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# The Cyclical Nature of Safety Failure: A Multi-Level Grounded Theory Framework for Construction Safety Management in Ghana

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## Abstract

Construction safety continues to be a significant concern in developing countries, like Ghana, which is characterised by elevated accident rates, inadequate enforcement, fragmented regulatory supervision, and constrained institutional capacity. The current construction safety frameworks are mostly descriptive, organisation-focused, and static, providing little understanding of the cyclical interactions among regulatory, organisational, and worker-level processes that perpetuate safety failures over time. This study establishes a multi-level, grounded theory framework to elucidate the cyclical nature of safety failures in the Ghanaian construction sector by including macro- (regulatory), meso- (organisational), and micro- (site/worker) dynamics. A qualitative grounded theory study was performed using a constructivist-interpretivist paradigm on semi-structured interviews with 41 participants from construction firms, site management, safety workers, craftsmen, and regulatory agencies. The findings indicate that safety problems are systemic rather than local, stemming from antiquated laws, persistent regulatory shortcomings, and selective enforcement influenced by political and economic disparities. The concept illustrates feedback loops, in which micro-level actions contribute to organisational deficiencies and regulatory disunity. It serves as both a diagnostic and strategic instrument, emphasising the need for legislative change, enhanced institutional capacity, and comprehensive safety management systems while providing relevant insights for other emerging nations.

## Keywords

Construction Safety, Multi-Level Framework, Ghana, Grounded Theory, Feedback Loops, OSH Governance, Macro-Meso-Micro Levels

## 1. Introduction

Construction safety represents a continual governance problem in emerging countries, as expedited project delivery often coincides with inadequate enforcement, disjointed regulation, and restricted institutional capacity [1] [2]. Worldwide, construction routinely ranks as one of the most hazardous sectors, with accident rates staying disproportionately elevated after decades of legislative and administrative efforts [3]. Data from developed countries indicate that construction-related injuries and fatalities result in significant human and economic burdens, highlighting that numerous incidents are preventable and closely associated with the efficacy of safety management systems rather than solely technical risks [4] [5].

The sector's pivotal position in national development in Ghana reinforces these issues. The construction sector accounts for about 15% of GDP and employs over 420,000 people, propelled by persistent demand for housing, transportation, and public infrastructure [6] [7]. Nevertheless, the prevalence of accidents, the severity of injuries, and insufficient compensation persist extensively. Official records indicate variable but persistent construction-related occurrences, with substantial evidence of under-reporting and inadequate investigation follow-up [8]. Prior study indicates that deficient safety cultures, inadequate training, and little institutional monitoring integrate risk into governance frameworks rather than confining it to individual worksites [9] [10]. In accordance with this, systemic deficiencies—insufficient institutional capacity, constrained funding, minimal prioritisation of safety, inadequate legal awareness, and lack of training—diminish OHS regulation in Ghana's construction sector, linking to inconsistent compliance and diminished regulatory efficacy [11].

Developing countries increasingly perceive construction safety performance as a multi-dimensional issue. At the macro level, disjointed regulatory requirements, antiquated laws, and weak enforcement hinder coherence across the system [2] [12]. At the meso level, the implementation of organisational safety management systems is inconsistent, especially among small and medium-sized enterprises, where adherence is influenced more by managerial discretion and resource availability than by formal institutional pressures [13] [14]. At the microlevel, hazardous work practices, risk normalisation, and substandard working conditions endure, often enabled by production demands and inadequate supervision [15] [16]. Discrepancies among these levels associate with hazardous results, suggesting that singular therapies are improbable to provide lasting enhancements [17].

Employee behaviour has a crucial role within this framework. Safety results rely not only on adherence to established regulations but also on safety participation—voluntary, proactive involvement in risk mitigation and peer safeguarding [18] [19]. Leadership techniques, company culture, and overarching socio-cultural norms influence these habits. Research in Ghana indicates that compliance-driven techniques provide little benefit, while participation-oriented practices are essential, although inconsistently supported [20]. Cultural influences, such as collectivist

social relations, spiritual beliefs, and deference to hierarchy, further shape risk perception and decision-making, occasionally promoting unsafe practices despite awareness of hazards [21]-[24].

Recent studies in Ghana have enhanced comprehension by correlating site-specific accident causation with competence development and knowledge transfer methods [10] [25]. Nonetheless, current frameworks predominantly exhibit a descriptive and firm-centric orientation, often analysing compliance systems, safety cultures, or behavioural factors in isolation or concentrating on particular firm types or geographic regions [23] [24] [26]-[29]. Consequently, they provide a limited understanding of the dynamic interactions between regulatory fragmentation, organisational adaptability, and worker behaviour that perpetuate safety failures over time.

This study enhances construction safety research by creating an empirically based, multi-tiered explanatory framework that represents these interactions as cyclical feedback loops. The study uses Grounded Theory to amalgamate macro-, meso-, and micro-level processes into a unified analytical framework, illustrating how site-level practices influence organisational systems and regulatory capacity, hence contributing to systemic vulnerabilities. The framework serves as a diagnostic and strategic instrument, pinpointing leverage areas for intervention across government levels and providing a contextually informed methodology for enhancing construction safety in Ghana and similar developing nations.

This study, therefore, seeks to provide a grounded, multi-tiered explanatory framework for cyclical safety failures in the Ghanaian construction sector. Specifically, it aims to:

1) Examine safety management procedures and circumstances at the regulatory, organisational, and site levels.

2) Explain the interrelated variables and limitations that produce persistent safety failures, and

3) Incorporate these interactions into a cyclical framework to guide context-specific safety solutions.

## 2. Safety Management Across Levels

### 2.1. Macro-Level: Policy, Regulation, and Institutional Framework

Legislative frameworks, institutional capability, and enforcement methods influence construction safety at the macro level. International frameworks, including [30]-[33], collectively advocate for proactive, governance-oriented safety management through leadership commitment, worker involvement, systematic hazard mitigation, organised training, and shared accountability, establishing occupational safety as an institutional obligation rather than an optional organisational practice. References [31]-[34] are examples of these frameworks.

In Ghana, employee protection is established by legislative documents such as the Factories, Offices and Shops Act (1970), the Labour Act (2003), Act 651, and the Workmen's Compensation Act (1987) [35]. Although these laws provide for-

mal legal responsibilities, their practical efficacy is hindered by antiquated provisions, disjointed mandates, and insufficient enforcement capability [35]-[37]. Sector-specific rules, shown as the Ministry of Health's 2010 OHS policy, possess a restricted scope and little applicability to construction, leading to poorly coordinated monitoring across authorities. Empirical research repeatedly links this disjointed regulatory framework to inadequate accountability, irregular inspections, and insufficient deterrence [20] [38]. Similar data from other emerging countries correlate regulatory inconsistency and enforcement shortcomings with increased occupational injury rates [14] [39]. A recent study illustrates that multi-level factors—such as regulatory and institutional frameworks, organisational and managerial systems, leadership practices, workgroup dynamics, and individual traits—interact to influence behavioural safety performance in the construction sector, thereby affecting workers' safety attitudes, behaviours, and performance on site [40].

### 2.2. Meso-Level: Organisational Systems and Safety Management Practices

At the organisational level, safety results are influenced by the framework and execution of Safety Management Systems (SMS), leadership dedication, and organisational competencies. Formal SMS—encompassing role clarity, subcontractor coordination, written processes, and performance monitoring—is often linked to enhanced safety performance [1] [41]. In Ghana, some construction sites (D1K1/A1B1 and D2K2/A2B2 and so on) often execute safety plans, toolbox meetings, and project-specific training; nevertheless, implementation is inconsistent, especially among small and medium-sized firms, where enforcement, incentives, and supply of personal protective equipment remain irregular [42] [43].

Organisational research underscores the significance of leadership commitment, work distribution, equipment supply, and training as essential facilitators of safety performance [26] [44]. Capability-based frameworks, such as the Safety, Health, and Environmental Management Capability Maturity Model (SHEM-CMM), underscore the strategic amalgamation of people, processes, resources, and information in influencing safety results [28]. These studies together illustrate that safety performance is influenced not just by formal compliance but also by the adaptability, compensation, or exploitation of larger institutional circumstances by organisational systems.

### 2.3. Micro-Level: Employee Behaviour and Safety Protocols

At the micro level, employee behaviour and risk perception significantly influence safety results. Safe practices are shaped by management conduct, the quality of supervision, participative frameworks, and interpersonal relationships on-site [45]-[47]. Observable managerial commitment, ongoing training, and reinforcement mechanisms promote safer behaviour, whereas production pressure and inadequate supervision heighten risk-taking.

In Ghana, socio-cultural and economic variables also influence worker behaviour. Faith in supernatural safeguarding, reverence for elders, and robust family duties shape risk perception and reactions to authorities, sometimes deterring hazard reporting or procedural contestation [23] [24]. Empirical research associates risky behaviour with insufficient skills, negative attitudes, inadequate equipment, and ineffective supervision [10] [27]. Recent data shows that knowledge-transfer mechanisms within local social networks may influence safety behaviour outside the workplace, illustrating the importance of culturally informed interventions [25].

## 2.4. Towards a Cyclical, Integrated Framework

A macro-meso-micro synthesis (**Figure 1**) reveals that construction safety in Ghana is hindered by disjointed and poorly implemented regulations, inconsistent organisational safety systems, and worker behaviour influenced by site circumstances and socio-cultural norms. Importantly, these levels do not function autonomously. Site-specific practices like under-reporting and risk normalisation obscure the frequency of accidents, undermining organisational learning and regulatory scrutiny, while institutional shortcomings promote selective compliance and informal adjustments at the corporate level [10] [23] [25].

While the current study investigates regulation, organisational systems, or worker behaviour independently, few conceptualise the interactions among these aspects via feedback loops that reinforce dangerous outcomes across time. A cyclical viewpoint is essential to explain the persistence of safety shortcomings notwithstanding established regulations, organisational actions, and individual awareness. By explicitly modelling these feedback processes, integrated frameworks may transcend descriptive accounts to pinpoint strategic intervention sites across governance levels, providing a more solid foundation for enhancing construction safety in institutionally limited environments.

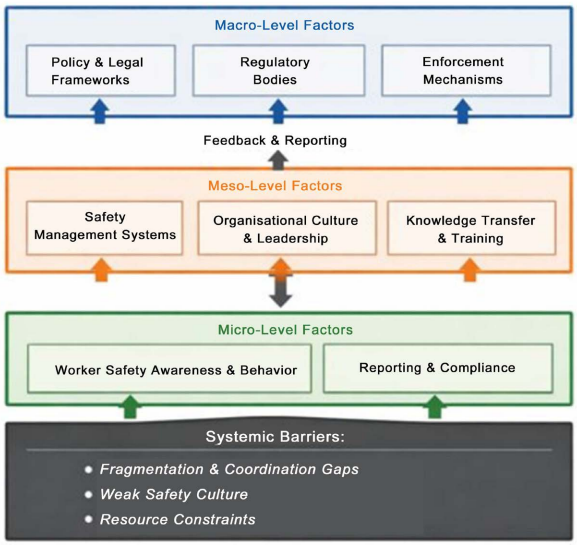


**Figure 1.** Literature-derived integrative framework for construction safety management (source: Authors' construct).

## 3. Methodology

### 3.1. Research Design and Philosophical Framework

This research was conducted under a constructivist-interpretivist framework, acknowledging knowledge as subjective, context-dependent, and collaboratively generated via collaboration involving the researchers and participants [48] [49]. Institutional frameworks, organisational standards, and socio-cultural settings influence practices and interpretations in Ghana, making this viewpoint especially appropriate for analysing construction safety. In accordance with this paradigm, a qualitative grounded theory (GT) methodology was employed to inductively formulate a multi-tiered explanatory framework for construction safety management, facilitating the emergence of theoretical insights from participants' lived experiences rather than imposing them a priori [50] [51]. A cross-sectional approach was used to document existing safety practices and governance dynamics at a specific moment. The framework defines safety failure as cyclical, yet the cross-sectional design reveals stakeholder perceptions of recurring and self-sustaining patterns instead of temporal behaviours over time.

### 3.2. Study Background

Data were gathered from five regions of Ghana—Greater Accra, Ashanti, Central, Western, and Upper East—chosen to represent diversity in construction activity, institutional presence, and safety protocols. The incorporation of significant metropolitan construction centres (Accra and Kumasi) with areas characterised by smaller rural labour forces increased contextual variety and analytical profundity [6] [43]. **Table 1** summarises participant and project demographics at the site level, the last section includes the regional summary of the project locations.

**Table 1.** Participants and project demographics at the site level.

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Gender | Male | 32 | 88.9% |
| | Female | 4 | 11.1% |
| Age (yrs) | 20 - 29 | 9 | 25% |
| | 30 - 39 | 17 | 47.2% |
| | 40 - 49 | 7 | 19.4% |
| | 50 - 59 | 3 | 8.3% |
| Highest Qualification | Bachelor | 18 | 50% |
| | Master's | 5 | 13.9% |
| | Diploma/NVTI/Tech Cert | 4 | 11.1% |
| | Tertiary | 3 | 8.3% |
| | Other HSE/Professional Cert | 6 | 16.7% |
| Job Role | Artisan/Helper | 4 | 11.1% |
| | Engineer | 2 | 5.6% |

**Continued**

| | | | |
|---|---|---|---|
| | Safety Officer/Assistant/Coordinator/Manager | 27 | 75% |
| | Project Manager/Operational Director | 3 | 8.3% |
| Construction Experience (yrs) | 1 - 10 | 28 | 77.8% |
| | 11 - 20 | 5 | 13.9% |
| | >20 | 3 | 8.3% |
| Project Contractor Type | Local | 18 | 50% |
| | Multinational | 9 | 25% |
| | Foreign | 9 | 25% |
| Project Role | Main Contractor | 27 | 75% |
| | Subcontractor | 7 | 19.4% |
| | Consultant/Mixed | 2 | 5.6% |
| Project Type | Apartments | 9 | 25% |
| | Offices | 10 | 27.8% |
| | Hospitals | 3 | 8.3% |
| | Stadium/Sports Complex | 2 | 5.6% |
| | Factories | 1 | 2.8% |
| | Data Centres | 2 | 5.6% |
| | Lecture Halls | 3 | 8.3% |
| | Harbour | 1 | 2.8% |
| | Multipurpose | 3 | 8.3% |
| | Residences | 1 | 2.8% |
| | Undisclosed | 1 | 2.8% |
| Project Location | Greater Accra | 28 | 77.8% |
| | Ashanti | 4 | 11.1% |
| | Central | 2 | 5.6% |
| | Upper East | 1 | 2.8% |
| | Western | 1 | 2.8% |

### 3.3. Participants and Sampling Methodology

Forty-one participants were purposefully chosen due to their direct engagement in construction safety management and regulation. The sample included thirty-six (36) construction site professionals (such as site leadership, consultants, safety officers, craftsmen, and labourers) and five (5) regulatory stakeholders from the principal state agencies tasked with overseeing occupational safety and health. This multi-stakeholder mix facilitated analysis across macro (regulatory), meso (organisational), and micro (site-level) domains [52]-[54]. The increased presence of safety officers in the site-level sample indicates their particular proficiency in safety management and their availability on busy construction sites. As institutional guardians of safety policy, they possess extensive knowledge of regulatory requirements, organisational procedures, and compliance issues, offering invaluable perspectives on safety dynamics across many levels. Conversely, some arti-

sans and temporary workers proved unavailable or hesitant to engage owing to stringent scheduling, location limitations, and apprehensions around audio recording. The final sample, therefore, comprises individuals who are both ready and capable of participating under actual site conditions, a typical result in qualitative research conducted in high-risk, time-sensitive environments. Participant characteristics are clearly shown in Table 1 and Table 2.

Table 2. Demographics of the regulatory bodies.

| Organisation/Unit | Role/Code | Duration | Location | Age | Qualifications | Experience |
|---|---|---|---|---|---|---|
| Department of Labour | Legal Unit/DL | 52 min 11 sec | Osu, Accra Sports Stadium | 40 - 50 | BSc (Economics, Business Admin, Accounting), LLB, BL | 16 yrs |
| Department of Factories Inspectorate | Inspector/DFI | 1 hr 00 min 11 sec | Accra Central, near Bank of Ghana | 40 - 50 | Master's (Field Not Specified) | 14 yrs |
| Ghana National Fire Service | Assistant Deputy Director | 1 hr 30 min | Accra HQ, Safety Dept. | 50 - 60 | Degree in Business Administration + Professional Safety Certificates | 36 yrs |
| Ghana National Fire Service | Commandant, Kyebi Fire Training School | 1 hr 00 min | Accra HQ, Safety Dept. | 50 - 60 | MSc Project Management + Professional Safety Certificates | 20+ yrs |
| Environmental Protection Agency | Deputy Director, Human Settlement Unit | 2 hr 30 min | Accra HQ, 4th Floor | 40 - 50 | MSc Water Supply & Environmental Sanitation Engineering | 14 yrs (EPA), 18 yrs Construction |

### 3.4. Data Collection

Data were mostly gathered via semi-structured interviews, allowing for flexibility while maintaining consistent coverage of essential safety characteristics. Interview guidelines were customised for participant categories and focused on safety management practices, leadership and organisational structures, worker behaviour, regulatory enforcement, perceived obstacles, and avenues for improvement. The complete interview items are included in the appendices. Interviews were conducted in person or over the telephone, audio-recorded with permission, and transcribed verbatim [55] [56]. Applicable laws and policy papers were examined to provide context for the results; nonetheless, only the interview data underwent rigorous coding and theoretical elaboration. The framework embodies a socially created depiction of the safety structure, mostly based on stakeholder views.

### 3.5. Data Analysis

Data were processed using an iterative grounded theory methodology that included

open, axial, and selective coding to establish higher-order categories and a central explanatory framework (Table 3). Continuous comparison analysis was applied for all participants and stakeholder categories to investigate cross-level interactions amongst macro- (regulatory), meso- (organisational), and micro- (site/worker) operations. Analytical rigour was maintained via memo composition, iterative category refining, and member validation. The gathering and analysis of data occurred simultaneously till theoretical saturation was achieved, as indicated by 1) the absence of fresh categories of concepts throughout open and focused coding, 2) a uniform observation of the features and dimensions of existing groupings among stakeholder groups, and 3) analytical memos offering adequate conceptual density to elucidate differences in safety practices at all phases. Saturation was evaluated using continuous comparison instead of quantitative thresholds, adhering to the concepts of constructivist grounded theory [57]-[60]. Microsoft Word served as a data management tool, emphasising conceptual integration rather than software-based coding. The resultant framework is based on participants' narratives and developing connections rather than preconceived theoretical assumptions.

**Table 3.** Grounded theory coding matrix for Ghanaian construction occupational safety and health.

| Open Coding | Axial Category (Conditions → Actions → Consequences) | Selective Themes (Higher-Order Integration) | Core Category | Level | Multi-Level Core Contribution |
|---|---|---|---|---|---|
| Fragmented OSH Laws; Outdated FOSA; Weak Penalties; Overlapping Mandates; Stalled OSH Act | Structural Fragmentation of OSH Governance.<br>- Conditions: outdated, dispersed laws, overlapping mandates<br>- Actions: conflicting interpretations; siloed enforcement<br>- Consequences: Weak compliance, contractor confusion | Theme 1: Systemic Fragmentation and Legal Obsolescence | Cyclical Safety Management Across Multi-Level Construction Systems | Macro | Macro fragmentations create inconsistencies at the institutional and site levels, partially offset by task forces and legislative advocacy |
| Inadequate Staffing; limited Logistics; Lack of Specialists | Capacity Deficits and Operational Constraints<br>- Conditions: staff shortages, poor mobility, limited expertise<br>- Actions: reactive inspections, reliance on complaints<br>- Consequences: reduced oversights, limited credibility | Theme 2: Capacity and Resource Constraints | | Macro | National capacity deficits cascade downwards; positive interventions, targeted staff training, and a mobile inspection unit improve coverage |

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| | | | | |
|---|---|---|---|---|
| Insufficient Prosecutorial Capacity; Political Interference; Foreign Contractor Shielding | Weak Enforcement Regime<br>- Conditions: limited closure powers, political or diplomatic pressure<br>- Action: reliance on persuasion, inconsistent sanctioning<br>- Consequences: low deterrence, non-compliance | Theme 3: Power Asymmetries and Uneven Enforcement | Macro | Macro-level political power shapes site-level compliance, and selective enforcement reforms temporarily reduce the cycle of unsafe practices |
| Low OSH Literacy; Weak Worker Advocacy; Contractor Unawareness | Safety Knowledge and Awareness Gaps<br>- Conditions: low literacy<br>- Action: minimal reporting, misrouting incidents<br>- Consequence: poor practices, low worker agency | Theme 4: Weak Safety Culture and Low Awareness | Macro | Low literacy feeds unsafe site behaviours; positive interventions, public education campaigns increase reporting and awareness |
| Joint Task Forces; Public Education Campaigns; Interagency Cooperation | Institutional Strategies and Adaptive Practices<br>- Condition: fragmentation triggers adaptive responses<br>- Actions: taskforces, education, curriculum proposals<br>- Consequences: incremental improvement | Theme 5: Emerging Reform and Adaptation | Macro | Task forces and campaigns partially disrupt unsafe cycles, improving compliance incrementally |
| Safety Committees, Supervisors; Hierarchical Decisions | Governance Structure and Decision Hierarchy<br>- Conditions: committee's present/absent, multi-level complexity<br>- Actions: incident review, escalation, coordination<br>- Consequences: strong governance improves accountability | Theme 6: Organisational Governance and Role Architecture | Micro | Organisational governance mediates micro gaps; effective committees enhance site-level safety practices |

**Continued**

| | | | | |
|---|---|---|---|---|
| Toolbox talks; WhatsApp Messaging; Signage; Inductions; Worker-Initiated Safety Measures (Buddy System, Safety Checks) | Communication and Worker Adaptive Practices<br>- Conditions: multiple, inconsistent channels.<br>- Actions: talks, digital messages, visual/audio signals; worker-led checks<br>- Consequences: confusion when fragmented; improved coordination when adaptive behaviours used | Theme 7: Communication and Worker Adaptive Practices | Micro | Worker adaptation mitigates site-level risks; mirrors macro-meso inconsistencies; positive practices: buddy system improves hazard detection |
| PPE Enforcement; Warnings; Penalties; Rewards | Enforcements, Sanctions and Incentives<br>- Conditions: mixed sanction-reward system<br>- Actions: NCRs, wage deductions, bonuses, PPE gifts<br>- Consequences: consistency builds trust, inconsistencies erode compliance | Theme 8: Enforcement Legitimacy | Micro | Weak enforcement at sites reflects macro-meso gaps; positive interventions (bonus schemes) reinforce compliance cycles |
| Incident Logs; Near Misses Reporting; Investigations | Reporting and Learning System<br>- Condition: variable reporting cultures<br>- Actions: logging; investigation; lesson dissemination<br>- Consequences: strong reporting leads to learning; weak reporting leads to repeated hazards | Theme 9: Outcome and Learning Nexus | Micro | Under-reporting at the national level replicated at the contractor sites; positive intervention; standardised incident reporting improves learning |
| Emergency Logistics; First Aid; Hospital Links; Firefighting Presence | Emergency Preparedness<br>- Conditions: uneven resource<br>- Actions: first response, evacuation, treatment<br>- Consequences: strong preparedness reduces injury severity | Theme 10: Emergency Preparedness and Response | Micro | Site emergency readiness depends on macro-level health/emergency capacity; training and drills partially disrupt unsafe cycles |

**Continued**

| | | | | |
|---|---|---|---|---|
| Written Policies; Poor Implementation | Policy Implementation Gaps<br>- Condition: policies exist but are inconsistently applied<br>- Actions: SOPs, induction<br>- Consequences: paper compliance without real change | Theme 11: Symbolic Compliance and Organisational Gaps | Meso | Organisational implementation mirrors national weakness; SOP reinforcement helps mitigate cyclical non-compliance |
| Leadership Behaviour; Cultural Context; Management Commitment | Implementation Leadership and Cultural Mediation<br>- Conditions: varied leadership commitment and cultural norms<br>- Action: modelling, motivation, enforcement<br>- Consequences: variable worker adherence | Theme 12: Leadership and Cultural Mediation | Micro | Micro-level safety behaviours influenced by leadership and culture, interacting with macro-meso structures; positive role modelling reduces the cycle of unsafe practices |
| Barriers: Missing Officers, Logistics Gaps, Under-Reporting | Cross-Cutting Cultural Barriers<br>- Conditions: structural constraints across levels<br>- Action: constrain inspection, communication, and enforcement<br>- Consequences: system-wide OSH deficits | Theme 13: Systemic Structural Barriers | Multi-level | Cross-level cultural barriers unify macro, meso, and micro weaknesses; recognition of adaptive practices and interventions partially interrupts cycles |

### 3.6. Research Integrity and Ethical Standards

Ethical permission was secured from relevant authorities, and all participants granted informed consent after the provision of a Plain Language Information Statement. The research guaranteed confidentiality, anonymity, voluntary participation, and the freedom to withdraw [61] [62].

Trustworthiness was established by triangulation across stakeholder groups, clear recording of analytical choices, and systematic focus on credibility, dependability, confirmability, and transferability [63] [64]. Reflexivity was maintained by

recognising the researcher's positionality and its possible impact on interpretation, in accordance with the principles of constructivist grounded theory.

## 4. Results and Discussion

### 4.1. Overview and Participant Demographics

This research leverages perspectives from 41 participants, including site-level craftsmen, supervisory staff, and top regulatory officials, to provide comprehensive, multi-faceted knowledge of construction safety dynamics in Ghana. The participants were mostly officially educated and mid-career professionals, many of whom held specialised safety or regulatory positions, thereby increasing the analytical trustworthiness of the results (Table 1 and Table 2).

Despite this professional competence, Greater Accra hosted the majority of projects, highlighting the persistent regional variations in regulatory scope and enforcement rigour. Regulatory participants had significant institutional expertise and macro-level governance understanding, allowing an examination of safety performance across the micro- (worker), meso- (organisational), and macro- (institutional) levels (Table 1 and Table 2). The participant composition enabled the study to investigate the emergence of safety outcomes through the interplay of individual behaviours, organisational systems, and institutional governance structures, aligning with previous construction safety research in Ghana and similar developing contexts [8] [10] [25].

### 4.2. Macro-Level Dynamics: Regulatory Fragmentation and Enforcement Limitations

At the macro level (Table 3), construction safety performance in Ghana is hindered by disjointed laws, redundant institutional responsibilities, and inadequate enforcement capabilities, mirroring trends often seen in developing countries [2] [12]. The persistent dependence on outdated legislation, including the Factories, Offices, and Shops Act (1970), the Labour Act (2003), and the Workmen's Compensation Act (1987), reveals a regulatory framework that is inadequately synchronised with modern construction dynamics, such as subcontracting networks, informal labour, and workforce mobility [35]-[37].

In reality, these structural deficiencies create a context for a negotiated and selective compliance landscape whereby construction firms amalgamate international norms with local mandates depending on perceived regulatory pressure rather than systematic enforcement [20] [38] [39]. Regulatory agencies encounter ongoing personnel deficiencies, logistical constraints, and technological capability shortfalls, mostly associated with reactive, complaint-based inspections. These limits are shaped by power imbalances and political influence, enabling some contractors—especially big, foreign, or politically affiliated firms—to avoid continuous scrutiny [14] [15] [35].

These results support previous research from Ghana and other developing nations, demonstrating that institutional deficiencies and regulatory fragmentation

significantly contribute to high accident rates in construction [10] [39]. Developed economies benefit from integrated frameworks like ILO Convention No. 167, OSHA, and ISO 45001, which institutionalise proactive risk management, leadership accountability, and worker participation [30] [31] [33]. In contrast, Ghana's primary challenge is implementation rather than principle. Even though inter-agency coordination and educational activities have started to fix these problems, not much effect has been realised, which means that more cohesive regulatory change is needed. These results together suggest that macro-level regulatory deficiencies in Ghana serve not just as a lack of formal regulations but rather as a motivator for discretionary and negotiated safety measures inside the construction industry.

### 4.3. Meso-Level Dynamics: Organisational Systems and Leadership Mediation

In **Table 3**, the structure, resources, and implementation of Safety Management Systems (SMS) influence safety performance at the organisational (meso) level. Formal mechanisms—such as delineated safety roles, subcontractor coordination, safety committees, documented procedures, and monitoring processes—were observable on certain sites but implemented inconsistently, especially among small and medium-sized enterprises (SMEs) [13] [42].

Resource constraints, erratic PPE availability, and variable supervisory commitment were reported to have impeded the effective implementation of SMS [26] [44]. Leadership commitment was a critical factor: locations with evident, proactive oversight reflected enhanced compliance and reduced harmful behaviours, whereas unclear responsibility and hierarchical intervention undermined safety governance. The findings illustrate how leadership commitment influences the implementation of organisational safety systems in a context characterised by regulatory fragmentation that is associated with adaptable and negotiable safety practices.

Capability-based frameworks, as exemplified by the Safety, Health, and Environmental Management Capability Maturity Model (SHEM-CMM), reinforce these insights by highlighting the amalgamation of people, procedures, and resources as critical factors influencing safety outcomes [28]. According to previous research, organisational safety performance in Ghana seems to be influenced more by management commitment, adaptive ability, and external scrutiny than formal certification [13] [14]. The meso-level results appear to underscore the pivotal role of organisational leadership and adaptive ability in converting macro-level regulatory deficiencies into site-level safety performance.

### 4.4. Micro-Level Dynamics: Employee Practices, Adaptation, and Safety Culture

At the micro level (**Table 3**), employees demonstrated inadequate occupational safety and health awareness, irregular personal protective equipment use, and lit-

tle incident reporting, which facilitated the normalisation of risk on construction sites [9] [23] [24]. Employee behaviour was significantly shaped by managerial exemplification, production demands, and socio-cultural conventions, including deference to authority, collective decision-making, and spiritual perceptions of danger [21] [22].

In reaction to systemic deficiencies, employees implemented adaptive and informal safety measures, including peer oversight, buddy systems, verbal danger alerts, and digital communication via platforms like WhatsApp. These solutions conferred a measure of operational resilience, somewhat alleviating risk in resource-limited contexts [25]. Nevertheless, evidence indicates that compliance-centric strategies are inadequate; enduring safety enhancement relies on participation and engagement-oriented methodologies [18] [19].

Emergency preparation has shown significant variability across locations, including official ambulance systems and hospital affiliations, to dependence on private transportation, with evident consequences for injury outcomes and response durations [65]. These micro-level factors correspond with extensive research from developing nations that associates risky behaviour, human error, and inadequate working conditions with consistently elevated accident rates [15] [16]. The micro-level results indicate that worker conduct demonstrates adaptability to systemic restrictions and feedback mechanisms that may either reinforce or partly disrupt overarching safety failures.

### 4.5. Cross-Level Feedback and Safety Dynamics

**Table 3** and **Figure 2** illustrate the study's results as a cohesive, multi-layered safety management cycle, emphasising the interrelated processes at the regulatory, organisational, and site levels. They demonstrate that fragmented regulation and inadequate enforcement at the macrolevel influence organisational discretion and prioritisation at the mesolevel, tend to foster subsequent impacts on worker practices, risk management, and safety culture at the microlevel. **Figure 2** converts stakeholder accounts into a theoretically designed feedback mechanism that demonstrates the ongoing interaction among regulatory gaps, organisational actions, and worker adjustments. These connections represent analytically deduced trends based on participant narratives instead of obvious or sequential activities.

Importantly, feedback mechanisms—such as underreporting, risk normalisation, and selective compliance—sustain a pattern of macro-level inertia, thereby appearing to reinforce safety failures over time. This integrated framework embodies the empirical findings presented in Sections 4.2 - 4.4 and emphasises safety as a dynamic, systemic phenomenon rather than a consequence of discrete behavioural or regulatory deficiencies.

This study empirically demonstrates that construction safety failures in Ghana mirror each other and are self-reinforcing. Macro-level regulatory deficiencies and inadequate enforcement contribute to organisational discretion and selective compliance, which shape micro-level practices such as underreporting and risk

normalisation. Site-specific practices disguise accident frequencies, diminish organisational learning, and decrease regulatory transparency; therefore, they appear to reinforce macro-level inertia [10] [23] [25].

Despite the existence of beneficial interventions at the regulatory, organisational, and employee levels—including educational programmes, leadership involvement, and worker-driven adaptation practices—their impacts remain confined and scattered. In the absence of coordinated alignment across institutional, organisational, and individual dimensions, interventions may fail to interrupt established safety cycles, highlighting the need for a comprehensive, multi-level transformation.

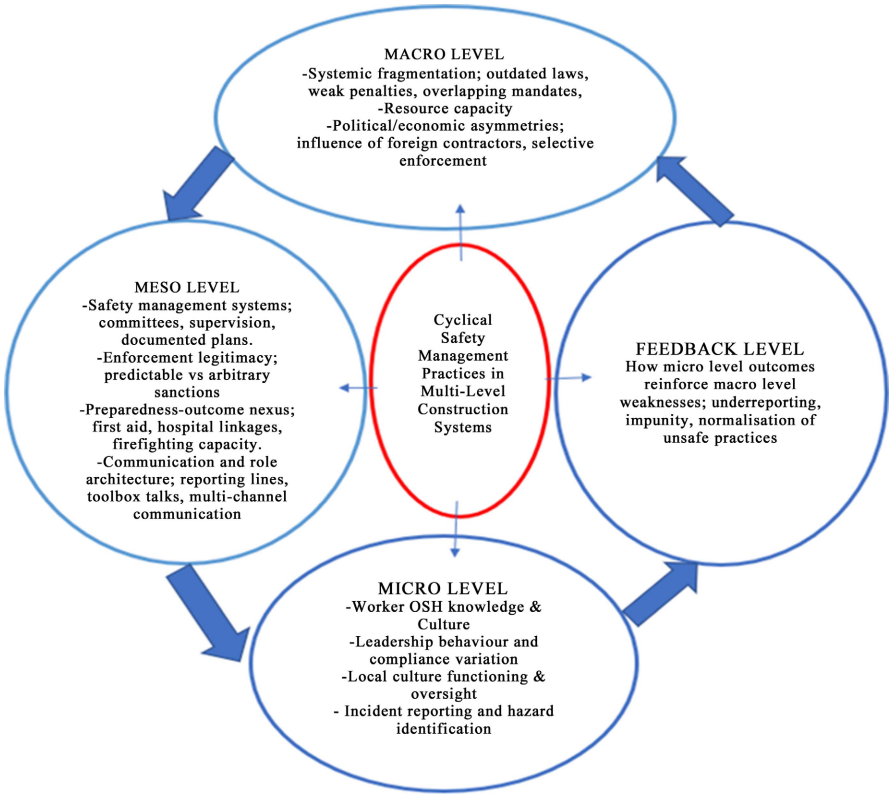


**Figure 2.** Empirical cyclical framework of safety management in multi-level construction systems (source: Authors' construct).

### 4.6. Global and Developing Country Relevance

The Ghanaian framework illustrates that while fundamental safety principles—leadership commitment, worker involvement, and danger identification—are universally relevant, their practical efficacy is significantly contingent upon context. In advanced economies, robust regulatory monitoring, institutional capabilities, and standardised reporting frameworks facilitate systematic safety management [30]-[32]. In Ghana and other developing settings, continuous institutional and resource limitations necessitate adaptive, context-specific strategies that include regulatory change, organisational capacity enhancement, and worker participa-

tion within a cyclical, multi-tiered framework.

This study enhances construction safety scholarship by transcending descriptive and firm-centric analyses and illustrating the dynamic interplay between regulatory fragmentation, organisational adaptation, and worker behaviour that supports a pattern of safety deficits [23] [26] [28]. These results tend to provide diagnostic and transferable insights, guiding the development of sustainable safety measures in low-resource construction environments worldwide.

The study enhances construction safety scholarship by conceptually establishing an internationally informed framework within Ghana's construction industry, offering practical insights for regulators and on-site practitioners.

## 4.7. Implications of the Study

Expanding upon the multi-level dynamics delineated in Sections 4.2-4.5, these effects illustrate the interaction of structural, organisational, and behavioural factors in influencing safety outcomes. The results demonstrate that construction safety performance in Ghana is systematically produced rather than limited to specific sites, enhancing multi-level occupational safety and health governance theory and highlighting the need for coordinated actions across legislative, organisational, and behavioural spheres. This study expands and contextualises current occupational safety and health theories in environments marked by institutional fragility, regulatory fragmentation, and adaptive compliance.

### 4.7.1. Theoretical Implications

Safety performance arises from interactions within the wider institutional ecology. In **Table 3**, macro-level deficiencies—disjointed regulation, inadequate deterrence, and politicised enforcement—affect organisational structures, decision-making, and employee behaviour [35] [36] [66]. Meso-level safety management systems (SMS) are deliberately modified or informally replaced to address institutional deficiencies rather than indicate organisational immaturity [34] [41] [67]. Micro-level practices, such as underreporting, risk normalisation, and procedural non-compliance, reinforce systemic vulnerabilities by perpetuating data deficiencies, undermining enforcement, and legitimising inactivity [18] [19] [68]. These findings underscore that sustainable safety outcomes depend not only on organisational intent or worker behaviour but also on the institutional conditions governing and normalising safety, explaining why the direct implementation of developed-country frameworks frequently results in minimal enhancement.

### 4.7.2. Policy Implications

Institutional consistency and the legitimacy of enforcement are essential for promoting national development goals and Sustainable Development Goals (SDGs). Disjointed legislation and insufficient regulatory capacity (**Table 3**) undermine SDG 8 (Decent Work), SDG 16 (Strong Institutions), and SDG 3 (Good Health), whereas the incorporation of occupational safety and health education into vocational training bolsters SDG 4 (Quality Education) and fosters a sustainable safety

culture [42] [69] [70]. Inadequate occupational safety and health governance adversely impacts Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure) by diminishing productivity, increasing accident-related expenses, and delaying infrastructure provision.

#### 4.7.3. Practical Implications

In low-resource and politically unstable environments, construction companies, site managers, and regulators should use SMS as effective governance instruments, ensuring explicit role distribution, hazard surveillance, systematic enforcement, and feedback systems [1] [71]. Transparent and predictable enforcement fosters confidence and compliance [66], while capacity-building in personnel, technical competence, logistics, and inter-agency coordination enhances institutional and site-level systems [14] [67]. Adaptive methods, such as grassroots safety meetings and digital communication (e.g., WhatsApp), may partly alleviate institutional deficiencies but must supplement formal governance frameworks to be successful [72]. Emergency preparation, including first-aid readiness, hospital connections, and firefighting capabilities, needs to be regarded as a fundamental safety performance metric [41] [70].

Adaptive approaches are essential but inadequate alone; sustainable construction safety needs coordinated, multi-tiered interventions that include legislative change, institutional fortification, credible enforcement, successful SMS deployment, and active worker engagement. This study connects local operational realities with global safety standards, presenting a transferable, theory-based model for emerging countries that offers practical recommendations for developing safer, more resilient construction industries aligned with the Sustainable Development Goals (SDGs).

## 5. Conclusions

This study established a conceptually robust and empirically substantiated explanatory framework that integrates legislative, organisational, and worker-level factors influencing construction safety management in Ghana. The primary conclusion is that safety failures might not be only local issues but rather foreseeable consequences of a structurally disjointed, politically imbalanced, and operationally deficient occupational safety and health regulatory structure.

Systemic deficiencies permeate at interconnected levels: at the macro level, fragmented regulation, inadequate enforcement, and politicised oversight correspond with inconsistent application of safety standards; at the meso level, organisational safety management systems are unevenly implemented and poorly monitored; at the micro level, a deficient safety culture, underreporting, and inconsistent practices mirror and manifest higher-level weaknesses. Sustainable advancements need cohesive laws, enhanced institutional capacity, impartial enforcement, and resilient organisational processes that can translate leadership intent into consistent, safe practices at the worker level.

This study demonstrates that construction safety performances in Ghana are

fundamentally influenced by legislative inertia, inadequate enforcement capabilities, and politicised regulation, as opposed to on-site behaviour. By synthesising institutional, organisational, and behavioural facts, it elucidates reasons international frameworks such as ISO 45001, OSHA, and ILO, among others, mostly serve a symbolic function, without legal consistency and rigorous enforcement. This study enhances Occupational Safety and Health governance theory by conceptualising safety culture as reliant on systems, resources, and impartial oversight, providing an empirically supported framework that holds practical significance for regulators, businesses, and emerging economies aiming to implement international safety standards effectively.

## 6. Limitations and Future Research

### 6.1. Limitations

This study utilised a qualitative, cross-sectional grounded theory design to facilitate comprehensive, theory-generating perspectives on safety management dynamics, other than for rigorous empirical validation of causal linkages or temporal patterns. Purposive sampling facilitated in-depth involvement with essential safety players; nonetheless, it constrained the generality of the findings, especially with small-scale, informal, and temporary construction environments.

The data gathering predominantly used semi-structured interviews, with limited corroboration from statutory or documentary sources. Thus, the findings represent co-created interpretations influenced by participants' narratives and the researcher's analysis, rather than independently verified data. While the study significantly gained insights from safety officers and supervisory staff, the experiences of craftsmen, casual labourers, and informal workers were relatively underrepresented due to access limitations and differing degrees of willingness to participate.

The cross-sectional qualitative technique facilitates interpretative comprehension and theoretical advancement; yet, it is constrained in its ability to document the longitudinal progression of safety practices, feedback mechanisms, and system adaptation across time. Reliance on self-reported interview data presents the possibility of perception and recollection bias, as conclusions are based on stakeholders' perceptions rather than verified empirical evidence.

### 6.2. Future Research

Subsequent research ought to expand upon the findings of this study by employing quantitative or mixed-methods approaches that can empirically investigate macro-meso-micro connections and possible mechanisms for feedback across construction safety systems. These methodologies would offer a formal assessment of system interactions, which a qualitative, cross-sectional paradigm cannot validate. To enhance micro-level analysis, future research should intentionally oversample frontline operational groups—specifically, artisans, casual labourers, and informal workers—to more thoroughly capture lived safety experiences and mitigate

supervisory or management bias.

The cyclical safety framework presented in this paper should be viewed as an analytically constructed depiction of system reproduction rather than a process validated over time. Therefore, longitudinal or focused intervention studies are necessary to investigate its temporal dynamics and evaluate the progression of safety practices over time. Longitudinal designs would facilitate the examination of how micro-level activities, such as underreporting, risk normalisation, and informal rule adaptation, may aggregate and combine to ripple through organisational vulnerabilities and regulatory fragmentation.

Furthermore, comparison assessments among enterprises, project scales, and contexts in developing countries are essential to assess how disparities in political and economic power influence regulatory enforcement, organisational compliance, and safety governance outcomes. Combining qualitative research with written and managerial sources—such as accident reports, inspection records, and organisational safety documents—would improve factual triangulation, reinforce system-level confirmation, and facilitate a more thorough assessment of safety management techniques over time and within various contexts.

## Data Availability

The data that support the findings for this study are available from the corresponding author upon reasonable request.

## Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, we used ChatGPT-5 and QuillBot grammar checks for the purpose of language. After using this tool or service, we reviewed and edited the content as needed and take full responsibility for the content of the publication.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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# Appendices

## Interview Guide for Construction Leadership Participants

**Section A: Bio Data and Personal Records of Interviewee**

1. Please can you briefly tell me about yourself in terms of your

a. Age bracket……...

b. Highest academic qualification……...

c. Years of experience in the construction industry……

d. Current company and your job schedule……

**Section B: Safety Management and Its Influence on Behaviour**

2a. Please, in what ways does your construction company ensure that health and safety are effectively managed to curb accidents, injuries, and deaths at your site? ……...……...

2b. Please, how do such management practices influence your behaviour concerning your

i) Compliance with health and safety rules and work procedures?.....…….

ii) Voluntary participation in ensuring the holistic health and safety delivery at your sites?.....

2c. Please, how do such management practices influence the leadership behaviours at your site?

**Section C: Safety Leadership Behaviour and Its Influence**

3a. Please, how do your safety leadership (managers, supervisors, and gang leaders) behave towards production issues as opposed to health and safety compliance at your sites?.....

3b. How do their behaviours impact your own health and safety behaviour and that of your coworkers?.....

**Section D: Worker's Safety Behaviour and Its Influences**

4a. Please, how do you relate to your workgroup? ……..

4b. Please, how does your workgroup's health and safety behaviour influence yours?……

4c. Please, to what extent do your coworkers' safety practices influence your safety behaviour and vice versa?.....

**Section E: Culture and Safety Behaviour**

5a. Please, in your opinion, how do the national cultural tendencies influence the health and safety culture of your company in terms of

i) Power distance between the leadership and workers?.....

ii) Individualistic/collectivist tendencies, leadership, and workers?.....

iii) Uncertainty avoidance through strict laws and rules, safety and security measures, philosophical and religious beliefs?.....

iv) Long-term orientation (*i.e.*, long-term planning and beliefs)?.....

5b. Please, to what extent does your company's organisational culture concerning

i) Organisational practices and……...

ii) Supervisory practices contribute to the safety performance at your site?.....

6. Please, how satisfied are you with regard to

i) The safety management practices……..……

ii) The safety behaviour and ……...……..

iii) The safety performance at your sites?.....

**Section G: Recommendations**

7. Please indicate your recommendations as to how best health and safety performance can be holistically improved at your sites?.....

## Interview Guide for Construction Worker Participants

**Section A: Bio Data and Personal Records of Interviewee**

1. Please can you briefly tell me about yourself in terms of your

a. Age bracket ……..

b. Highest academic qualification……...…….

c. Years of experience in the construction industry……..

d. Current company and your job schedule…….

**Section B: Safety Management and Its Influence on Behaviour**

2a. Please, in what ways does your construction company ensure that health and safety are effectively managed to curb accidents, injuries, and deaths at your site?.....

2b. Please, how do such management practices influence your behaviour concerning your

i) compliance with health and safety rules and work procedures?.....

ii) voluntary participation in ensuring the holistic health and safety delivery at your sites?.....

2c. Please, how do such management practices influence the leadership behaviours at your site?.....

**Section C: Safety Leadership Behaviour and Its Influence**

3a. Please, how do your safety leadership (managers, supervisors, and gang leaders) behave towards production issues as against health and safety compliance at your sites?.....

3b. How do their behaviours impact your own health and safety behaviour and that of your coworkers?.....

**Section D: Worker's Safety Behaviour and Its Influences**

4a. Please, how do you relate to your workgroup?……..

4b. Please, how do the health and safety practices of your working group affect you?.....

4c. Please, to what extent do your coworkers' safety practices influence your safety behaviour and vice versa?.....

**Section E: Culture and Safety Behaviour**

5a. Please, in your opinion, how do the national cultural tendencies influence

the health and safety culture of your company in terms of

i) Power distance between the leadership and workers?.....

ii) Individualism/collectivism tendencies, leadership, and workers?.....

iii) Uncertainty avoidance through strict laws and rules, safety and security measures, philosophical and religious beliefs?.....

iv) Long-term orientation (*i.e.*, long-term planning and beliefs)?.....

5b. Please, to what extent does your company's organisational culture concerning

i) Organisational practices and……...

ii) Supervisory practices contribute to the safety performance at your site?.....

**Section F: Satisfaction**

6. Please, how satisfied are you with regard to

a. The safety management practices……...……

b. The safety behaviour and…….

c. The safety performance at your sites?.....

**Section G: Recommendations**

7. Please indicate your recommendations as to how best health and safety performance can be holistically improved at your sites?.....

## Interview Guide for Department of Factories and Inspectorate Participant

**Section A: Bio Data and Personal Records of Interviewee**

1. Please can you briefly tell me about yourself in terms of your

a. Age bracket ……..…

b. Highest academic qualification……..…..

c. Years of experience in your work…….....

d. Your current job schedule……

**Section B: Health and Safety Enforcement Practices at the Construction Project Sites and Its Influence on Behaviour**

2. Please, what is your mandate as DFI in construction health and safety delivery?...

3. How often do you visit the construction sites to enforce the health and safety laws?.....

**Section C: Challenges**

4. Please, what are some of the challenges you face in the enforcement of the health and safety laws at the construction site, and how do you overcome such challenges?.....

**Section D: Satisfaction**

5. How satisfied are you so far with your work?……...…….

**Section E: Recommendations**

6. Please, what are your recommendations for improving health and safety performance at construction project sites and in the construction industry?.....

## Interview Guide for Department of Labour Participant

**Section A: Bio Data and Personal Records of Interviewee**

1. Please can you briefly tell me about yourself in terms of your

a. Age bracket ……

b. Highest academic qualification……..……..

c. Years of experience in your work……..……

d. Your current job schedule……

**Section B: Health and Safety Enforcement Practices at the Construction Project Sites in Ghana**

2. Please, what is your mandate as the Department of Labour in construction health and safety delivery…….

3. How often do you visit the construction sites to enforce the health and safety laws……

**Section C: Procedures for Workman's Compensation Claims**

4. Please, what are the processes and procedures for the workmen's compensation claims?.....

5. Please, how well have you executed your mandate to improve the health, safety, delivery, and welfare of the construction workers in Ghana?.....

**Section D: Challenges**

6. Please, what are some of the challenges you face in the enforcement of the health and safety laws at the construction site, and how do you overcome such challenges?.....

**Section E: Satisfaction**

7. Please, how satisfied are you so far with your work?.....

**Section F: Recommendations**

8. Please, what are your recommendations for improving health and safety performance at construction project sites and in the construction industry?.....

## Interview Guide for Ghana National Fire Service Participants

**Section A: Bio Data/Personal Records**

1. Please can you briefly tell me about yourself in terms of your

a. Your age brackets…….

b. Your highest educational qualification……

c. Your rank and job role……..

d. Experience in the service and with the construction industry safety……..

**Section B: Mandate of the Service**

2. In the light of the Ghana National Fire Service Act, 1997 (Act 357), section 4b, what is your mandate to the construction project site safety delivery in Ghana concerning the following?

a. Fire Prevention…….

b. Emergency Response……...……

c. Safety Inspections……..…
d. Emergency Preparedness…….……
e. Collaboration with Other Agencies…….……
f. Investigation of Incidents…….……
e. How well have you executed your mandate?.....

**Section C: Challenges**

3. What are the various challenges that confront your mandate?.....

**Section D: Satisfaction**

4. What are your satisfactions?.....

**Section E: Recommendations**

5. What are your recommendations? ……..…….

## Interview Guide for Environmental Protection Agency Participant

**Section A: Bio Data/Personal Records**

1. Please can you briefly tell me about yourself in terms of your
a. Your age brackets……..……
b. Your highest educational qualification……...……
c. Your rank and job role……..
d. Experience in the service and with the construction industry safety……...

**Section B: Mandate of the Environmental Protection Agency**

2. In the light of the Environmental Protection Agency Act, 1994 (Act 490), Sections 12 and 28, what are your functions on the construction project sites in Ghana concerning the following:
a. Pre-construction…….……..
b. During construction……...……..
c. Post construction……..……
3. What are your specific responsibilities?…….
4. What are your focus areas on construction project sites?.....
5. How well have you carried out your mandate regarding the consequences of non-compliance?.....

**Section C: Challenges**

6. Please, what are some of the challenges you face in carrying out your functions at the construction site, and how do you overcome such challenges?.....

**Section D: Satisfaction**

7. Please, how satisfied are you so far with your work?.....

**Section E: Recommendations**

8. Please, what are your recommendations for improving health, safety and environmental performance at construction project sites and in the Ghana construction industry?.....