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HEALTH AND SAFETY MANAGEMENT IN HIGH-RISK CONSTRUCTION ENVIRONMENTS: A COMPARATIVE STUDY OF PAKISTAN AND THE UNITED KINGDOM

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Abstract

Construction is one of the world's most hazardous industries because workers are routinely exposed to falls, electrical hazards, moving equipment, struck-by incidents, hazardous materials and other occupational risks. Effective health and safety management therefore requires not only protective equipment but also appropriate regulation, worker training, organizational commitment, risk assessment and continuous monitoring. This study examines health and safety management in high-risk construction environments through a comparative analysis of Pakistan and the United Kingdom (UK). The research adopted a mixed-methods design combining a questionnaire survey of construction professionals in Pakistan with secondary quantitative and qualitative evidence from regulatory documents, academic literature, industry reports and institutional sources. The primary survey targeted 30 construction professionals, of whom 24 responses were obtained, representing an 80% response rate. The findings indicate that weak regulatory enforcement and inadequate safety training were among the most frequently identified safety challenges in Pakistan. Sixty-five percent of respondents reported weak or infrequent regulatory enforcement, while 70% identified inadequate training as a major problem. Falls were identified as a leading source of construction incidents. The comparative evidence indicates substantial differences between Pakistan and the UK in regulatory enforcement, training, technology integration and safety culture. The UK framework, particularly the Construction (Design and Management) Regulations 2015 (CDM 2015), distributes safety responsibilities across clients, designers, principal designers, principal contractors, contractors and workers. The study argues that Pakistan can benefit from adapting selected elements of the UK approach rather than directly transferring the entire regulatory model. Priorities include stronger enforcement, competency-based training, project-level safety planning, worker participation, improved incident reporting and gradual adoption of digital technologies. The findings provide a practical framework for strengthening construction safety management in Pakistan and other developing construction markets.

1. INTRODUCTION

The construction industry is essential to economic development, infrastructure

provision and urbanization, but construction activities are also associated with substantial occupational health and safety risks. Workers may be exposed to falls from height, electrical hazards, heavy machinery, excavation risks, falling objects, hazardous substances, excessive noise and physically demanding working conditions. The International Labour Organization (ILO) identifies construction as a sector characterized by diverse and significant occupational safety and health hazards and emphasizes the need for preventive safety and health management throughout the construction project life cycle (ILO, 2022).

Construction safety is consequently not simply a matter of providing personal protective equipment (PPE). Effective safety management requires an integrated system involving risk identification, planning, worker competence, supervision, communication, organizational leadership, regulatory compliance and continuous improvement. ISO 45001:2018 similarly conceptualizes occupational health and safety management as a systematic process involving leadership, worker participation, hazard identification, risk assessment, legal compliance, emergency preparedness, incident investigation and continual improvement (ISO, 2018).

The problem is particularly significant in developing construction markets where regulatory systems, institutional capacity, training provision and safety resources may be uneven. Research specifically examining Pakistan has identified weaknesses in the implementation of construction safety requirements and argued that existing occupational safety legislation has historically not provided a sufficiently integrated construction-specific framework (Raheem & Issa, 2016). Their proposed safety implementation framework emphasizes three interconnected areas: regulatory improvement, corporate safety management and training.

The UK provides a useful comparative case because its construction safety system incorporates formal responsibilities across the project life cycle. Under CDM 2015, clients, designers, principal designers, principal contractors, contractors and workers have defined responsibilities for managing health and safety. HSE guidance emphasizes that risks should be considered during design and planning rather than only after construction begins.

Against this background, the present study compares construction safety management in Pakistan and the UK. The purpose is not to assume that one national system can simply be transplanted into another context. Rather, the study identifies differences in regulatory enforcement, training, safety culture and technology and considers which elements of the UK approach may be adapted to Pakistan's economic and institutional circumstances.

Research Questions

The study addresses four research questions:

What are the key challenges affecting construction safety in Pakistan?

How do construction safety practices in Pakistan compare with those in the UK?

What factors contribute to differences in safety standards between the two countries?

What measures can be implemented to improve construction safety in Pakistan based on relevant UK practices?

2. Literature Review

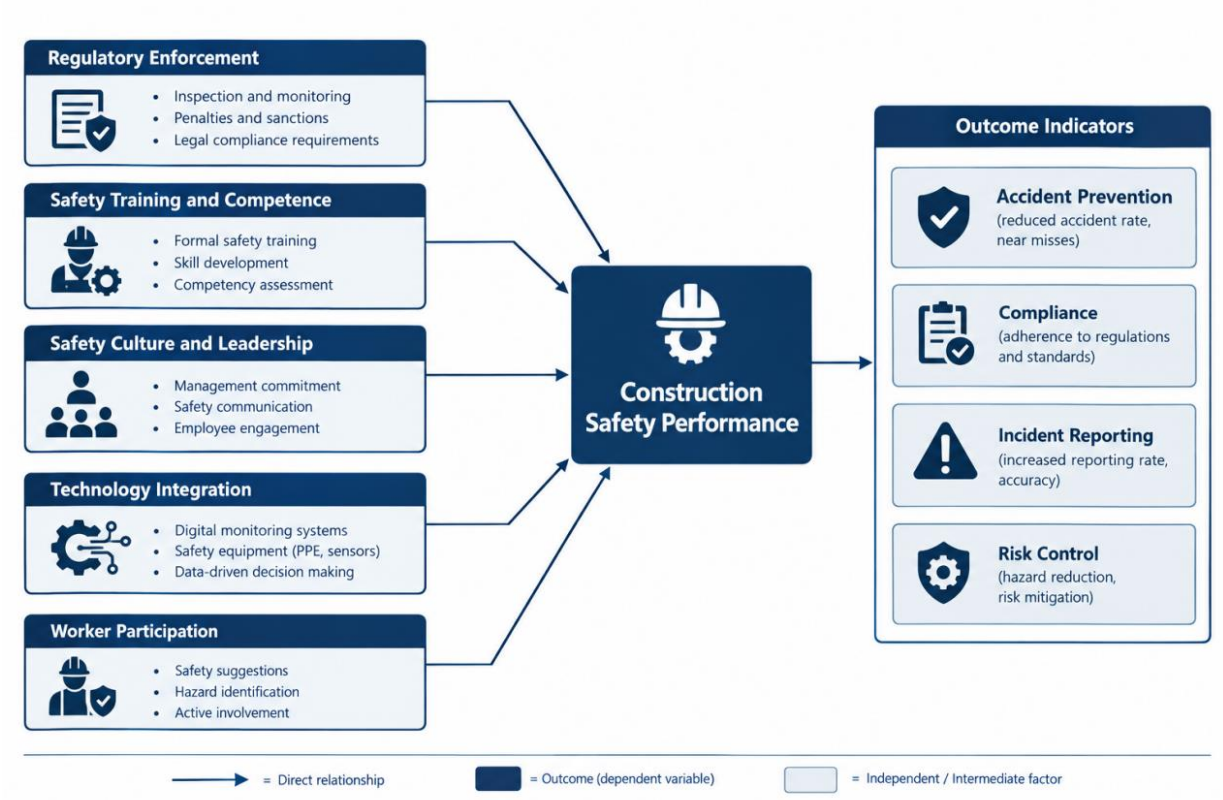
2.1 Theoretical foundations of construction safety

Construction accidents are rarely attributable to a single factor. Traditional accident causation approaches, including Heinrich's Domino Theory, conceptualize accidents as sequences in which unsafe acts or conditions contribute to subsequent events. Later systems-oriented approaches broaden this perspective by considering organizational, technological and environmental interactions.

Systems thinking is particularly relevant to construction because construction projects involve multiple contractors, subcontractors, designers, managers, workers, machines and changing site conditions. Reason's (1997) organizational accident perspective emphasizes the importance of latent organizational conditions in addition to immediate unsafe acts. Similarly, Leveson (2011) argues that safety should be understood as a property of a wider socio-technical system rather than solely as the behavior of individual workers.

Safety culture provides another important analytical perspective. Construction organizations with strong safety cultures tend to integrate safety into management decisions rather than treating it as a separate compliance activity. This includes leadership commitment, communication, worker participation and learning from incidents.

Figure 1. Conceptual framework linking regulatory enforcement, safety culture, training, technology and construction safety performance.



2.2 Construction safety in Pakistan

Previous research indicates that Pakistan's construction industry faces challenges related to regulatory fragmentation, weak enforcement, insufficient safety training and variable safety practices. Raheem and Issa (2016) found that the implementation of safety rules was hindered by weaknesses in the regulatory environment and organizational safety culture. Their expert-based framework emphasized stronger regulatory responsibilities, corporate safety management and training as major components of improvement.

The dissertation underpinning the present study similarly identifies weak enforcement, limited training, insufficient PPE use, informal employment arrangements and cost-oriented project practices as recurring problems. These issues can be particularly difficult to address on smaller projects where formal safety personnel and structured management systems may be limited.

Importantly, Pakistan's regulatory environment is evolving. In April 2026, the Government of Pakistan approved a national Occupational Safety and Health Code of Practice for the construction sector, representing a significant recent development in the country's construction safety policy environment. This development should be considered when interpreting older studies and illustrates why construction safety research requires continual updating.

2.3 Construction safety in the UK

The UK's construction safety framework is built around the Health and Safety at Work etc. Act 1974 and sector-specific regulations including CDM 2015. Under CDM, safety responsibilities are distributed throughout the project. Designers are expected to eliminate, reduce or control foreseeable risks during design, while principal designers coordinate health and safety during pre-construction. Principal contractors plan, manage, monitor and coordinate the construction phase. Workers are also expected to participate in safety management and report dangerous conditions.

This life-cycle approach is important because hazards can often be reduced before workers arrive on site. The ILO's revised 2022 construction safety code similarly promotes prevention throughout the construction project life cycle and emphasizes cooperation between governments, employers, workers and their representatives.

Technology is also increasingly incorporated into construction risk management. Building Information Modelling (BIM), digital inspections, drones, wearable devices and simulation-based training can provide additional mechanisms for identifying and controlling hazards. However, technology should complement rather than replace competent safety management.

3. Methodology

3.1 Research design

A mixed-methods comparative design was employed. Primary quantitative evidence was obtained through a structured questionnaire administered to construction professionals in Pakistan. Secondary quantitative and qualitative evidence was obtained from academic publications, government and regulatory sources, industry reports and construction safety frameworks.

The dissertation reports that 30 construction professionals were targeted and 24 completed responses were obtained, giving an 80% response rate. Respondents included site managers, safety officers and engineers. The questionnaire contained 20 closed-ended questions incorporating Likert-scale and multiple-choice items.

Table 1. Summary of Research Methodology

Component	Description
Research approach	Mixed methods
Primary method	Structured questionnaire
Target population	Construction professionals in Pakistan
Target sample	30 professionals
Completed responses	24
Response rate	80%
Respondent groups	Site managers, safety officers, engineers
Questionnaire	20 closed-ended questions
Scale	Primarily 5-point Likert scale and multiple choice
Secondary sources	Academic literature, HSE, ILO, regulatory documents and industry reports
Quantitative analysis	Frequencies, percentages, means and standard deviations
Comparative analysis	Pakistan–UK safety framework comparison
Qualitative analysis	Thematic analysis of documents and case evidence
Main themes	Enforcement, training, safety culture, technology and worker participation

The questionnaire was designed around the research questions and focused on regulatory enforcement, training, PPE, safety practices and the feasibility of adopting selected international practices. The dissertation indicates that responses were organized and analyzed using spreadsheet/statistical tools.

3.2 Secondary data

Secondary evidence was used to establish the comparative context. Sources included HSE material concerning UK construction safety and CDM 2015, ILO construction safety

guidance, academic studies concerning Pakistani construction safety and international occupational safety standards.

The use of multiple source categories was important because national construction safety data are not always directly comparable. Differences in definitions, reporting systems, inspection regimes and coverage can affect cross-national comparisons.

3.3 Data analysis

Descriptive statistics were used to summarize questionnaire responses. Means and standard deviations were calculated for relevant Likert-scale questions, while percentages were used for categorical responses. The qualitative component involved thematic identification of recurring issues relating to regulatory enforcement, safety culture, training and technology.

Because the primary sample was small and purposively selected, the questionnaire results are interpreted as evidence of professional perceptions within the study sample rather than nationally representative estimates.

4. Results

4.1 Key safety challenges in Pakistan

The primary questionnaire identified regulatory enforcement and training as major concerns. Sixty-five percent of respondents reported weak or infrequent regulatory enforcement, with a reported mean score of 2.3 (SD = 0.8). Seventy percent identified inadequate training, with a mean score of 2.1 (SD = 0.9). Falls were identified as the leading incident category in the survey, accounting for approximately 50% of reported causes within the study data.

Table 2. Main Construction Safety Challenges Identified by Respondents

Safety challenge	Result reported in study
Weak/infrequent regulatory enforcement	65%
Inadequate safety training	70%
Falls as leading incident cause	50%
Mean enforcement rating	2.3
SD for enforcement rating	0.8
Mean training adequacy rating	2.1
SD for training adequacy rating	0.9

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These findings are consistent with earlier Pakistani construction safety research. Raheem and Issa (2016) identified weaknesses in regulatory implementation and emphasized the importance of corporate safety management and training.

4.2 Pakistan–UK comparison

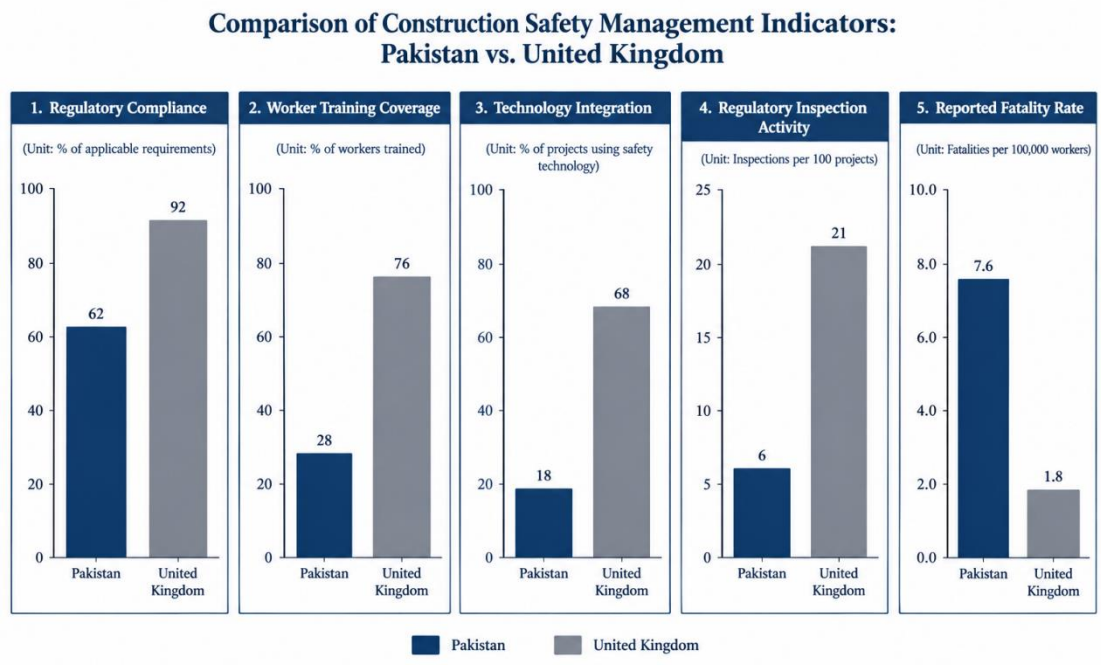
The dissertation reports a substantial contrast between Pakistan and the UK in safety compliance, training and technology integration. Within the secondary dataset used by the study, Pakistan was associated with lower reported compliance and training coverage, while the UK was associated with substantially higher levels.

Table 3. Comparative Safety Indicators Reported in the Study

Indicator	Pakistan	UK
Reported fatality rate	12.5 per 100,000	2.1 per 100,000
Regulatory compliance	32%	85%
Technology adoption indicator	Lower/manual methods	Approximately 60% BIM indicator
Worker training coverage	Approximately 20%	Approximately 90%
Regulatory inspections reported	Approximately 5,000	Approximately 38,100
Dominant safety approach	More reactive/manual	More structured/preventive

Important methodological note: these figures are the comparative values reported in the dissertation's dataset and should not be presented as current official national statistics without re-verification against the underlying original datasets. The article therefore treats them as **study-level comparative indicators**, not as newly established national estimates.

Figure 2. Comparative construction safety management indicators in Pakistan and the UK.



4.3 Factors underlying the differences

The analysis identified four major explanatory themes:

Regulatory enforcement: Stronger institutional enforcement in the UK creates clearer accountability.

Training and competence: UK practice incorporates structured competency and continuing training systems, whereas training coverage in Pakistan is more variable.

Safety culture: The study identifies a stronger tendency toward formal accountability and reporting in the UK, while cost and schedule pressures may influence safety priorities in some Pakistani construction environments.

Technology: UK projects increasingly use digital tools for design coordination, monitoring and training, whereas many Pakistani sites continue to rely heavily on manual procedures.

Table 4. Thematic Comparison of Safety Management Systems

Dimension	Pakistan	UK	Potential lesson
Regulation	Fragmented/variable implementation	Structured legal duties	Clarify responsibilities
Enforcement	Resource and coverage constraints	Formal enforcement structure	Strengthen inspection capacity
Training	Uneven coverage	More systematic competency development	Introduce competency-based training
Safety planning	Variable	Life-cycle planning under CDM	Integrate safety from design
Technology	Increasing but uneven	Greater integration on major	Adopt scalable digital

		projects	tools
Worker participation	Variable	Formal duties for consultation/engagement	Strengthen worker voice
Incident reporting	Often underdeveloped	Established reporting mechanisms	Develop learning-oriented reporting

5. Discussion

The findings demonstrate that construction safety is a systemic management issue rather than a problem that can be solved through PPE alone. The high proportion of respondents identifying inadequate training and weak enforcement suggests that safety performance is influenced by institutional and organizational conditions.

The findings are consistent with Raheem and Issa's (2016) argument that improving Pakistani construction safety requires coordinated intervention across regulatory, corporate and training dimensions. Their research specifically identified the need for stronger regulatory mechanisms and improved corporate safety culture.

The UK comparison demonstrates the value of assigning safety responsibilities throughout the project life cycle. CDM 2015 does not place responsibility exclusively on workers or site managers. Instead, clients, designers, principal designers, principal contractors and contractors all have defined responsibilities. Designers must consider foreseeable risks, while principal contractors must plan, manage, monitor and coordinate construction-phase safety.

This approach is relevant to Pakistan because some construction risks can be eliminated or reduced before construction starts. For example, design decisions can influence working-at-height requirements, access arrangements, lifting operations and maintenance hazards. Consequently, safety should be integrated into procurement, design review and project planning rather than introduced only during construction.

Training is another major area for improvement. The study's finding that 70% of respondents identified inadequate training indicates a need to move from occasional safety briefings toward structured competency development. Training should be tailored to job responsibilities and risks, including working at height, electrical safety, equipment operation, emergency response, hazard identification and incident reporting.

The ILO's revised construction safety code provides a useful international framework because it emphasizes cooperation among governments, employers and workers and promotes a preventive safety culture throughout the project life cycle.

Technology should also be adopted strategically. BIM can support hazard identification during planning and design, while mobile inspection systems can improve documentation and monitoring. Wearable devices, drones and virtual simulation may offer additional benefits on complex projects. However, technological adoption should be proportional to project requirements and organizational capability. A sophisticated digital system will not compensate for absent supervision, inadequate training or weak enforcement.

The comparison therefore suggests that Pakistan should not attempt to copy the UK system in its entirety. Instead, a staged adaptation strategy is more realistic. Basic measures such as project-specific safety plans, hazard assessments, toolbox talks, competent safety personnel and incident reporting can be strengthened before more expensive digital systems are introduced.

A particularly important development is Pakistan's approval in April 2026 of a national construction-sector Occupational Safety and Health Code of Practice. This development provides a contemporary policy context for the study and suggests that the regulatory environment is moving toward greater formalization. Future research should examine how effectively the new code is implemented across provinces, project sizes and contractor categories.

6. Practical Framework for Improving Construction Safety in Pakistan

Based on the findings, a five-stage improvement framework is proposed.

Stage 1: Regulatory strengthening
Construction safety requirements should be clearly defined and consistently enforced. Inspection resources should be strengthened, while serious violations should generate appropriate corrective action.

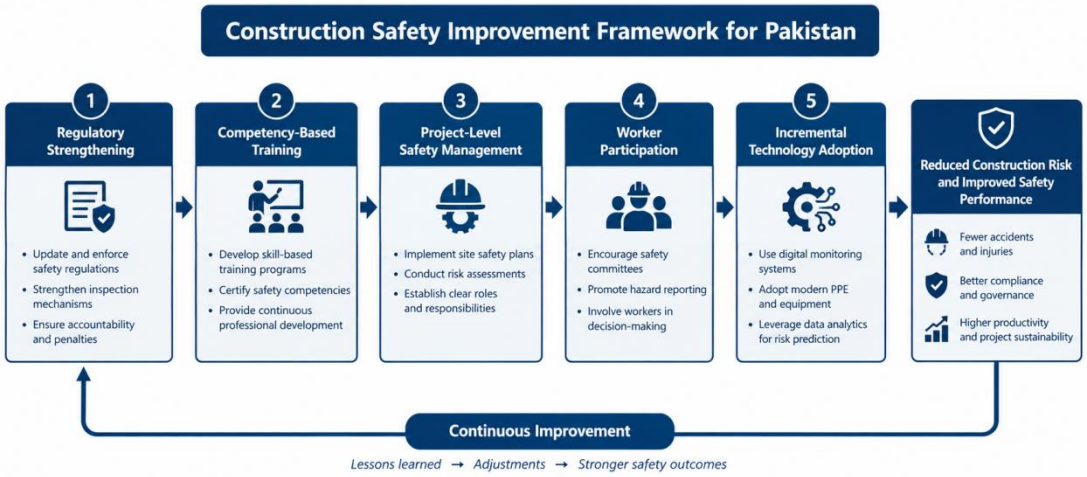
Stage 2: Competency-based training
Construction firms should introduce mandatory induction training followed by role-specific competency training. Training records should be maintained digitally or through standardized documentation.

Stage 3: Project-level safety management
Every major construction project should maintain a project-specific safety plan incorporating hazard identification, risk assessment, emergency arrangements, PPE requirements, inspection schedules and incident reporting procedures.

Stage 4: Worker participation
Workers should be encouraged to report hazards without fear of retaliation. Toolbox talks, safety committees and worker consultation can create feedback mechanisms through which site-level risks are identified.

Stage 5: Incremental technology adoption
Technology should be introduced according to project complexity and available resources. Priority can initially be given to mobile inspection systems, digital training records, BIM-based hazard identification and electronic incident reporting.

Figure 3. Proposed five-stage construction safety improvement framework for Pakistan.



7. Implications

7.1 Policy implications

Policymakers should focus on translating safety legislation into enforceable site-level practices. The new national construction OSH Code of Practice provides an important basis, but implementation capacity will determine its practical impact. Regulatory agencies should develop clear inspection priorities and standardized reporting systems.

7.2 Industry implications

Construction companies should treat safety as an operational management responsibility rather than a separate compliance function. Contractors should allocate resources for competent safety personnel, training, hazard assessment and incident investigation.

7.3 Project-management implications

Project managers have a central role because safety decisions interact with cost, schedule, procurement and quality. Safety requirements should therefore be incorporated into project planning and contractor selection. Lowest-cost procurement strategies should not unintentionally create incentives for unsafe practices.

7.4 Research implications

Future studies should use larger samples and longitudinal data. Comparative research should also examine provincial differences

within Pakistan because safety regulation and enforcement can vary across jurisdictions. Researchers should investigate the implementation of Pakistan's 2026 construction-sector OSH Code of Practice and evaluate whether changes in compliance, training and incident reporting occur following implementation.

8. Limitations

Several limitations should be considered when interpreting the findings. First, the primary questionnaire involved only 24 completed responses. Although the 80% response rate within the targeted sample is useful, the sample cannot be treated as statistically representative of Pakistan's entire construction workforce.

Second, the comparative analysis relies partly on secondary data collected under different national reporting systems. Differences in definitions, data collection methods and institutional coverage may limit direct comparison.

Third, the study focuses primarily on Pakistan and the UK. Other countries may provide alternative models that are more appropriate for particular Pakistani contexts.

Fourth, no primary qualitative interviews were conducted. The qualitative component was based on documentary and secondary evidence. Future studies should incorporate interviews with workers, contractors, safety officers, regulators and project managers.

Finally, some statistical indicators reported in the dissertation originate from secondary sources whose original datasets should be checked before publication in a peer-reviewed journal. Consequently, the present article distinguishes between the study's survey findings and externally verifiable institutional evidence.

9. Conclusion

Construction safety in Pakistan is influenced by interconnected regulatory, organizational, human and technological factors. The present comparative study indicates that weak regulatory enforcement and inadequate training are important perceived barriers within the Pakistani construction environment. The questionnaire findings show that 65% of respondents identified weak or infrequent enforcement and 70% identified inadequate training as significant challenges.

The comparison with the UK demonstrates the value of a structured, life-cycle approach to safety management. CDM 2015 distributes safety responsibilities across project participants and requires risks to be considered during design, planning and construction. The ILO's international framework similarly promotes preventive safety management and cooperation among governments, employers and workers.

For Pakistan, the evidence suggests that improvement should focus first on fundamentals: enforceable regulations, competent personnel, effective training, project-specific risk assessment, worker participation and systematic incident reporting. Digital technologies such as BIM and mobile inspection systems can subsequently strengthen these foundations.

The approval of Pakistan's national construction-sector OSH Code of Practice in 2026 creates an important contemporary policy opportunity. Its effectiveness will depend on implementation, institutional capacity and engagement by contractors, workers and regulators.

Overall, the study supports an approach based on adaptation rather than direct transplantation. UK practices provide useful reference points, but Pakistani safety interventions should be designed around local economic conditions, institutional capacity, workforce characteristics and project types. A combination of regulatory strengthening, organizational commitment, competency development, worker participation and appropriate technology offers a practical pathway toward safer high-risk construction environments.

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