



Worker and Organizational Factors Associated with Safety Outcomes in Construction Projects in Iba, Zambales: Basis for a Construction Safety Enhancement Plan

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Abstract

Construction safety remains a significant concern due to the hazardous nature of construction work and the complex interaction of workers and organizational factors that influence safety outcomes. This study examined worker-related and organizational factors associated with safety outcomes in construction projects in Iba, Zambales and served as the basis for a proposed Construction Safety Enhancement Plan (CSEP). A quantitative descriptive-correlational research design was employed involving 140 construction personnel from selected construction projects in Iba, Zambales. Data were gathered using a validated structured questionnaire with an overall pilot-test reliability coefficient of $\alpha = .89$. Descriptive statistics, correlation analysis, multiple regression, and Structural Equation Modeling (SEM) were used to analyze the data. Findings revealed generally favorable worker behaviors ($M = 3.42$), attitudes ($M = 3.71$), and perceptions ($M = 3.68$), as well as positive assessments of workplace influence ($M = 3.63$), safety policy effectiveness ($M = 3.52$), resource availability ($M = 3.61$), communication and management support ($M = 3.58$), and safety training effectiveness ($M = 3.84$). Safety outcomes in terms of policy quality ($M = 3.45$), compliance ($M = 3.63$), incident rate ($M = 3.48$), and policy and training refinement ($M = 3.66$) were likewise rated favorably. However, SEM results revealed weak and statistically nonsignificant relationships among worker-related factors, organizational factors, and safety outcomes, indicating limited explanatory power of the proposed model. Based on the findings, a six-component Construction Safety Enhancement Plan was developed focusing on safety leadership, hazard management, competency development, communication and participation, performance monitoring, and continuous improvement. Construction safety is influenced by multiple interacting factors that extend beyond the variables examined in the study. The proposed CSEP offers a practical framework for strengthening safety culture and supporting continuous safety improvement in construction projects.

Keywords: construction safety; safety culture; worker behavior; organizational support; structural equation modeling (SEM); safety management



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INTRODUCTION

The construction industry supports development through infrastructure and employment but remains hazardous. Accidents are associated with unsafe worker behavior, peer pressure, organizational culture, optimism bias, and weak safety perceptions (Ye et al., 2020; Choi, 2023; He et al., 2023; Man et al., 2022; Yuan et al., 2022). Differences in operations, competency, and environmental conditions limit standardized safety policies, emphasizing site-specific interventions (Shrestha et al., 2015; Mo et al., 2023; Zhang et al., 2023). Safety training

and management involvement improve compliance and risk awareness (Silla et al., 2020; Andi et al., 2022; Giri et al., 2023). Peer norms and social interactions further shape safety behavior, highlighting the importance of shared safety culture (Liang et al., 2018; Li et al., 2024).

In the Philippines, Department of Labor and Employment (DOLE) requires construction safety programs, although compliance varies across projects (Neyestani, 2020). Safety awareness alone may not ensure compliance because discomfort, habits, and cultural beliefs

can influence behavior (Toyado, 2021). Emerging technologies offer safety opportunities but may face financial, digital-literacy, and infrastructure limitations (Wu et al., 2022; Li et al., 2022). Therefore, this study examined worker-related and organizational factors associated with safety outcomes in Iba, Zambales, providing evidence for safety management initiatives within the local construction industry.

LITERATURE REVIEW

Worker Behavior and Risk Perception. Worker behavior is critical to construction safety and is shaped by individual, social, and situational factors. Optimism bias may cause workers to underestimate accident likelihood and severity, encouraging complacency and habitual risk-taking (Ye et al., 2020). Production pressure and cognitive dissonance may further encourage workers to rationalize safety violations (Choi, 2023), while overconfidence in risk-handling abilities can normalize unsafe practices (He et al., 2023). Under stressful and uncertain conditions, bounded rationality may lead workers to rely on heuristics that weaken hazard assessment (Man et al., 2022). Ajzen's Theory of Planned Behavior (1991) explains safety behavior through attitudes, subjective norms, and perceived behavioral control. Reason's (2000) person-system approach further emphasizes that accidents arise from both individual errors and organizational conditions, consistent with the Swiss cheese model. Thus, effective interventions should address attitudes, social norms, situational pressures, supervision, and organizational conditions to strengthen safety practices, particularly in resource-constrained settings such as Iba, Zambales.

Safety Policies and Implementation Challenges. Construction safety policies provide essential guidelines for hazard prevention, emergency response, and compliance, but their effectiveness depends on implementation, enforcement, and contextual adaptation. Mo et al. (2023) criticize "template-style" regulations that overlook site-specific risks, recommending

dynamic policies incorporating real-time risk feedback and worker participation. Similarly, Zhang et al. (2023) identified fragmented legal frameworks, weak interagency coordination, and inadequate safety training as barriers to consistent policy enforcement across Asia and the Middle East, noting that programs are often treated as compliance documents rather than working tools. Neyestani (2020) emphasizes regular policy review using incident investigations, inspections, and worker feedback. Shrestha et al. (2015) and Mo et al. (2023) advocate hybrid enforcement combining top-down requirements with bottom-up participation, supported by strong leadership and supervisor involvement. These findings are relevant to construction projects in Iba, Zambales, where resource limitations, varying oversight, and inconsistent enforcement may affect policy implementation, requiring assessment of both regulations and practices.

Safety Training and Learning Modalities. Safety training is essential for shaping workers' attitudes, improving hazard awareness, and promoting construction-site safety. Its effectiveness depends on appropriate content, delivery methods, and cultural relevance. Andi et al. (2022) emphasize behavioral and experiential approaches, including interactive exercises, quizzes, feedback, peer demonstrations, and site walks, which strengthen safe habits and reduce incidents. Giri et al. (2023) found that training preferences vary by age, with younger workers favoring mobile microlearning and older workers responding well to in-person visual instruction; thus, blended learning, critical-phase training, and refresher sessions can improve compliance. Silla et al. (2020) recommend evaluating training through leading and lagging indicators, including incident rates, near-miss reporting, and worker-initiated hazard reports, rather than attendance alone. In Iba, Zambales, cost-effective approaches such as peer mentoring, safety posters, toolbox talks, workplace guidance, and worker participation in training design can enhance contextualized learning and engagement.

Peer Norms and Social Influence. Social processes within construction sites strongly shape safety behavior through peer norms, shared experiences, and group acceptance. Liang et al. (2018) found that safe and unsafe practices can spread through observation and imitation, identifying “norm anchors” informal influential workers whose behaviors become standards for others. When such individuals disregard PPE or safety warnings, peers may imitate them to maintain group acceptance. Li et al. (2024) further explain that group-level events, such as accidents, can temporarily increase safety awareness, but peer discussions and debriefings are needed to strengthen “incident memory” and sustain behavioral change. Social identity theory also suggests that strong crew identification may encourage shortcuts that prioritize group cohesion over safety, requiring interventions targeting shared norms. In Iba, Zambales, close familial and community ties may further influence reporting behaviors. Therefore, safety programs should promote open communication and empower workers, regardless of position, to report hazards without fear of social repercussions or retaliation.

Leadership and Organizational Culture. Leadership is critical to construction safety performance because rules and technical controls require strong organizational commitment and safety-oriented culture. Effective leaders prioritize safety, communicate expectations, and model appropriate behavior. Andi et al. (2022) found that transformational leadership, which models, encourages, and rewards safe practices, produces better safety performance than compliance-based approaches. Giri et al. (2023) emphasize that frontline supervisors and middle managers influence safety culture through visible participation in high-risk activities, feedback, inspections, and empathetic responses that promote psychological safety. Weick and Sutcliffe's (2007) High-Reliability Organization (HRO) theory further highlights constant vigilance, learning from near misses, reliance on expertise, and resilience as essential principles for high-hazard environments. Gibb

et al. (2006) likewise found that positive reinforcement through recognition, incentives, and praise improves safety performance, whereas excessive punishment fosters fear and discourages reporting and learning. Thus, visible, supportive, and participatory leadership is essential for sustained safety compliance.

Technology and Safety Tools. Digital technology has transformed construction safety by enabling proactive hazard monitoring, real-time data collection, and faster decision-making. Wearable devices, artificial intelligence (AI), and mobile applications support hazard detection while reducing human error. Wu et al. (2022) found that smart helmets, sensor-enabled vests, and geolocation tags can monitor workers' vital signs, movements, and hazard exposure, triggering alerts during dangerous conditions. Li et al. (2022) demonstrated that AI-based monitoring can predict risks such as scaffolding falls, crane incidents, and fires, supporting safer manpower deployment, task sequencing, and equipment use. Pourrahmani et al. (2021) reported that mobile safety applications improve hazard visibility, near-miss reporting, inspections, and follow-up while reducing paperwork. However, adoption in areas such as Iba, Zambales may be constrained by costs, limited digital literacy, connectivity, and resistance to change. Therefore, technology should complement human monitoring, training, and safety culture, with accessible tools, meaningful data review, and transparent implementation.

Cultural and Regional Dimensions. Construction safety is shaped by cultural beliefs, social norms, and local practices that influence risk perception, training responses, and safety participation. Toyado (2021) highlights fatalistic beliefs among Filipino construction workers, such as “*kung oras mo na, oras mo na*,” which may weaken adherence to safety procedures and hazard reporting. Man et al. (2022) found that cultural cognition and collectivist values can prioritize group cohesion over personal safety, particularly where challenging authority is discouraged. Shrestha et al. (2015) identified uncontrolled employment systems and

language barriers as challenges, recommending culturally and linguistically accessible interventions through community gatherings and local institutions. Lingard and Rowlinson (2005) further noted that patriarchal environments may discourage women from reporting hazards, while younger workers may imitate unsafe practices of senior workers. Thus, safety initiatives in Iba, Zambales should be culturally grounded through local language, appropriate imagery, and community leadership, while tailoring communication and enforcement strategies to local conditions and strengthening management-worker collaboration.

Theoretical Framework. Construction safety was examined through three complementary theories: Ajzen's TPB, Reason's Swiss Cheese Model, and Weick and Sutcliffe's HRO Theory. TPB explains that behavior is shaped by attitudes, subjective norms, and perceived behavioral control, highlighting how workers' beliefs, peer influence, and access to resources may affect safety compliance (Ajzen, 1991). Reason's Swiss Cheese Model views accidents as resulting from aligned weaknesses across protective barriers, including inadequate training, weak supervision, poor procedures, insufficient resources, and unsafe actions (Reason, 2000). HRO Theory emphasizes preoccupation with failure, operational sensitivity, resilience, leadership, communication, and continuous learning in high-risk environments (Weick & Sutcliffe, 2007). Together, these theories provided an integrated framework linking worker behavior with organizational systems and safety management. The study therefore examined worker behavior, attitudes, perceptions, workplace influence, safety policies, training, resources, communication, and management support in relation to policy quality, compliance, incident rates, and safety improvement in construction projects in Iba, Zambales.

Conceptual Framework. Figure 1 illustrated the conceptual relationship among worker-related factors, organizational factors, safety outcomes, and the proposed CSEP. The

framework was grounded in the TPB, which emphasized the influence of attitudes, perceptions, and behaviors on actions (Ajzen, 1991), and construction safety literature emphasizing organizational support for safe practices. The independent variables comprised worker behavior, attitudes, and perceptions, together with organizational factors including workplace influence, safety policy effectiveness, safety training effectiveness, resource availability, communication flow, and management support. These factors represented workers' safety practices and hazard awareness, as well as organizational conditions supporting safe work. The dependent variables were safety outcomes, measured through policy quality, compliance, and incident rate, reflecting policy effectiveness, adherence to safety requirements, and workplace safety events, respectively. The framework examined their relationships and provided the basis for developing the CSEP to support continuous safety improvement in construction projects in Iba, Zambales.

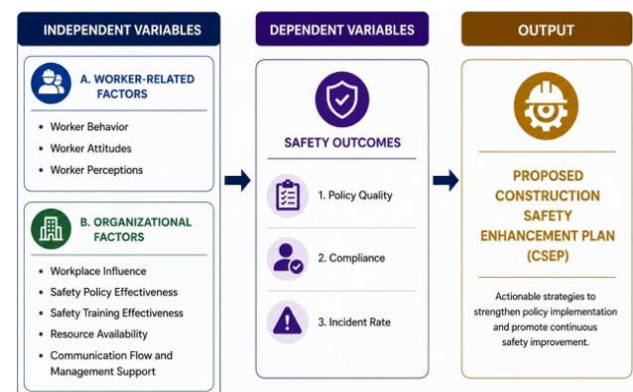


Figure 1

Conceptual Framework of the Study

Author's Note: AI-assisted figure generation was used in developing this figure; all outputs were reviewed and finalized by the researcher prior to inclusion in the manuscript.

This study looked into the worker-related and organizational factors associated with safety outcomes in construction projects in Iba, Zambales. It investigated how worker behavior, attitudes, perceptions, organizational support systems, workplace conditions, and safety-related practices relate to policy quality, compliance, and workplace incident outcomes in construction settings.

Specifically, it sought answers to the following questions:

1. What are the prevailing worker behaviors, attitudes, and perceptions that influence safety compliance in construction projects?
2. What organizational factors affect workers' adherence to safety policies?
3. What is the extent of safety training effectiveness in improving workers' knowledge, attitudes, and compliance with safety procedures?
4. Is there any relationship between worker-related factors, organizational factors, and safety outcomes in terms of policy quality, compliance, and reduction of workplace incidents?
5. What strategies can be proposed to enhance safety policy implementation and strengthen a culture of continuous safety improvement in construction projects?

Null Hypothesis. There is no significant relationship between worker-related factors, organizational factors, and safety outcomes in construction projects.

METHODS

Research Design. A quantitative descriptive-correlational design was used to examine worker and organizational factors associated with safety outcomes in construction projects in Iba, Zambales. The descriptive component characterized safety practices, attitudes, and organizational conditions, while correlational component examined relationships among variables without manipulation.

Population and Sampling. The study involved 200 frontline construction workers, foremen, safety officers, and site engineers or managers from ongoing projects in Iba, Zambales. Respondents were selected based on their direct experience with workplace safety and policy implementation. Using Cochran's formula

at a 95% confidence level, 5% margin of error, and $p = 0.50$, a minimum sample of 132 was required.

The respondents were predominantly laborers, comprising 57.86% of the sample, followed by workers occupying other construction-related positions. Most respondents were male (89.29%), reflecting the male-dominated nature of the construction industry. In terms of age, the largest proportion belonged to the 36-45 years age group (37.14%), indicating that the workforce was primarily composed of individuals in their productive working years. Regarding work experience, nearly half of the respondents (47.14%) reported having 4-6 years of construction experience, suggesting a moderately experienced workforce with sufficient exposure to construction operations and safety practices. Overall, the demographic profile indicates that the study respondents possessed relevant industry experience and practical knowledge that enabled them to provide informed assessments of worker-related factors, organizational practices, training effectiveness, and safety outcomes within construction projects.

Instrumentation. Data were collected using a nine-section structured questionnaire covering demographics, worker behavior and attitudes, workplace influences, safety training, policy effectiveness, resources, communication and management support, safety outcomes, and policy/training refinement. Sections II-IX used a four-point Likert scale from 4 (Strongly Agree) to 1 (Strongly Disagree), with a Not Applicable option. Expert validation and pilot testing with 15 excluded workers were conducted. The instrument yielded a Cronbach's alpha of 0.89.

Data Gathering Procedure. Authorization was obtained from site foremen and managers. Questionnaires were administered during toolbox meetings or breaks after orientation on the study, confidentiality, anonymity, and voluntary participation. Completed questionnaires were checked, encoded, and collected over one month across at least five construction sites.

Ethical Considerations. The study adhered to established ethical principles throughout the research process. Prior to data collection, permission was obtained from the appropriate project authorities and site management. Participation in the study was voluntary, and all respondents were informed of the purpose, procedures, and significance of the research before providing their consent. Respondents were assured that their participation would not affect their employment status and that they could decline participation or withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained by excluding personally identifiable information from survey responses and research reports. All collected data were used solely for academic purposes and were handled securely to protect the privacy of the participants. These measures were implemented to ensure respect for participant rights, data integrity, and ethical compliance throughout the conduct of the study.

Table 1
Four-Point Likert Scale for Measuring Level of Agreement

Scale Range	Verbal Interpretation
3.26 – 4.00	Strongly Agree
2.51 – 3.25	Agree
1.76 – 2.50	Disagree
1.00 – 1.75	Strongly Disagree

Data Analysis. Survey data were analyzed using Structural Equation Modeling (SEM) to examine direct and indirect relationships among worker-related factors, organizational factors, and safety outcomes. Excel was used for data preparation, SPSS for descriptive statistics and Cronbach's alpha, and AMOS for Confirmatory Factor Analysis (CFA) and structural model testing. The measurement model assessed factor loadings and construct validity, while the structural model evaluated hypothesized relationships. Path coefficients (B and β), standard errors, z -values, p -values, and R^2 were examined, while model fit was assessed using χ^2/df , GFI, NFI, CFI, TLI, and RMSEA. A four-point Likert scale interpreted weighted means, as indicated in table 1. Statistical

significance was set at $p \leq 0.05$. SEM was appropriate for examining complex interactions among study variables and potentially weak or nonsignificant relationships (Hair et al., 2019). Results were presented using fit indices, path coefficients, significance tests, R^2 values, and a structural model diagram.

RESULTS

Prevailing Worker Behaviors, Attitudes, and Perceptions Influencing Safety Compliance.

Table 2 shows that respondents generally demonstrated favorable safety behavior, with an overall worker behavior composite mean of 3.42 (SD = 0.22). Among the indicators, consistent use of required personal protective equipment (PPE) obtained the highest mean score (A1, $M = 3.46$, $SD = 0.83$), indicating that workers generally observed and practiced basic safety requirements on-site. This suggests that PPE use is widely recognized as an important component of workplace safety.

Table 2
Prevailing Worker Behavior Influencing Safety Compliance

Code	Indicator	Mean	SD
A1	The use of required PPE among workers is consistently observed on-site.	3.46	0.83
A2	I sometimes take shortcuts that bypass safety procedures.	1.67	0.94
A3	Unsafe acts (e.g., improper tool/machine use) happen on site.	1.61	0.84
A4	Workers sometimes ignore hazard or warning signs.	1.50	0.75
A5	Risk-taking behavior is common in order to finish tasks faster.	1.60	0.80
WB_mean	Overall worker behavior composite	3.42	0.22

The lowest mean score was recorded for workers ignoring hazard or warning signs (A4, $M = 1.50$, $SD = 0.75$). Since the item was negatively worded, the low mean indicates strong disagreement with unsafe behavior, reflecting a generally positive orientation toward hazard awareness and compliance. Similarly, low mean scores were observed for unsafe acts (A3, $M = 1.61$, $SD = 0.84$), risk-taking behavior to complete tasks faster (A5, $M = 1.60$, $SD = 0.80$), and taking shortcuts that bypass safety procedures (A2, $M = 1.67$, $SD = 0.94$), suggesting that these unsafe practices were not commonly reported among respondents.

Variations in responses were most evident in shortcut-taking behavior ($SD = 0.94$), indicating differing experiences and perceptions among workers regarding adherence to safety procedures. Overall, the findings suggest that workers generally practice safe behaviors and awareness of safety requirements, although some inconsistencies in compliance may still exist across work environments.

Table 3 shows that respondents generally demonstrated favorable attitudes toward safety, as reflected by an overall worker attitude composite mean of 3.71 ($SD = 0.37$). The results indicate strong agreement with safety-related attitudes across all indicators.

Table 3
Prevailing Worker Attitudes Influencing Safety Compliance

Code	Indicator	Mean	SD
A6	I feel confident reporting hazards or unsafe conditions without fear of punishment.	3.37	0.97
A8	I am motivated to follow safety rules and procedures.	3.81	0.51
A10	PPE use and safety training are important for me.	3.96	0.19
WA_mean	Overall worker attitudes composite	3.71	0.37

Among the indicators, the perceived importance of PPE use and safety training received the highest mean score (A10, $M = 3.96$, $SD = 0.19$), indicating near-unanimous agreement regarding the value of protective equipment and safety education. The very low standard deviation further suggests a high degree of consistency among respondents in recognizing the importance of these safety measures.

Motivation to follow safety rules and procedures also received a high rating (A8, $M = 3.81$, $SD = 0.51$), suggesting that respondents generally possess a positive mindset toward safety compliance. In contrast, confidence in reporting hazards or unsafe conditions without fear of punishment obtained the lowest mean score (A6, $M = 3.37$, $SD = 0.97$). Although still favorable, this indicator exhibited the highest variability, indicating differences in workers' perceptions of their ability to communicate safety concerns openly.

Overall, the findings suggest that workers hold positive attitudes toward safety and recognize

the importance of complying with safety measures. However, variations in hazard-reporting confidence indicate potential differences in workplace communication and employee participation in safety-related concerns.

Table 4 presents the prevailing worker perceptions influencing safety compliance. The results indicate generally favorable perceptions of workplace safety, with an overall worker perception composite mean of 3.68 ($SD = 0.50$).

Table 4
Prevailing Worker Perceptions Influencing Safety Compliance

Code	Indicator	Mean	SD
A7	I am aware of the safety risks related to my work.	3.66	0.69
A9	The overall safety climate in this project is positive.	3.70	0.62
WP_mean	Overall worker perception composite	3.68	0.50

The highest-rated indicator was the perception that the overall safety climate in the project is positive (A9, $M = 3.70$, $SD = 0.62$). This suggests that respondents generally perceive workplace conditions, safety practices, and organizational support as conducive to maintaining safety on-site. Similarly, awareness of safety risks related to work activities received a favorable rating (A7, $M = 3.66$, $SD = 0.69$), indicating that workers generally recognize the hazards associated with their assigned tasks.

The relatively similar mean scores across both indicators suggest consistency in workers' perceptions regarding workplace safety conditions and risk awareness. However, the moderate standard deviations indicate some variation in respondents' experiences and viewpoints. These differences may reflect varying work assignments, site conditions, supervisory practices, or exposure to safety-related activities.

In general, the findings indicate that workers maintain a positive perception of workplace safety and demonstrate awareness of occupational hazards. Such perceptions reflect a generally favorable safety environment across the participating construction sites

while acknowledging that individual experiences may vary among workers.

Organizational Factors Affecting Workers' Adherence to Safety Policies. Table 5 shows that workplace influences generally supported workers' adherence to safety policies, as reflected by an overall workplace influence composite mean of 3.63 (SD = 0.32). The results indicate that respondents perceived their work environment as conducive to maintaining safety compliance.

Table 5
Workplace Influence on Safety Policy Adherence

Code	Indicator	Mean	SD
B1	Supervisors and managers demonstrate commitment and support for worker safety.	3.55	0.89
B2	Co-workers encourage and remind each other to follow safety procedures.	3.90	0.30
B3	The company provides enough safety resources for safe work operations.	3.64	0.85
B4	Workload and deadlines allow workers to perform tasks safely without pressure.	3.28	0.79
B5	Hazards in the workplace are properly identified and controlled through management and worker cooperation.	3.81	0.40
WI_mean	Overall workplace influence composite	3.63	0.32

Among the indicators, co-worker encouragement and reminders to follow safety procedures received the highest mean score (B2, M = 3.90, SD = 0.30), suggesting that peer support and mutual reinforcement of safety practices were strongly evident within the workplace. The relatively low standard deviation indicates a high level of agreement among respondents regarding the positive influence of co-workers on safety adherence.

The lowest-rated indicator was workload and deadlines allowing workers to perform tasks safely without pressure (B4, M = 3.28, SD = 0.79). Although still rated favorably, this indicator exhibited greater variability compared to the others, suggesting that workers differed in their experiences regarding time constraints and work demands. Some respondents may have perceived that production schedules occasionally created pressure that could affect the pace at which safety procedures were followed.

Overall, the findings indicate that workplace influence is generally favorable, with strong peer support, management commitment, resource provision, and cooperative hazard management contributing to workers' adherence to safety policies. However, workload pressures appear to be the area with the greatest variation in worker perceptions.

Table 6 presents the effectiveness of safety policies as perceived by the respondents. The results indicate generally favorable assessments, with an overall safety policy effectiveness composite mean of 3.52 (SD = 0.24).

Table 6
Safety Policy Effectiveness as an Organizational Factor

Code	Indicator	Mean	SD
D1	I am aware of the company's safety policy and its purpose.	3.91	0.28
D2	Safety audits and inspections are conducted regularly to maintain safe operations.	2.94	0.84
D3	Workers are encouraged and supported in reporting safety concerns or near-miss incidents.	3.54	0.62
D4	Corrective actions for safety issues are implemented promptly and effectively.	3.39	0.59
D5	Management and employees work together to promote and maintain a strong safety culture.	3.84	0.37
SPE_mean	Overall safety policy effectiveness composite	3.52	0.24

The highest-rated indicator was workers' awareness of the company's safety policy and its purpose (D1, M = 3.91, SD = 0.28), suggesting that safety policies were effectively communicated and understood by employees. Similarly, management and employee collaboration in promoting and maintaining a strong safety culture received a high rating (D5, M = 3.84, SD = 0.37), indicating a shared commitment to workplace safety.

In contrast, the regular conduct of safety audits and inspections received the lowest mean score (D2, M = 2.94, SD = 0.84). This item also exhibited the highest standard deviation among the indicators, indicating considerable variation in respondents' experiences regarding safety monitoring activities. The findings suggest that while workers generally recognize and understand organizational safety policies, perceptions regarding the consistency of

inspections and audits vary across worksites or operational conditions.

The results indicate that safety policies are generally viewed as effective, particularly in terms of awareness, communication, and collaborative safety efforts, although opportunities remain to strengthen the consistency of policy monitoring and enforcement.

Table 7 shows that resource availability was generally perceived as adequate, as reflected by an overall resource availability composite mean of 3.61 (SD = 0.25). The findings suggest that respondents generally considered organizational resources supportive of safe work practices.

Table 7
Resource Availability Affecting Safety Policy Adherence

Code	Indicator	Mean	SD
E1	I always have access to proper personal protective equipment (PPE) needed for my work.	3.92	0.27
E2	The tools and equipment provided to me are well-maintained and safe to use.	3.93	0.26
E3	I am given enough time to follow safety procedures without being rushed by work deadlines.	3.35	0.79
E4	Safety officers or support staff are available when I need assistance.	3.14	0.74
E5	The resources provided by the company are sufficient to control hazards in my workplace.	3.69	0.54
RA_mean	Overall resource availability composite	3.61	0.25

The highest rated indicators were the availability of safe and well-maintained tools and equipment (E2, M = 3.93, SD = 0.26) and access to appropriate personal protective equipment (PPE) (E1, M = 3.92, SD = 0.27). The low variability associated with these indicators indicates strong agreement among respondents regarding the adequacy of these material resources.

The lowest rate indicator was the availability of safety officers or support staff when assistance was needed (E4, M = 3.14, SD = 0.74). This item also demonstrated relatively greater variability, suggesting differences in workers' access to safety-related personnel across project locations or work environments. Likewise, the adequacy of time to follow safety procedures without being rushed by work deadlines (E3, M

= 3.35, SD = 0.79) received a comparatively lower rating and showed substantial variation among respondents.

The results indicate that material resources such as PPE, tools, and equipment were generally accessible and sufficient. However, human support resources and time-related factors appear to be less consistently available, reflecting areas where variations in worker experiences are more evident.

Table 8 presents the respondents' assessment of communication flow and management support related to safety policy adherence. The overall composite mean of 3.58 (SD = 0.25) indicates generally favorable perceptions of communication practices and management involvement in workplace safety.

Table 8
Communication Flow and Management Support Affecting Safety Policy Adherence

Code	Indicator	Mean	SD
F1	Safety instructions and updates are clear, easy to understand, and regularly communicated.	3.92	0.27
F2	Hazards reported by workers are addressed promptly, and corrective actions are communicated clearly.	3.52	0.50
F3	Management actively participates in safety meetings and provides adequate resources for safety improvement.	3.78	0.42
F4	Supervisors and managers lead by example in following safety rules and practices.	3.29	0.78
F5	Workers feel safe and confident to report hazards or safety issues without fear of retaliation.	3.41	0.72
CFMS_mean	Overall communication flow and management support composite	3.58	0.25

The highest-rated indicator was the clarity, simplicity, and regular communication of safety instructions and updates (F1, M = 3.92, SD = 0.27). The low standard deviation suggests strong consistency among respondents in perceiving safety-related information as clear and regularly communicated.

The lowest-rated indicator was supervisors and managers leading by example in following safety rules and practices (F4, M = 3.29, SD = 0.78). This item demonstrated the highest variability among the indicators, indicating differing perceptions regarding leadership behavior and visible safety commitment. Workers may have experienced varying levels of supervisory engagement depending on their

work assignment, project conditions, or management practices.

Similarly, workers' confidence in reporting hazards or safety issues without fear of retaliation (F5, $M = 3.41$, $SD = 0.72$) received a favorable but comparatively lower rating, suggesting that while reporting mechanisms are generally accepted, perceptions of psychological safety may differ among respondents.

Overall, the findings suggest that communication systems are generally effective and that management support for safety is positively perceived. However, variations in leadership role modeling and workers' confidence in reporting concerns indicate areas where stronger and more consistent management engagement may further enhance safety policy adherence.

Extent of Safety Training Effectiveness in Improving Workers' Knowledge, Attitudes, and Compliance. The extent to which safety training improves workers' knowledge, attitudes, and compliance with safety procedures were examined. Safety training is treated as its own construct because the panel recommended that variables should not be combined into overly broad tables. Training is a key mechanism for translating safety policy into worker knowledge, risk recognition, and routine compliance (Ricci et al., 2016; Silla et al., 2020).

Table 9
Safety Training Effectiveness

Code	Indicator	Mean	SD
C1	I have attended and completed the required safety training provided by the company.	3.85	0.36
C2	The training improved my knowledge and awareness of workplace hazards.	3.92	0.27
C3	After the training, I am more consistent in following safety practices and using PPE.	3.94	0.25
C4	Training sessions help reduce the number of workplace incidents and accidents.	3.93	0.26
C5	I feel more confident handling safety risks because of the training I received.	3.56	0.50
STE_mean	Overall safety training effectiveness composite	3.84	0.14

Table 9 showed that safety training was generally perceived as effective, with an overall composite mean of 3.84 ($SD = 0.14$), interpreted

as Strongly Agree. The highest-rated indicator was workers' understanding of safety procedures and proper work practices after training (C3, $M = 3.94$, $SD = 0.25$), indicating that training strengthened hazard awareness and safe work practices.

The lowest-rated indicator concerned the consistent application of training lessons during actual work operations (C5, $M = 3.56$, $SD = 0.50$). Although favorable, this suggested that workload, deadlines, workplace habits, and inconsistent supervision may have limited the transfer of training into practice.

Analysis of Worker and Organizational Factors on Safety Outcomes. Table 10 presents the reliability screening results for the major constructs included in the structural model. The analysis yielded relatively low construct-level Cronbach's alpha and McDonald's omega coefficients. Although these values suggest limited internal consistency at the individual construct level, the survey instrument demonstrated strong overall reliability during pilot testing, with a Cronbach's alpha coefficient of .89. The discrepancy may be attributed to the multidimensional nature of the constructs, variations in respondents' interpretation of specific indicators, and the limited number of items retained within certain dimensions.

Table 10
Reliability Screening of Major Constructs

Construct	Cronbach's α	McDonald's ω
Worker behavior, attitudes, and perceptions	.201	.328
Workplace influence	.120	.279
Safety training effectiveness	.250	.287
Safety policy effectiveness	.183	.226
Resource availability	.195	.334
Communication flow and management support	.238	.285
Policy quality	.147	.188
Compliance	.233	.299
Incident-rate dimension	.228	.383
Policy/training refinement	.268	.319

Note: Reliability coefficients are from the uploaded statistical reliability output. Low reliability is treated as an analytic limitation and a basis for instrument refinement, not as a reason to discard the descriptive findings.

Given these considerations, the construct-level reliability coefficients should be interpreted cautiously and viewed primarily as diagnostic indicators rather than definitive measures of overall instrument quality. The retained constructs remained theoretically grounded, were subjected to expert validation, and reflected key dimensions of construction safety identified in the literature. Nevertheless, future studies may refine the measurement indicators and reassess their psychometric properties to improve construct-level reliability and strengthen robustness of measurement model.

Table 11
Preliminary Correlations between Predictors and Safety Outcomes

Predictor / Relationship Screened	Outcome	Pearson r	P
Worker behavior	SO_Overall_mean	-0.019	.824
Workplace influence	SO_Overall_mean	-0.072	.400
Safety training effectiveness	SO_Overall_mean	0.020	.816
Safety policy effectiveness	SO_Overall_mean	0.063	.462
Resource availability	SO_Overall_mean	0.009	.919
Communication flow and management support	SO_Overall_mean	-0.072	.397
Organizational factors composite	SO_Overall_mean	-0.040	.642
Safety outcomes overall	Policy and training refinement	-0.074	.385

The correlation analysis in Table 11 showed a notable absence of meaningful linear relationships between the predictor variables and overall safety outcomes. Correlation coefficients clustered very close to zero, indicating minimal association regardless of direction.

The largest observed relationships were workplace influence ($r = -.072$) and communication flow and management support ($r = -.072$), although these values remained weak. Positive correlations were likewise negligible, with safety policy effectiveness ($r = .063$), safety training effectiveness ($r = .020$), and resource availability ($r = .009$) showing almost no association with safety outcomes. The relationship between safety outcomes and policy or training refinement was similarly weak ($r = -.074$).

Taken together, the results indicate that favorable perceptions of worker and

organizational factors did not translate into measurable differences in reported safety outcomes. The uniform weakness of the coefficients suggests limited variation in responses and points to the possibility that other unmeasured factors may have exerted a stronger influence on safety performance.

Table 12
Preliminary Multiple Regression Model Predicting Overall Safety Outcomes

Metric	Value
R	.112
R ²	.013
Adjusted R ²	-.032
F (6, 133)	.282
P	.945

When the predictor variables were examined collectively, the resulting regression model in Table 12 explained only a very small portion of the variability in safety outcomes. The coefficient of determination ($R^2 = .013$) indicates that the set of worker and organizational factors accounted for approximately 1.3% of the variance in the dependent variable.

The nonsignificant model outcome ($p = .945$) reinforces the pattern already observed in the correlation analysis. Even when combined, the predictors demonstrated limited capacity to explain differences in perceived safety outcomes.

A closer examination of the results suggests that the factors included in the model may not have been sufficient to capture the complexity of safety performance in construction settings. Although respondents generally expressed favorable perceptions regarding safety-related conditions, such perceptions alone were not enough to produce substantial predictive effects within the regression framework.

Structural Equation Modeling Results. The relationships among worker behavior, organizational factors, and safety outcomes were examined using SEM. The analysis focused on model fit to assess how well the

proposed model represented the observed data and path relationships to determine the strength and significance of the relationships among variables.

The model fit assessment presented in Table 13 produced mixed results. The chi-square statistic and RMSEA indicated an acceptable level of fit between the proposed model and the observed data. The nonsignificant chi-square value and very low RMSEA suggest that substantial discrepancies between the model and the data were not evident.

Table 13
Structural Equation Model Fit Indices

Metric	Value	Threshold / Decision Rule	Assessment
Chi-square (χ^2)	12.593	$p > .05$	Acceptable
Df	12	-	Reported
p-value	.399	$> .05$	Acceptable
RMSEA	.019	$< .05$	Excellent
CFI	.935	$\geq .90$	Poor
TLI	-.4.482	$\geq .90$	Poor
GFI	.633	$\geq .90$	Poor
NFI	.633	$\geq .90$	Poor
AIC	47.820	Lower is better	Reported
BIC	118.420	Lower is better	Reported

On the other hand, the incremental fit indices displayed a markedly different pattern. CFI, TLI, GFI, and NFI all fell substantially below recommended thresholds, indicating that the model did not perform well when evaluated against comparative benchmarks.

This contrast between acceptable absolute fit and weak incremental fit implies that the model may capture certain relationships within the dataset while still lacking sufficient explanatory structure overall. Consequently, the model should be interpreted as exploratory rather than conclusive, particularly given the measurement limitations identified during reliability screening.

The direct path analysis in Table 14 revealed that none of the specified relationships reached statistical significance. Regardless of whether the paths originated from worker-related variables or organizational factors, the resulting coefficients remained small and statistically nonsignificant.

Table 14
Direct Path Estimates in the Structural Equation Model

Dependent	Predictor	B	Beta	SE	z	p
Safety outcomes	Worker behavior	-0.018	-0.025	0.060	-0.296	.767
Safety outcomes	Workplace influence	-0.027	-0.055	0.043	-0.640	.522
Safety outcomes	Safety training	0.016	0.015	0.096	0.167	.867
Safety outcomes	Safety policy effectiveness	0.033	0.049	0.057	0.569	.569
Safety outcomes	Resource availability	-0.000	-0.000	0.055	-0.003	.997
Safety outcomes	Communication and management support	-0.042	-0.067	0.054	-0.783	.434
Policy/training refinement	Safety outcomes	-0.091	-0.074	0.103	-0.879	.380

Among the predictors, communication flow and management support produced the largest standardized effect ($\beta = -.067$), followed by workplace influence ($\beta = -.055$) and safety policy effectiveness ($\beta = .049$). However, these coefficients were too small to indicate meaningful predictive influence. Resource availability demonstrated virtually no effect at all ($\beta = -.000$). Similarly, the path linking safety outcomes to policy and training refinement yielded a weak coefficient ($\beta = -.074$), suggesting that variations in safety outcomes were not associated with substantial differences in refinement activities.

Overall, the model portrays a pattern of weak and unstable relationships. The results indicate that the measured worker and organizational factors did not emerge as dominant drivers of safety outcomes within the study sample.

Final Structural Equation Model with Standardized Path Coefficients. The final SEM diagram in Figure 2 reinforces the statistical findings obtained from the path analysis. All predictor variables exhibited relatively small, standardized coefficients, and none demonstrated a meaningful influence on safety outcomes. The strongest effect was associated with resource availability, although its magnitude remained minimal.

The amount of variance explained by the model was likewise limited. Safety outcomes accounted for only 1.3% of explained variance, while policy and training refinement accounted for less than one percent. These values indicate that the model captured only a small fraction of

the factors contributing to the dependent variables.

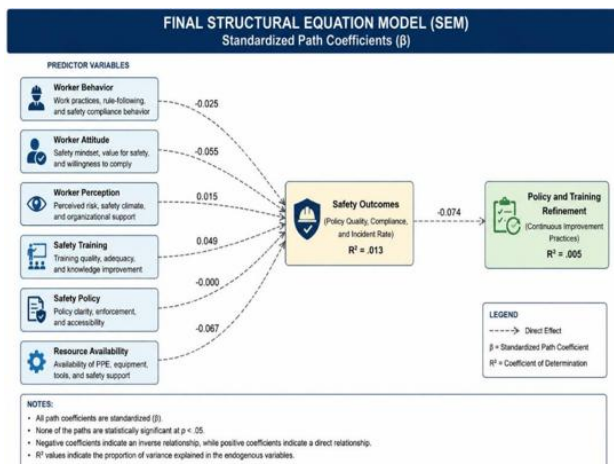


Figure 2

Final Structural Equation Model Showing Standardized Relationships Among Worker-Related Factors, Organizational Factors, and Safety Outcomes

Author's Note: This figure was developed using AI-assisted visualization tools (ChatGPT). All statistical values, model specifications, and graphical representations were reviewed and validated by the researcher prior to inclusion in the manuscript.

The overall pattern suggests that favorable safety perceptions and organizational practices did not translate into significant structural relationships within the model. Restricted response variability and contextual differences may have contributed to the weak effects. Other factors, including safety culture, leadership commitment, scheduling pressures, economic constraints, contractor safety maturity, and workforce dynamics, may have better explained safety outcomes. Nevertheless, the descriptive findings supported continued attention to hazard reporting, leadership involvement, communication, resource accessibility, and practical safety training.

Table 15

Direct Path Estimates in the Structural Equation Model

Endogenous Variable	R^2	Adjusted R^2
Safety outcomes overall	.013	-.032
Policy/training refinement	.005	-.002

An examination of the R^2 values, as shown in Table 15, confirms the limited explanatory capability of the structural model. The

predictors collectively explained only 1.3% of the variation in safety outcomes and 0.5% of the variation in policy and training refinement. These values indicate that a substantial portion of the variability in both endogenous variables remains unexplained. The findings suggest that additional determinants may be operating within the construction environment and may exert a greater influence on organizational safety performance than the factors currently represented in the model. Consequently, the results should be interpreted as indicative rather than definitive, providing a preliminary understanding of the relationships among the study variables.

Safety Outcomes Measured by Policy Quality, Compliance, and Incident Rate. The ratings for policy quality (Table 16) reflect generally positive perceptions regarding the organization's safety framework. Respondents expressed the strongest agreement with the clarity and understandability of safety policies, indicating that workplace rules and requirements were generally well communicated.

Table 16

Safety Outcome Dimension 1: Policy Quality

Code	Indicator	Mean	SD	Interpretation
G1	Clear and understandable safety policies	3.89	0.31	Strongly Agree
G2	Relevant safety policies to site hazards and risks	3.31	0.47	Strongly Agree
G3	Accessible safety policies and procedures	3.27	0.48	Strongly Agree
G4	Regular review and update of safety policies	3.31	0.77	Strongly Agree
G1-G4 mean	Policy quality composite	3.45	0.32	Strongly Agree

The remaining indicators clustered within a relatively narrow range of means, suggesting that workers viewed policy relevance, accessibility, and periodic review favorably. Among these, accessibility of policies received the lowest mean score, although the rating remained within a highly favorable range.

The pattern of responses suggests that workers generally recognize the existence of an established safety policy system. However, the moderate variation in responses regarding policy review and accessibility implies that

implementation practices may differ across projects or worksites.

Compliance emerged as one of the strongest-performing safety outcome dimensions as reflected in Table 17. Participation in mandatory safety training and involvement in safety drills were the most highly rated indicators, reflecting strong engagement in organizational safety activities.

Table 17
Safety Outcome Dimension 2: Compliance

Code	Indicator	Mean	SD	Interpretation
G5	Consistent use of required PPE	3.66	0.65	Strongly Agree
G6	Completion of required safety training	3.70	0.46	Strongly Agree
G7	Active participation in safety drills and exercises	3.69	0.47	Strongly Agree
G8	Timely resolution of reported safety issues	3.47	0.56	Strongly Agree
G5-G8 mean	Compliance composite	3.63	0.38	Strongly Agree

Consistent PPE use also received a favorable assessment, suggesting widespread adherence to basic protective measures. In contrast, the timeliness with which reported safety concerns were resolved received the lowest rating, although it remained positively evaluated overall.

The pattern indicates that preventive and compliance-oriented activities are generally well established. Nevertheless, variations in the responsiveness to reported concerns suggest that follow-through mechanisms may not be experienced uniformly by all workers.

Table 18
Safety Outcome Dimension 3: Incident Rate

Code	Indicator	Mean	SD	Interpretation
G9	Low lost-time injuries (LTIs)	3.50	0.60	Strongly Agree
G10	Low accident severity and workdays lost	3.45	0.65	Strongly Agree
G11	Frequent near-miss reporting	3.40	0.70	Strongly Agree
G12	Low first-aid cases and fatalities	3.55	0.55	Strongly Agree
G9-G12 mean	Incident-rate composite	3.48	0.45	Strongly Agree

The incident-rate dimension presents a generally favorable safety picture. Respondents reported positive perceptions regarding the occurrence of injuries, lost workdays, and severe incidents, as reflected in the consistently high ratings across indicators. The strongest rating was associated with the low

occurrence of first-aid cases and fatalities, suggesting that serious incidents were perceived as relatively uncommon. In contrast, near-miss reporting received the lowest mean and displayed the greatest variation among responses.

This wider variability may indicate differences in reporting practices, awareness levels, or reporting culture among worksites. While respondents generally perceived incident outcomes positively, the inconsistency associated with near-miss reporting suggests that opportunities remain to strengthen proactive safety monitoring practices.

Table 19
Policy and Training Refinement Through Continuous Improvement Practices

Code	Indicator	Mean	SD	Interpretation
H1	Regular review and updating of safety policies	3.50	0.68	Strongly Agree
H2	Prompt policy updates after incidents or regulatory changes	3.48	0.54	Strongly Agree
H3	Integration of workers' feedback into policies and training	3.71	0.45	Strongly Agree
H4	Safety meetings for sharing concerns and experiences	3.56	0.50	Strongly Agree
H5	Post-training evaluations and refresher sessions	3.61	0.49	Strongly Agree
H6	Prompt implementation of corrective and preventive actions	3.86	0.34	Strongly Agree
H7	Industry benchmarking and updates based on audits/certifications	3.88	0.33	Strongly Agree
PTR_mean	Policy and training refinement composite	3.66	0.19	Strongly Agree

Responses regarding policy and training refinement (Table 19) reveal a positive orientation toward continuous improvement activities. The highest ratings were recorded for benchmarking practices and the implementation of corrective and preventive actions, indicating that respondents perceived these activities as actively occurring within their organizations.

Worker feedback integration, safety meetings, and post-training evaluations also received favorable assessments, suggesting that learning and communication mechanisms are generally embedded within existing safety processes.

Lower ratings were observed for policy review and policy updates following incidents or regulatory changes. Although still strongly

positive, these indicators showed greater variation, implying that the consistency of review mechanisms may differ across project settings.

Overall, the findings portray organizations that are generally committed to improving safety systems but may benefit from more systematic and timely approaches to policy evaluation and updating. The response pattern points to opportunities for strengthening continuous improvement processes through regular reviews, structured feedback systems, and ongoing reinforcement of safety initiatives.

Proposed Construction Safety Enhancement Plan (CSEP). Based on the findings of the study, a Construction Safety Enhancement Plan (CSEP) was developed to provide a structured and practical framework for improving workplace safety in construction projects in Iba, Zambales. The proposed plan (Figure 3) addresses areas that showed opportunities for improvement in the findings, including hazard reporting, safety monitoring, supervisor involvement, policy implementation, and training reinforcement. The framework integrates worker-related and organizational factors into six interconnected components designed to promote a stronger safety culture and support continuous safety improvement.

The first component, Safety Leadership and Commitment, emphasizes visible management support, clear assignment of safety responsibilities, and regular safety communication. The study identified variability in supervisor role modeling and organizational consistency, indicating the need for stronger leadership involvement in promoting workplace safety. Consistent leadership commitment helps reinforce accountability, strengthen worker trust, and encourage adherence to safety policies and procedures.

The second component, Hazard Identification and Risk Control, focuses on routine site inspections, hazard assessments, and prompt corrective actions. Findings revealed concerns regarding the consistency of safety audits and

monitoring activities. Strengthening hazard identification processes may help organizations detect unsafe conditions early and implement preventive measures before accidents or incidents occur.



Figure 3
Matrix of Proposed Construction Safety Enhancement Plan (CSEP)

Author's Note: This figure was generated with the assistance of artificial intelligence (AI) tools for layout design, visualization, and graphic enhancement. All concepts, framework components, data interpretations, and final content decisions were conceived, reviewed, and approved solely by the researcher.

The third component, Training and Competency Development, highlights mandatory safety orientation, refresher training, practical demonstrations, and peer mentoring. Although respondents generally viewed safety training positively, workers reported comparatively lower confidence in applying training lessons during actual work situations. This component therefore emphasizes continuous and experience-based learning to improve knowledge retention, hazard recognition, and safe work practices.

The fourth component, Communication and Worker Participation, promotes toolbox

meetings, safety briefings, hazard-reporting mechanisms, and open communication between workers and management. Since confidence in reporting hazards and near-miss incidents emerged as a relatively weaker area, the plan encourages the creation of a non-punitive reporting culture where workers can raise safety concerns without fear of negative consequences. Enhanced participation also supports shared responsibility for safety and strengthens organizational learning.

The fifth component, Monitoring and Performance Evaluation, focuses on regular safety audits, compliance assessments, behavioral safety observations, and the use of measurable safety indicators. Continuous monitoring allows organizations to evaluate the effectiveness of safety programs, identify implementation gaps, and ensure that safety standards are consistently maintained across construction activities. This component supports evidence-based decision-making and accountability among both workers and supervisors.

The sixth component, Continuous Improvement, emphasizes regular policy review, integration of corrective and preventive actions, benchmarking of safety practices, and adaptation to changing workplace conditions. Findings showed opportunities to improve the timeliness and consistency of policy updates and safety refinements. Through continuous evaluation and learning, organizations can ensure that safety systems remain responsive, relevant, and effective in addressing emerging workplace risks. Collectively, these six components provide a comprehensive framework for strengthening construction safety and represent the primary practical contribution of the study to construction projects in Iba, Zambales.

DISCUSSION

Worker-Related Factors and Safety Outcomes.

The findings indicate that construction workers generally demonstrated positive safety behaviors, attitudes, and perceptions,

suggesting a high level of awareness regarding workplace safety. Favorable ratings imply that workers recognize the importance of complying with established safety protocols and using personal protective equipment (PPE) to minimize occupational risks. These findings are consistent with studies showing that regular supervision, safety orientations, and enforcement mechanisms contribute to safer work practices among construction personnel (Ismail et al., 2012; Sitalaksana et al., 2021).

The results likewise suggest that workers value safety programs as important safeguards against accidents and injuries. Similar findings were reported by Teo et al. (2005) and Mohammadi et al. (2018), who found that positive safety attitudes promote compliance with workplace safety requirements. Consistent with the Theory of Planned Behavior, favorable attitudes toward safety increase the likelihood of engaging in safe behaviors.

Workers also demonstrated favorable safety perceptions, particularly regarding hazard awareness and risk recognition. This finding supports previous studies showing that hazard perception and safety climate significantly influence safety compliance (Ismail et al., 2012; Pham et al., 2018). Consistent with Social Cognitive Theory, workers develop safety-related behaviors through observation, communication, and prior experiences. Nevertheless, the findings suggest that continuous supervision and organizational support remain necessary, particularly when production demands may compete with safety compliance (Toyado, 2021; Department of Labor and Employment, 2020).

Organizational Factors and Safety Compliance.

The study found that organizational factors, including leadership support, policy implementation, communication systems, and safety management practices, were generally perceived positively. This highlights the critical role of organizations in creating work environments that support safety compliance and accident prevention.

The findings support the view that workplace safety is influenced not only by worker behavior but also by organizational systems and management decisions. This observation aligns with Reason's (2000) Swiss Cheese Model and the work of Weick and Sutcliffe (2007), which emphasize that accidents often result from weaknesses within organizational processes rather than isolated human errors.

Respondents likewise recognized the positive influence of peer support and teamwork on workplace safety. This finding is consistent with Liang et al. (2018) and Li et al. (2024), who emphasized the role of social norms and peer influence in promoting compliance with safety requirements. However, some responses also suggest that production pressures and scheduling demands may occasionally affect safety-related decisions. Similar concerns were reported by Choi (2023) and Hashemian and Triantis (2022), who noted that project deadlines can sometimes challenge safety prioritization.

The favorable assessment of policy implementation suggests that safety procedures were generally communicated and enforced. Nevertheless, studies by Neyestani (2020), Mo et al. (2023), and Zhang et al. (2023) emphasize that effective policies require continuous monitoring, inspections, and corrective actions to ensure sustained compliance.

Safety Training and Safety Outcomes. The findings demonstrate that safety training was generally effective in improving worker knowledge, hazard recognition, and compliance with safety procedures. Respondents perceived training activities as useful in preparing them to identify workplace hazards and adopt safer work practices.

This result is consistent with studies indicating that safety training enhances risk awareness, hazard recognition, and safety compliance (Ricci et al., 2016; Silla et al., 2020). Likewise, practical and site-specific training approaches have been shown to improve safety

performance in construction environments characterized by changing work conditions and elevated risk levels (Andi et al., 2022; Silla et al., 2020).

The findings also support Social Cognitive Theory, which suggests that learning and behavioral change occur through observation, reinforcement, and experience. However, training alone may not ensure sustained safety performance. Giri et al. (2023) and Ricci et al. (2016) argued that training must be complemented by continuous supervision, mentoring, and organizational support to achieve long-term safety improvements.

Integrated Effects of Worker and Organizational Factors. The SEM results revealed weak relationships between worker-related factors, organizational factors, and safety outcomes. Although the relationships were theoretically meaningful, the findings suggest that construction safety is influenced by a broader set of interconnected variables beyond those included in the model.

This finding supports the Swiss Cheese Model (Reason, 2000) and High Reliability Organization Theory (Weick & Sutcliffe, 2007), which view safety performance as the result of multiple interacting organizational and individual factors. Similarly, previous studies have emphasized the combined influence of training, leadership, communication systems, and worker engagement on safety performance (Toyado, 2021; Giri et al., 2023).

The low explanatory power of the model suggests that other variables, such as safety culture, workload, project complexity, contractor management practices, and regulatory enforcement, may also affect safety outcomes (Hair et al., 2019; Kline, 2016). Despite these limitations, the findings emphasize that sustainable safety improvement requires an integrated approach involving workers, management, and organizational systems.

Proposed Construction Safety Enhancement Plan. The proposed Construction Safety

Enhancement Plan was developed based on the identified strengths and areas requiring improvement in worker-related and organizational safety factors. The framework integrates safety leadership, hazard management, competency development, worker participation, performance monitoring, and continuous improvement to address construction safety needs in Iba, Zambales. The plan operationalizes the study findings and provides construction organizations with a systematic approach to strengthening safety culture and reducing workplace risks.

Practical Implications, Limitations, and Future Research. The findings highlight the need for continued safety training, active supervisory involvement, regular inspections, and stronger worker participation in safety initiatives. Organizations should encourage near-miss reporting and collaborative safety discussions, as these practices contribute to accident prevention and organizational learning (Sadeghi et al., 2025; Silla et al., 2020). The results further support the implementation of the proposed Construction Safety Enhancement Plan as a localized strategy for strengthening safety performance.

The study was limited to construction projects in Iba, Zambales and utilized a cross-sectional, self-report design, which may affect generalizability and causal interpretation. Future studies may include broader geographical coverage, longitudinal approaches, and additional variables to improve explanatory power. Qualitative investigations may also provide deeper insights into worker experiences and organizational safety culture within the construction sector.

Conclusion. This study examined the influence of worker-related and organizational factors on safety outcomes in construction projects in Iba, Zambales. The findings revealed that workers generally demonstrated favorable safety behaviors, attitudes, and perceptions, while organizations maintained positive safety management practices, policy implementation, and training programs. Safety training was likewise perceived as effective in improving

hazard awareness and compliance with workplace safety requirements. These results indicate that both individual and organizational dimensions contribute to the promotion of safer construction environments.

Although the structural equation model revealed limited predictive relationships among the examined variables, the findings suggest that construction safety is a complex and multidimensional phenomenon influenced by the interaction of workers, management systems, organizational practices, and contextual conditions. The study contributes localized empirical evidence to the construction safety literature and reinforces the importance of integrating leadership support, effective communication, continuous training, and worker engagement in safety management efforts. Ultimately, the proposed Construction Safety Enhancement Plan offers a practical framework for strengthening safety performance and fostering a culture of prevention and continuous improvement in construction projects.

DISCLOSURES

Author contributions. The author solely conceptualized the study, conducted the literature review, designed the research methodology, developed and validated the research instrument, collected and analyzed the data, interpreted the findings, prepared the proposed framework, wrote and revised the manuscript, and approved the final version for publication.

Conflict of interest. The author declares no conflict of interest.

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Artificial intelligence use. AI-assisted language editing was performed using Copilot to improve grammar, clarity, and readability of the manuscript. The author reviewed and approved all AI-assisted content and remains fully responsible for the accuracy, originality,

interpretation, and final content of the manuscript. Likewise, AI tools were utilized to assist in the visual design and formatting of the figures in the study. The author retained full responsibility for the conceptualization, content development, verification, and final approval of the figures.

Ethics approval statement. Ethical clearance was obtained from the Polytechnic University of the Philippines Research Ethics Committee (PUP-REC) under OUSREC Code 0296-0040. The study was granted approval through an Exempted Review on October 15, 2026, and all participants provided informed consent prior to participation.

Data availability statement. All data supporting the findings of this study are included within the manuscript.

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