation	1	1
	○ Appointment of HSE PIC and pre-visit briefings	3	2
	○ Internal challenges in team supervision and conditioning	5	2
	○ Corrective actions for safety violations	1	3
	● X2. HSE Committee Structure	9	2
	○ Increased committee visit intensity on high-activity projects	2	1
	○ Need for additional personnel for effective audits	3	1
	○ Central committee as external supervisor	3	1
	○ No issues encountered during restructuring	1	1
	● X3. Committee Meetings and Regular Evaluations	10	1
	○ Frequency of routine and additional committee visits	3	3

Groups	Code	Groundedness	Density
	o Involvement of all functions in committee activities	3	2
	o Committee visits more frequent than planned, appreciated by project	1	1
	o Two-day HSE committee activity rundown	2	1
	o Warning letters issued due to low committee scores	1	1
	● X4. Inspections and Audits by the HSE Committee	12	1
	o Division of audit teams for effective inspections	1	1
	o SOP refinement as a result of committee recommendations	3	2
	o Design of reward and punishment systems based on committee recommendations	1	1
	o Routine field findings and documentation	3	1
	o Rapid follow-up on recommendations	4	1
	● X5. Communication and Education by the HSE Committee	10	1
	o Field education on HSE Golden Rules	4	2
	o Project communication with the committee is smooth and scheduled	3	1
	o Sharing of audit results and cross-project learning	1	0
	o Cross-functional electrical safety socialisation	2	1
	● X6. Data Management and Reporting by the Committee	6	1
	o Committee report outputs in print and presentation formats	3	1
	o Clear reporting, challenges with project team consistency	3	1
	● X7. Performance Evaluation and Continuous Improvement by the Committee	13	1
	o Discipline and consistency as factors in SMK3 implementation effectiveness	1	1
	o Committee involvement in continuous improvement of SMK3L	3	4
	o Long-term commitment to OHS implementation from project start to finish	1	1
	o Input to strengthen committee roles through official certification and supporting docs	4	1
	o Feedback on committee visit intensity	4	1

The interview evidence strongly reinforces this interpretation. One project manager explained that the committee was highly helpful in implementing SMK3L procedures at project level, while another stressed that occupational health and safety could not stand alone and needed support from all project functions. A third informant described how the project team remained open to committee visits and inputs precisely because the committee actively helped minimise incidents and improve HSE practices rather than functioning purely as an evaluator. These accounts indicate that committee effectiveness was shaped not only by formal authority, but by collaborative acceptance and cross-functional legitimacy across the project environment.

This finding is consistent with Rahmat et al. (2023), who demonstrate that both active managerial oversight and passive resource provision significantly improve safety committee performance, and with Boudreau (2024), who shows that systematic institutional strengthening of committees leads to lower accident rates without compromising productivity. The present findings extend these arguments by showing that under post-restructuring conditions, where supervisory scope expanded significantly across multiple regions, committee effectiveness depended specifically on the capacity to operate adaptively rather than uniformly. Unlike earlier studies that

evaluated committee effectiveness in stable organisational settings, this study reveals that governance quality is shaped by how well institutional mechanisms adjust to structural and operational discontinuities. In this sense, the HSE Committee functioned not merely as a compliance body but as a strategic governance actor sustaining safety management across conditions of organisational complexity.

The groundedness and density patterns further highlight that leadership engagement, when translated consistently into audit mechanisms, communication routines, and corrective action cycles, produced cumulative rather than episodic improvements in safety governance. This is a meaningful departure from compliance-oriented models in which oversight is treated as periodic rather than continuous. The data suggest that the durability of committee effectiveness was a product of relational consistency, not regulatory mandate.

Implementation of HSE Committee Functions in Project Operations

The findings further reveal that the HSE Committee's role extended well beyond formal supervision and involved direct operational intervention across six major domains: standard operating procedure and policy development, risk assessment and hazard identification, supervision of personal protective equipment and workplace environment, worker training and certification, incident and near miss handling, and risk control and monitoring. Worker training and certification (groundedness = 11, density = 3), incident and near miss handling (groundedness = 12, density = 2), and PPE supervision (groundedness = 10, density = 3) were among the most prominent dimensions, while risk control and monitoring (density = 4) emerged as the most interconnected dimension in the overall system, suggesting it served as a structural node linking implementation activities to safety outcomes.

Table 2. Groundedness and Density of “IMPLEMENTATION OF HSE COMMITTEE FUNCTIONS IN OHS (Y)”

Groups	Code	Groundedness	Density
IMPLEMENTATION OF HSE COMMITTEE FUNCTIONS IN OHS (Y)	● Y1. Committee Involvement in SOP and OHS Policy Development	8	2
	○ Committee involved in revision and refinement of project SOPs	3	3
	○ Flexible coordination regarding safety policy	1	1
	○ SOP development based on cross-project learning from the Committee	1	1
	○ SOP recommendations based on actual project conditions	3	1
	● Y2. Committee Role in Risk Assessment and Hazard Identification	10	2
	○ Committee verifies technical readiness of heavy equipment	3	1
	○ Reporting of safe/unsafe conditions via digital media before work	1	1
	○ Formation of Safety-First team for initial site verification	2	1
	○ Technical inspection by Committee of critical equipment	1	1
	○ Fire simulation and emergency evaluation from Committee recommendations	1	1
	○ Field verification of JSA by Committee	3	1
	● Y3. Supervision of PPE and Workplace Environment Inspection	10	3
	○ Inspection frequency can be project initiative, not only from head office	3	2

Groups	Code	Groundedness	Density
	○ Committee warnings and authority regarding PPE violations	3	1
	○ Immediate stop-work action (SWA) for hazardous conditions	4	1
	● Y4. Worker Training and Certification	11	3
	○ Training effectiveness evaluated by checking certificates and interviews	3	1
	○ Training needs identified independently from the start	3	1
	○ Committee facilitates training from start to execution	3	4
	○ Verification of training and skill documents by HSE Committee	1	1
	○ Mandatory sharing of training outcomes with all project functions	1	1
	● Y5. Incident and Nearmiss Handling by Committee	12	2
	○ Incident reporting flow based on SOP	3	3
	○ No direct investigation experience, but procedures are in place	3	1
	○ Preparedness despite no incident cases yet	3	2
	○ Formal reporting via monthly system, direct action for field cases	3	1
	○ Implementation of stand-down meetings across projects after incidents	1	1
	● Y6. Risk Control and Monitoring	9	4
	○ Monitoring results used as a basis for internal improvement	3	2
	○ Committee input for HSE budget adjustment	3	1
	○ Risk monitoring conducted online regularly	3	1

The interview findings demonstrate that these functions were implemented in concrete and adaptive ways that went beyond procedural compliance. In relation to standard operating procedures, project managers explained that procedures were developed at project level but continuously refined through committee feedback and cross-project lessons, aligning with the pattern identified by Arumsari & Nugroho (2023), who show that SOP improvement is most effective when driven by field-based evidence rather than top-down standardisation. In risk assessment, the committee actively reviewed technical readiness, certification requirements, work methods, and field conditions before activities proceeded, a practice consistent with the findings of Magfirona et al. (2025) and Putra et al. (2021), who demonstrate that technically skilled committees achieve higher adaptability and safety compliance. In PPE supervision, inspections were conducted not only according to routine schedules but also in response to project team requests, indicating a demand-driven rather than purely schedule-driven mode of oversight. Training and certification were verified through document checking and direct interviews, a practice that Triyanto et al. (2024) associate with improved accuracy of competency monitoring.

Analytically, these results show that effective OHS implementation in infrastructure projects operates as a cyclical rather than linear system. Standard setting, inspection, training, reporting, and monitoring continuously reinforced one another in a way that mirrors the integrated cycle described by the Safety Management System framework, namely policy, risk management, assurance, and safety promotion (Carolino et al., 2023; Suwaini & Iskandar, 2022). Critically, however, the present findings reveal that this cycle could not sustain itself through procedural design alone. The committee functioned as an adaptive intermediary, the institutional actor capable

of contextualising each SMS component to the specific risk profiles, workforce conditions, and operational constraints of individual project sites. This role is not adequately captured by existing SMS applications in the construction literature, which tend to treat the framework as a uniform system rather than a contextually negotiated process.

The interconnections among implementation functions also demonstrate that safety practices were not isolated activities. Risk assessment shaped the scope of PPE supervision; PPE compliance was reinforced through training; training outcomes were validated through reporting; and reporting fed back into risk monitoring and budget adjustment. The density value of Y6 (risk control and monitoring, density = 4) reflects precisely this centrality: it was not simply one of six implementation domains but the integrating mechanism through which all other committee functions were evaluated and refined.

Impact of HSE Committee Performance on Safety Culture, Incidents, and Compliance

The findings show that the most visible impact of HSE Committee performance was the strengthening of safe work culture, the reduction of incidents and near misses, and the improvement of regulatory compliance. Among these dimensions, reduction in incidents and near misses showed the highest density (density = 4), indicating that it was the most strongly connected outcome in the qualitative evidence and that participants most directly associated committee activities with tangible improvements in everyday safety performance.

Table 3. Groundedness and Density of “IMPACT OF HSE COMMITTEE PERFORMANCE (Z)”

Groups	Code	Groundedness	Density
IMPACT OF HSE COMMITTEE PERFORMANCE (Z)	● Z1. Safe Work Culture	4	2
	○ Committee fosters a disciplined and accountable work culture	3	1
	○ Central committee strengthens a safety-oriented work culture	1	1
	● Z2. Reduction in Incidents and Nearmisses	6	4
	○ Nearmisses still occur but in small numbers	3	1
	○ Reduction in incidents and increased PPE compliance	1	1
	○ Decreased severity of nearmiss cases from major to minor	1	2
	○ No incidents since the HSE Committee was established	1	2
	● Z3. Regulatory Compliance	6	1
	○ Committee promotes compliance with SMK3L standards	3	1
	○ Assessment mechanisms encourage project seriousness towards OHS	2	2
	○ Direct influence of committee visits on procedural compliance	1	2
	○ Publication of committee scoring results as collective motivation	1	1

The respondents' accounts strongly support this conclusion. One project manager stated that project teams became more disciplined and more committed because they felt monitored by the head office committee. Another reported visible change in PPE use and worksite organisation, explaining that routine inspections gradually transformed safety compliance into habit rather than obligation. Recurring violations, such as smoking in prohibited areas and incomplete PPE use, had declined following committee findings and the implementation of reward and punishment mechanisms. These accounts demonstrate that committee influence extended beyond isolated

corrections and contributed to a broader process of behavioural normalisation, consistent with Handayani et al. (2024), who identify continuous training and strong safety culture as foundational conditions for long-term OHS system effectiveness.

This finding is theoretically important because it shows that the impact of committee performance cannot be reduced to incident frequency metrics. More fundamentally, the committee cultivated an organisational environment in which occupational health and safety became embedded in everyday expectations and collective discipline. This is consistent with Zhang et al. (2023) and Pakpahan et al. (2023), who demonstrate that sustained field communication and worker participation in hazard reporting produce durable rather than temporary improvements in safety behaviour. The present findings add contextual specificity by showing how these cultural and procedural changes were experienced in decentralised infrastructure projects following organisational restructuring, a context that prior studies have not examined directly.

Notably, the evidence also reveals a shift from reactive correction to proactive anticipation. As recurring violations declined, project teams were able to redirect attention toward identifying emerging risks rather than repeatedly addressing the same minor failures. This trajectory, from compliance enforcement toward risk anticipation, reflects the movement toward a more mature safety culture grounded in awareness and forward-looking risk management, a shift theorised by Heinrich's Accident Pyramid as a systemic indicator of reduced latent risk (Calvetti et al., 2024; Majumdar et al., 2022). The HSE Committee's role in sustaining this trajectory was not incidental but institutional: its ongoing presence, feedback cycles, and cross-site knowledge sharing created the conditions under which safety awareness became progressively normalised rather than externally imposed.

The Relationship Between HSE Committee Effectiveness, Implementation, and Outcomes

The findings demonstrate that committee effectiveness, implementation of committee functions, and project safety outcomes formed an interdependent causal chain in which no single element was independently sufficient. Leadership and management commitment (groundedness = 14), performance evaluation and continuous improvement (groundedness = 13), incident and near miss handling (groundedness = 12), and worker training and certification (groundedness = 11) occupied the most prominent positions across the coding structure, while risk control and monitoring (density = 4) and incident and near miss reduction (density = 4) emerged as the most structurally connected elements, bridging institutional effectiveness and operational outcomes.

Table 4. Groundedness and Density of “The Relationship Between HSE Committee Effectiveness, OHS Implementation, and Its Impact”

Groups	Code	Groundedness	Density
EFFECTIVENESS OF THE HSE COMMITTEE (X)	○ X1. Leadership and Management Commitment	14	2
	○ X2. HSE Committee Structure	9	2
	○ X3. Committee Meetings and Regular Evaluations	10	1
	○ X4. Inspections and Audits by the HSE Committee	12	1
	○ X5. Communication and Education by the HSE Committee	10	1
	○ X6. Data Management and Reporting by the Committee	6	1
	○ X7. Performance Evaluation and Continuous Improvement	13	1
IMPLEMENTATION OF HSE	○ Y1. Committee Involvement in SOP and OHS Policy Development	8	2

Groups	Code	Groundedness	Density
COMMITTEE FUNCTIONS IN OHS (Y)	○ Y2. Committee Role in Risk Assessment and Hazard Identification	10	2
	○ Y3. Supervision of PPE and Workplace Environment Inspection	10	3
	○ Y4. Worker Training and Certification	11	3
	○ Y5. Incident and Nearmiss Handling by Committee	12	2
	○ Y6. Risk Control and Monitoring	9	4
	○ Z1. Safe Work Culture	4	2
IMPACT OF HSE COMMITTEE PERFORMANCE (Z)	○ Z2. Reduction in Incidents and Nearmisses	6	4
	○ Z3. Regulatory Compliance	6	1

This interdependence pattern carries significant analytical weight. Leadership and commitment alone were insufficient without translation into concrete mechanisms such as training, site inspection, audit follow-up, and reporting systems. Equally, practical field interventions could not produce sustainable outcomes without institutional evaluation, data management, and organisational backing. This finding is consistent with Alhammadi et al. (2022), who demonstrate that contractor and consultant engagement from the earliest project stages is essential for embedding safety standards, and with Ningsih et al. (2024), who show that active and adaptive committees play a decisive role in rapid incident mitigation and risk escalation prevention.

The interdependent governance model identified here offers a meaningful analytical contribution beyond the individual findings. Prior studies have tended to examine discrete components of OHS governance, such as leadership, training, or audit systems, in relative isolation. The present study shows that these components function as a system rather than a set of parallel interventions. The weakening of any single element in the chain, whether through leadership disengagement, understaffed audits, or inconsistent reporting, creates compounding vulnerabilities that erode overall system effectiveness. This has direct implications for how project-based organisations should evaluate and invest in OHS governance: not by optimising individual components in sequence, but by maintaining the coherence and connectivity of the entire institutional system. Where these elements operate in sustained alignment, safety outcomes become more stable, more predictable, and more resistant to disruption from structural or operational change.

Theoretical Contribution and Practical Implications

The findings of this study offer a meaningful theoretical contribution to the literature on occupational health and safety governance in project-based organisations. The HSE Committee should be understood not merely as a compliance body or a formal supervisory unit, but as an enabling condition for adaptive OHS governance in complex, multi-site infrastructure environments. This reframing departs from prior conceptualisations that treat committee effectiveness primarily as a function of structural completeness, regulatory adherence, or audit frequency (Rahmat et al., 2023; Arumsari & Nugroho, 2023). The present findings demonstrate that structural and procedural elements alone, while necessary, are insufficient to explain sustained safety improvements. Instead, the decisive factor was the quality of institutional engagement through which the committee continuously translated central policy into locally responsive action across geographically dispersed project sites.

This study advances the concept of HSE Committee effectiveness as an adaptive governance process, a concept that draws on and extends the adaptive governance literature (Folke et al.,

2005; Chaffin et al., 2016) into the domain of occupational safety management. Adaptive governance, in this context, refers to the capacity of institutional actors to respond flexibly to changing operational conditions, redistribute authority across levels, and sustain learning processes in the face of structural and environmental complexity. The HSE Committee in this study exhibited precisely these characteristics: it adjusted visit intensity in response to project risk levels, facilitated cross-site knowledge transfer through shared audit findings, and maintained institutional legitimacy by remaining responsive rather than merely directive. This constitutes a theoretical departure from static institutional models of safety management, in which committees are evaluated primarily by their formal mandates and procedural outputs. The present findings suggest instead that effectiveness is a relational and dynamic property, shaped by the ongoing interaction between leadership commitment, operational context, and organisational learning capacity.

This contribution also extends the Safety Management System framework as applied in construction and infrastructure contexts. Prior applications of SMS have largely focused on the four-component cycle of policy, risk management, assurance, and promotion as a linear or iterative process (Carolino et al., 2023; Suwaini & Iskandar, 2022). This study shows that under conditions of organisational restructuring and multi-site dispersion, the SMS cycle cannot operate effectively without an adaptive institutional actor, in this case the HSE Committee, capable of contextualising each SMS component to the specific demands of diverse project environments. The committee therefore functions as an adaptive intermediary between the formal SMS architecture and the fluid realities of large-scale infrastructure delivery.

The findings also generate several practical implications for occupational health and safety management in large-scale infrastructure organisations. From a managerial standpoint, organisations cannot rely on the formal establishment of a committee as a sufficient governance mechanism. Managerial commitment must be active, visible, and continuously responsive to evolving field conditions rather than exercised only during audit cycles or incident reviews. From an organisational development perspective, committee structures require adequate staffing, certified personnel, and sufficient operational support to maintain consistent engagement across geographically dispersed projects. The evidence shows that understaffing and limited visit capacity were among the primary factors constraining committee reach and effectiveness. From a systems and technology standpoint, digital reporting and real-time monitoring tools need to be developed further to improve follow-up accuracy, cross-site comparability, and early warning capacity. Finally, from a human resource and knowledge management perspective, cross-project learning mechanisms, structured communication channels, and reward and punishment systems must be institutionalised rather than applied sporadically, because sustained behavioural change in safety compliance depends on consistent reinforcement rather than periodic intervention. Taken together, these implications demonstrate that the strengthening of HSE Committee governance is not a peripheral concern but a strategic organisational investment with direct consequences for project safety performance, workforce development, and operational effectiveness.

The effectiveness of the HSE Committee in infrastructure projects should also be understood from a broader managerial perspective, because safety governance depends not only on technical procedures but also on communication, human behaviour, digital systems, process evaluation, and cross functional coordination. Risk communication is essential in shaping preventive behaviour, particularly when workers are expected to recognise hazards, report unsafe conditions, and respond appropriately to safety instructions (Putra & Ardianto, 2022). This behavioural dimension is also supported by studies on organisational citizenship behaviour, which show that employee willingness

to contribute beyond formal duties can strengthen organisational performance and collective responsibility (Putra et al., 2020). In addition, HSE governance requires coordination among organisational functions, since safety implementation involves not only the HSE unit but also project management, human resources, corporate communication, and operational teams, as reflected in prior research on the need for collaboration across HR, corporate communication, and marketing communication functions (Rinaldi & Putra, 2022; Andriani & Putra, 2019). From a system perspective, digital monitoring and structured reporting are increasingly important because technology acceptance, sustainability, and process standardisation can improve the consistency of operational control (Fahmi et al., 2024; Kunaifi et al., 2022). Furthermore, operational performance studies highlight the importance of redesigning work processes, strengthening supplier and partner coordination, and improving managerial responsiveness in post pandemic business environments (Fahmi et al., 2024). These arguments are consistent with the view that sustainable organisational advantage is built through adaptive capabilities, operational reliability, and continuous value creation, including in service based and project based organisations (Putra et al., 2024). Therefore, strengthening HSE Committee effectiveness should be positioned as a strategic organisational investment that integrates risk communication, worker participation, digital reporting, process compliance, cross functional coordination, and continuous operational improvement.

Research Limitations and Future Directions

This study has several limitations that need to be acknowledged. The research relied on three project managers as key informants and focused on projects that had already demonstrated improvement in HSE Committee scores. As a result, the findings provide strong contextual insight into improving cases but may not fully represent projects with stagnant or deteriorating safety performance. In addition, the study was conducted within one organisational division, which means that its contribution lies primarily in analytical depth and contextual understanding rather than broad statistical generalisation.

At the same time, these limitations open opportunities for future research and practical development. Future studies may compare improving and non-improving project sites, include a wider range of stakeholders such as HSE officers and field workers, and combine qualitative evidence with quantitative safety indicators. From a practical perspective, the findings indicate the importance of institutionalising regular committee evaluation, strengthening personnel capacity, expanding digital monitoring, and promoting structured inter project learning. These directions are important for strengthening occupational health and safety governance more systematically in complex infrastructure environments.

CONCLUSION

This study concludes that the HSE Committee played a pivotal role in strengthening occupational health and safety implementation across infrastructure projects managed by Infrastructure 1 Division of PT. X. In response to the first research question, the key dimensions of HSE Committee effectiveness under restructuring were found in the integration of leadership and management commitment, clear committee structure, regular meetings and evaluations, inspections and audits, communication and education, data management and reporting, and continuous improvement. These dimensions show that committee effectiveness was not determined only by formal organisational structure, but also by the ability of the committee to maintain active

coordination, managerial support, and consistent evaluation across geographically dispersed project sites.

In response to the second research question, the findings show that OHS implementation mechanisms were enacted and sustained through the committee's direct involvement in SOP and OHS policy development, risk assessment and hazard identification, supervision of PPE and workplace conditions, worker training and certification, incident and near miss handling, and risk control and monitoring. These mechanisms enabled the committee to translate safety policies into practical field actions. The committee also functioned as a bridge between central management and project level implementation by ensuring that safety standards were not only documented, but also communicated, monitored, corrected, and improved according to the specific risk conditions of each project site.

In response to the third research question, this study found that the main barriers to consistent OHS outcomes across geographically dispersed infrastructure projects were related to differences in project conditions, limited committee personnel, uneven worker compliance, varying levels of project team readiness, and the need for stronger digital reporting and monitoring systems. These barriers indicate that the effectiveness of HSE Committee governance depends on continuous institutional support, adequate human resources, and reliable information systems. Without these supporting conditions, committee activities may remain procedural and may not fully produce sustainable improvements in safety behaviour, incident prevention, and regulatory compliance.

The findings further demonstrate that the implementation of committee functions contributed to more adaptive standard operating procedures, stronger worker training and certification, more structured risk assessment, tighter personal protective equipment supervision, and more consistent incident and near miss handling. As a result, committee performance was associated with the strengthening of safe work culture, the reduction of incidents and near misses, and the improvement of regulatory compliance. These findings confirm that occupational health and safety governance in infrastructure projects depends on the continuous interaction between institutional effectiveness, operational implementation, and measurable safety outcomes.

Theoretically, this study contributes to the development of knowledge by showing that HSE Committee effectiveness should be understood as an adaptive governance process rather than a static administrative function. This perspective is important because infrastructure projects operate in dynamic, high risk, and geographically dispersed environments that require flexible coordination, rapid response, and continuous learning. The HSE Committee therefore should not be viewed merely as a compliance body, but as an institutional mechanism that connects safety policy, field level supervision, worker behaviour, and organisational learning.

Practically, the findings suggest that infrastructure companies need to strengthen HSE Committee capacity through adequate staffing, clearer role distribution, regular certification, stronger audit follow up, and more intensive cross functional coordination. Project managers should ensure that committee recommendations are translated into concrete corrective actions, while HSE officers should be supported with sufficient authority, resources, and digital tools to monitor risks more consistently. The use of digital reporting systems, real time monitoring, integrated near miss databases, and cross project learning platforms should be expanded to improve early warning capacity and support faster decision making.

From a policy perspective, organisations and regulators should encourage stronger institutionalisation of HSE Committees in large scale infrastructure projects. Internal company policies should require regular committee evaluation, transparent reporting of safety performance,

standardised follow up mechanisms, and periodic review of committee capacity. At the regulatory level, policy makers may consider strengthening guidelines on HSE Committee competence, digital safety reporting, multi site supervision, and integration between SMK3, ISO 45001, and project based safety governance. Future research is encouraged to examine a wider range of project conditions, involve broader stakeholder groups such as HSE officers and field workers, and combine qualitative and quantitative approaches to deepen understanding of occupational health and safety governance in complex construction environments.

ACKNOWLEDGMENT

The author wishes to express sincere gratitude to the Department of Civil Engineering, Faculty of Engineering, Universitas Diponegoro for their continuous support and guidance throughout the research and preparation of this article. The academic environment, access to resources, and constructive feedback provided by the department have been invaluable in the completion of this work. Special thanks are extended to all faculty members and colleagues who contributed insightful suggestions and encouragement, enabling the successful conduct of this study.

REFERENCES

- Alhammadi, S. A., Tayeh, B. A., Alaloul, W. S., & Jouda, A. F. (2022). Occupational health and safety practice in infrastructure projects. *International Journal of Occupational Safety and Ergonomics*, 28(4), 2631–2644. <https://doi.org/10.1080/10803548.2021.2013034>
- Ali, E., Dokhan, S., & El-Dash, K. (2023). Identifying The Factors That Increase The Cost of hse in Sustainable Projects Compared to Traditional Projects in Egypt. *Engineering Research Journal (ERJ)*, 4, 48–56.
- Anaba, D. C., Azeez, J. K.-M., & Sodruddeen, A. A. (2024). Health, safety, and environmental (HSE) standards in industrial operations: A comprehensive review. *International Journal of Applied Research in Social Sciences*, 6(7), 1321–1332. <https://doi.org/10.51594/ijarss.v6i7.1269>
- Andriani, R., & Putra, W. B. T. S. (2019). The Intersection of Marketing and Human Resource Disciplines: Employer Brand Equity as a Mediator in Recruitment Process. *International Journal of Innovative Science and Research Technology (IJISRT)*, 4(12), 465–475.
- Arumsari, P., & Nugroho, A. Z. A. (2023). Improvement of the Health, Safety and Environment (HSE) Standard Operational Procedure in Construction Project. *E3S Web of Conferences*, 426. <https://doi.org/10.1051/e3sconf/202342601031>
- Boudreau, L. (2024). Multinational enforcement of labor law: Experimental evidence on strengthening occupational safety and health committees. *Econometrica*, 92(4), 1269-1308. <https://doi.org/10.3982/ECTA19408>
- Calvetti, D., Mêda, P., & de Sousa, H. (2024). Electronic performance monitoring framework to quantify unhealthy and unsafe on-site behaviours. *Procedia Computer Science*, 232, 274–283. <https://doi.org/10.1016/j.procs.2024.01.027>
- Carolino, R. C., Bernabe, G. O., & Bienes, J. R. (2023). Implementation of safety management of selected construction companies in Manila. *International Journal*, 10(2), 2829-2849.
- Chaffin, B. C., Gosnell, H., & Cosens, B. A. (2016). A decade of adaptive governance scholarship: synthesis and future directions. *Ecology and Society*, 21(3), 56. <https://doi.org/10.5751/ES-08827-210356>
- Fahmi, M. A., Mukti, M., Alamsah, U., & Putra, W. B. T. S. (2024). Acceptability and Sustainability of Warehouse Management System: Extended Technology Acceptance Model 3 and Sustainable Approach. *Review of Integrative Business and Economics Research*, 13(1), 241–261.

- Fahmi, M. A., Putra, W. B. T. S., Kunaifi, A., Alamsah, U., & Natari, S. U. (2024). Post-Pandemic Operational Performance: Redesigning Coffee Shops' Inventory Management Strategy Using Economic Order Quantity, Just-In Time, And Supplier Partnership. In *Int. Symp. Econ. Econom. Theory Econom.* (Vol. 34, pp. 27–43). Emerald Publishing. <https://doi.org/10.1108/S1571-038620240000034003>
- Falahati, M., Zokaei, M., Asady, H., Mojre, M. N., Biabani, A., & Torshizi, Y. F. (2019). Model of the selection KPI for assessing the performance of the urban HSE management system. *Iran Occupational Health*, 16(1) :60-71. <https://acjih.ir/wp-content/uploads/2019/08/ACGIH-ir-v16n1p60-fa.pdf>
- Farida, E., Sholihah, Q., Andarini, S., & Natsir, M. H. (2024). Occupational Safety And Health Implementation Model In Construction Safety Management System Based On Pupr Minister Regulation Number 10 Of 2021 To Support Infrastructure Development In East Java Province. *Revista de Gestao Social e Ambiental*, 18(2). <https://doi.org/10.24857/rgsa.v18n2-109>
- Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, 30, 441–473. <https://doi.org/10.1146/annurev.energy.30.050504.144511>
- Handayani, H., Masjuli, M., Madhona, Y. F., & Amaliah, S. (2024). The Importance of HSE (Health, Safety, And Environment) Communication on A Voyage. *Asian Journal of Engineering, Social and Health*, 3(8), 1895-1904.
- Kunaifi, A., Suryani, E., Fahmi, M. A., Natari, S. U., & Putra, W. B. T. S. (2022). Evaluation of the Raw Material Import Process Using the Authorized Economic Operator Application. *Review of Integrative Business and Economics Research*, 12(4), 163–183.
- Kurniawan, N. K., Ngaliman Ngaliman, & Ana Faizah. (2024). Evaluation of the Implementation of Occupational Safety and Health Management Systems in Building Construction Projects in the Public Works, Spatial Planning and Land Affairs Agency of Kepulauan Riau Province. *International Journal of Management Research and Economics*, 2(4), 317–332. <https://doi.org/10.54066/ijmre-itb.v2i4.2420>
- Larasati, A. Q., & Yosalli. (2024). Implementation of Safety Talk on Construction Project at PT Kerinci Meragin Hidro Batang Merangin Kerinci District in 2023. *Radinka Journal of Health Science*, 2(2), 272-279. <https://rjupublisher.com/ojs/index.php/RJHS/article/view/414/313>
- Magfirona, A., Rachmawati, G. Z., & Rizana, R. (2025). Analysis of Occupational Health and Safety Risk Level in the Implementation of the Solo Balapan–Kadipiro Elevated Railway Construction Project (Stage 2). *IOP Conference Series: Earth and Environmental Science*, 1444(1). <https://doi.org/10.1088/1755-1315/1444/1/012009>
- Majumdar, A., Manole, I., & Nalty, R. (2022). Analysis of Port Accidents and Calibration of Heinrich's Pyramid. In *Transportation Research Record* (Vol. 2676, Issue 2, pp. 476–489). SAGE Publications Ltd. <https://doi.org/10.1177/03611981211044447>
- Ningsih, P. O., Harsono, H., & Wulandari, M. D. (2024). Strategic Factors that Influence Critical Thinking Ability in Mathematics Learning in Elementary Schools. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 14(1). 115-128
- Nuruzzaman, W. (2023). Analysis of the Implementation of the Construction Safety Management System (SMKK) on the Cisempur-Budiwangi Road Reconstruction Activity, Cibalong District Tasikmalaya Regency. *Jurnal Improsci*, 1(2), 88-98. <https://doi.org/10.62885/improsci.v1i2.68>
- Pakpahan, D. R., Hermawan, F., & Ismiyati, I. (2023). Analysis of Occupational Safety and Health Implementation in National Strategic Projects Case Study of Kulon Progo Airport Infrastructure Development Project. *International Journal of Social Service and Research*, 3(6), 1403–1415. <https://doi.org/10.46799/ijssr.v3i6.429>
- Putra, A. D., Syamsuir, E., & Wahyuni, F. I. (2021). Analisis Penerapan Kesehatan Dan Keselamatan Kerja (K3) Di Perusahaan Jasa Konstruksi Kota Payakumbuh. *Rang Teknik Journal*, 4(1). <https://doi.org/10.31869/rjt.v4i1.2034>

- Putra, W. B. T. S., & Ardianto, B. (2022). Why Does Risk Communication Matter? Preventive and Excessive Health Behavior among Uninfected People. *South Asian Journal of Social Studies and Economics*, 13(2), 56–72.
- Putra, W. B. T. S., Harista, F. V., & Kurniawan, N. (2024). Redefining the road ahead in the sharing economy: How to build sustainable competitive advantage of ride-hailing services. *International Journal of Research in Business & Social Science*, 13(3), 1-13.
- Putra, W. B. T. S., Perkasa, D. H., Ahmadi, S. N., & Pramestuti, D. (2020). Analisis Faktor Penentu Organizational Citizenship Behaviour Pada Perusahaan Otomotif Manufaktur Indonesia. *Jurnal Perspektif Manajerial Dan Kewirausahaan (JPMK)*, 1(1), 40–52.
- Rahmat, A. K., Ibrahim, I., Senathirajah, A. R. S., & Mokthar, M. Z. (2023). The Relationship Between Green Management Commitment and Effectiveness of Occupational Safety and Health Committee. *International Journal of Professional Business Review*, 8(4), 1-17. <https://doi.org/10.26668/businessreview/2023.v8i4.933>
- Rinaldi, F. R., & Putra, W. B. T. S. (2022). Why HR, corporate and marketing communication divisions should work together? The mediating role of Indonesia Bank's employer branding to attract job pursuit intention. *International Journal of Research in Business and Social Science*, 11(8), 11–23.
- Sia, W. C., Ahmad, Z. A., Muhamad, S., Ali, A. R., & Hamdan, H. M. (2024). Effective Risk Management Through Data-Driven HSE Assurance Program for Safe Execution Project Delivery. *Society of Petroleum Engineers - ADIPEC 2024*. <https://doi.org/10.2118/221994-MS>
- Suwaini, L., & Iskandar, I. (2022). Implementation Of Construction Safety Management System On Construction Projects In Indonesia (Case Study: Bridge Replacement In Bangka Regency, Bangka Belitung Province). *International Journal of Engineering Applied Sciences and Technology*, 7(4), 6–14. <https://doi.org/10.33564/ijeast.2022.v07i04.002>
- Triyanto, D., Kismartini, Purnaweni, H., & Luqman, Y. (2024). Analisis Penerapan Smart Governance di Kota Semarang. *PERSPEKTIF*, 13(2), 466–477. <https://doi.org/10.31289/perspektif.v13i2.10817>
- Yuliana, I. (2021). Analisis Penerapan Sistem Manajemen Keselamatan Dan Kesehatan Kerja Pada Proyek Konstruksi Gedung Bertingkat Tinggi. *Jurnal Penelitian Dan Kajian Teknik Sipil*, 7(1), 1-5. <https://jurnal.um-palembang.ac.id/bearing/article/view/3634>
- Zhang, X., Wang, Y., Gao, Y., Liu, Y., & Feng, S. (2023). Evaluation and Improvement of Employee Performance with respect to Health, Safety, and Environment (HSE) Factors: A Case of Complex Transport Construction Project. *Computational Intelligence and Neuroscience*, 2023(1). <https://doi.org/10.1155/2023/1741886>