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Enhancing Regional Development Project Delivery through Health, Safety, and Environmental Audit Systems

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Abstract- ***Regional development programmes increasingly depend on complex portfolios of roads, utilities, housing, tourism assets, industrial zones and public facilities. Their delivery performance is often judged through cost, schedule and quality, yet the same projects also create high exposure to occupational injury, environmental degradation, community disruption and reputational loss. This review examines how health, safety and environmental audit systems can improve regional development project delivery by converting fragmented compliance checks into a structured governance mechanism for risk prevention, corrective action and organisational learning. The aim is to develop a practical evidence-based framework that links HSE audit maturity with project delivery outcomes. The objectives are to: identify the core components of effective HSE audit systems; synthesize recent literature on occupational health and safety management, environmental management, digital monitoring and client-contractor performance control; evaluate how audit findings influence time, cost, quality, stakeholder confidence and sustainable value; and propose a maturity model suitable for large regional development programmes aligned with Saudi Vision 2030. A narrative review methodology was applied, drawing on peer-reviewed studies and institutional guidance published from 2020 to 2025. The findings show that HSE audits enhance delivery when they are risk-based, integrated with planning and procurement, supported by leading indicators, verified through competent auditors, and closed through time-bound corrective action. Digital tools, including dashboards, BIM, sensors, mobile inspections and AI-assisted analytics, strengthen audit traceability but cannot replace leadership commitment, workforce participation and contractor accountability. The paper concludes that HSE audits should be positioned as delivery assurance systems rather than as post-event inspection tools. Such systems can reduce rework, improve productivity, protect communities, support environmental compliance, and enable more resilient regional development outcomes.***

Keywords- ***HSE audit, regional development, project delivery, construction safety, environmental management, corrective action, Saudi Vision 2030, sustainable infrastructure.***

I. INTRODUCTION

Regional development projects differ from single-building projects because they combine physical infrastructure with economic, social and environmental transformation. A regional programme may include highways, drainage, utilities, workforce camps, public spaces, logistics corridors, hospitality assets and industrial facilities. These assets are usually delivered by multiple contractors, designers, consultants and public authorities working under demanding milestones. In such an environment, health, safety and environmental risk is not a side activity; it is part of the delivery system. A fall-from-height incident, heat stress outbreak, uncontrolled discharge, traffic accident or waste violation can stop work, attract regulatory attention, weaken trust and delay public benefits.

Saudi Arabia's Vision 2030 has accelerated a new generation of regional and giga-projects, placing higher expectations on governance, sustainability, localisation and investor confidence (Vision 2030, 2025). Similar pressures appear in international infrastructure programmes, where lenders and clients increasingly require environmental and social risk management, contractor oversight, grievance channels and transparent reporting (World Bank, 2024; IFC, 2025). The implication is clear: project delivery is no longer only an engineering and scheduling challenge. It is also an assurance challenge in which risks must be identified, controlled, verified and improved through disciplined systems.

HSE audits are one of the most important assurance tools in this setting. An audit is a systematic, documented and objective evaluation of whether policies, legal requirements, management plans, method statements, permits and field practices are actually implemented. Traditional audits, however, are often criticised for being checklist-driven, reactive and

separated from decision making. When audit reports are filed without timely closure, they become administrative documents rather than delivery tools. Recent research on occupational health and safety management systems shows that benefits appear when systems are supported by leadership, communication, workforce participation, training and reliable performance indicators (Kineber et al., 2023; Marhavilas et al., 2022). Construction safety studies also emphasise the need to move from lagging injury statistics to leading indicators such as inspections, observations, training, corrective action closure and safety climate (Golabchi et al., 2024; Fracasso et al., 2021).

The purpose of this paper is to review how HSE audit systems enhance regional development project delivery. The paper contributes a delivery-oriented framework that integrates audit planning, field verification, corrective action, digital evidence and management review. It also proposes a maturity pathway that moves projects from compliance checking to predictive, learning-centred audit governance. The argument is that HSE audits create value when they are embedded into the project life cycle, linked to procurement and contractor performance, and used by senior leadership to remove systemic barriers before they become incidents, claims or delays.

II. REVIEW METHODOLOGY

This paper adopts a narrative review design, similar in structure to regional development working papers that combine policy reports, technical studies and academic literature to identify trends, problems and responses. The review was not designed as a statistical meta-analysis because the topic crosses several domains: construction safety, environmental management, digital monitoring, project governance and regional development policy. Instead, the method follows a structured qualitative synthesis intended to produce a practical framework for project owners, consultants and contractors.

Documents were selected from peer-reviewed journals, institutional guidance and recent project assurance material published between 2020 and 2025. Search concepts included HSE audit, construction safety audit, occupational health and safety management systems, environmental management systems, leading indicators, digital construction safety, contractor performance measurement, environmental and social audit, and regional development infrastructure. The inclusion criteria were: relevance to project delivery or construction operations; explicit attention to health, safety, environmental or social risk management; publication in English; and practical transferability to large multi-contractor programmes. Studies focused only on manufacturing operations, healthcare settings or mature operational facilities were used only where they offered transferable evidence on HSE interventions.

The synthesis used four analytical questions. First, what audit system components are repeatedly associated with effective HSE governance? Second, how do audit activities influence delivery outcomes such as productivity, schedule certainty, quality, cost control and stakeholder confidence? Third, what role do digital technologies play in audit evidence, risk visibility and corrective action management? Fourth, how can regional development projects align audit systems with national transformation agendas, including Vision 2030, environmental stewardship and community protection?

The methodological limitation is that the review depends on published evidence and does not include new field survey data. However, its strength is the integration of recent safety, environmental and project governance literature into a single HSE audit delivery model. This is useful for regional programmes where specialist functions often work in separate silos despite sharing common delivery risks.

III. CONTRIBUTION OF THE REVIEW

The review offers three contributions for scholars and practitioners. First, it reframes HSE auditing as a delivery assurance process, not a compliance ritual. This matters because regional projects fail silently when schedule pressure separates safety, environment and production decisions. Second, it brings together occupational safety, environmental management and

client contractor governance into one framework. Most published studies examine these areas separately, while project teams experience them as connected field problems. Third, it translates recent research into usable audit design principles: risk based sampling, competent verification, leading indicators, corrective action discipline, digital evidence, and executive review. The framework can help owners compare contractors fairly, focus attention on high consequence activities, and identify systemic barriers that require management intervention. It can also support consultants who need a defensible structure for monthly audits, independent reviews and lender style assurance reports. For researchers, the framework creates testable propositions: projects with faster corrective action closure, stronger leadership participation and higher audit recurrence analysis should show fewer stoppages, lower incident potential, fewer environmental complaints and more predictable delivery. Thus, the review links theory with a governance route for safer and more sustainable regional development. It is especially useful for mega project environments where public value, contractor productivity, worker welfare, environmental protection and investor confidence must be managed together under compressed delivery timelines and evolving stakeholder expectations and controls.

IV. CONCEPTUAL FOUNDATION OF HSE AUDIT SYSTEMS

An effective HSE audit system is more than a periodic site visit. It is a repeatable management process that links requirements, risks, controls, evidence and corrective action. The system starts with clear audit criteria: legal obligations, client standards, ISO-based management system requirements, environmental and social commitments, project HSE plans, emergency procedures, permit systems, training matrices, and approved method statements. The audit then tests whether these criteria are understood and applied at the workface. This makes the audit a bridge between formal governance and real practice.

Table 1: HSE audit system dimensions, evidence, indicators and delivery value

Audit dimension	Typical evidence	Suggested KPI	Delivery value
Governance and leadership	Policy, audit authority, budget, leadership walks, escalation records	Management audit completion; critical finding escalation time	Clear accountability and faster removal of blockers
Risk-based planning	Activity risk register, audit universe, seasonal risk map, contractor risk profile	High-risk work packages audited on plan	Prevents stoppages during high consequence activities
Operational controls	Permits, method statements, lifting plans, temporary works, traffic controls	Permit compliance and critical control verification rate	Improves safe productivity and reduces rework
Environmental controls	Waste logs, discharge permits, monitoring records, spill response, dust/noise data	Environmental nonconformity closure time	Protects permits, communities and project reputation
Corrective action	CAPA register, root cause analysis, evidence of closure and field verification	Actions closed on time; repeat finding rate	Converts audit findings into permanent prevention

Contractor assurance	Prequalification, mobilisation audits, subcontractor inspections, scorecards	Contractor audit score trend	Creates comparable standards across the programme
Digital evidence	Mobile inspection records, geotagged photos, dashboards, drones, BIM links	Aged open findings; recurring risk trend	Improves transparency and executive decision making
Management review	Monthly trend review, lessons learned, resource decisions, policy updates	Systemic issues closed by function	Turns audit data into delivery intelligence

Source: Author synthesis based on recent HSE management and construction safety literature.

The first foundation is risk-based planning. High-risk activities such as lifting, excavation, work at height, confined spaces, energised systems, heavy traffic interfaces, waste handling, concrete works, chemical storage and heat exposure need greater audit frequency and stronger evidence requirements. A uniform monthly checklist cannot capture the changing risk profile of a regional programme. Safety research shows that construction work is dynamic and that resource allocation must account for management, machinery, mission, people and environmental conditions (Zeibak-Shini et al., 2024). Therefore, audit planning should follow the construction sequence, seasonal conditions, contractor capability and incident trends.

The second foundation is competence and independence. Auditors must understand both management systems and field execution. They need enough independence to report weaknesses without pressure, but enough project knowledge to distinguish isolated nonconformities from systemic failure. A competent audit does not simply ask whether a document exists. It tests whether supervisors use it, workers understand it, controls match the hazard, records are reliable, and corrective actions prevent recurrence. Arifuddin et al. (2025) show that leadership participation, planning, support, operations and performance evaluation are key dimensions of a construction safety audit system. These dimensions are directly relevant to regional projects because weak coordination across contractors can turn minor nonconformities into programme-wide vulnerability.

The third foundation is corrective action discipline. Audit value is realised only when findings are prioritised, assigned, closed and verified. Findings should be classified by severity and recurrence: critical stop-work issues, major system weaknesses, minor deviations, positive practices and improvement opportunities. Closure evidence should include photographs, revised procedures, training records, procurement actions, engineering changes or direct field verification. Repeated findings should trigger root cause analysis and management review rather than more reminders to the same supervisors.

The fourth foundation is integration. HSE audits should be connected to quality, planning, commercial and stakeholder management. Environmental findings can affect permits and community relations. Safety findings can affect productivity, manpower planning and insurance. Welfare findings can affect workforce stability. When audit information is isolated inside the HSE department, leaders lose early warning signals. When audit trends are reviewed with project controls, procurement and senior management, they become delivery intelligence.

V. SITUATION AND TRENDS IN REGIONAL PROJECT HSE GOVERNANCE

The construction industry has entered a period where HSE governance is being reshaped by scale, sustainability expectations and digitalisation. Large regional development projects involve extended supply chains and temporary organisations where performance depends on the weakest interface. Subcontractors may differ in language, safety maturity, equipment quality, supervision ratios and environmental awareness. In this context, audit

systems provide a common discipline for verifying minimum expectations and aligning behaviour across the programme.

Occupational health and safety management systems remain central. Kineber et al. (2023) reviewed OHSMS benefits in sustainable construction and found that implementation challenges often include poor communication, training gaps, weak safety culture, insufficient PPE use and incomplete compliance practices. These issues are common in regional development projects because fast mobilisation and schedule pressure can create uneven controls. Audits can expose such weaknesses early, but only if they include interviews, document sampling and field observation rather than office review alone.

The shift from lagging to leading indicators is another major trend. Traditional performance dashboards emphasise lost-time injuries and recordable incidents. These metrics are important, but they arrive after harm has occurred and can be distorted by underreporting. Leading indicators monitor preventive capacity: hazard observations, inspection completion, permit compliance, training coverage, closeout time, leadership site walks, emergency drills, near-miss reporting, environmental monitoring and subcontractor audit scores. Golabchi et al. (2024) highlight that leading indicators have evolved and are increasingly viewed as tools for understanding safety culture, management factors and early intervention. For an audit system, this means the checklist should measure control quality and learning behaviour, not merely paperwork availability.

Environmental audit expectations are also increasing. Regional development projects generate impacts through land disturbance, dust, noise, waste, wastewater, ecology, traffic, resource consumption and community disruption. The World Bank Environmental and Social Framework requires integrated risk management, stakeholder engagement and adaptive oversight (World Bank, 2024). The IFC ESMS toolkit emphasises policies, risk identification, management programmes, organisational capacity, emergency preparedness, stakeholder engagement, reporting, monitoring and review (IFC, 2025). These elements show that environmental auditing should not be limited to housekeeping. It should verify whether environmental commitments are embedded in construction methods and supply chain decisions.

Digitalisation is the fourth trend. Mobile inspection applications, QR-coded permits, drones, BIM, sensors, digital twins and dashboards can improve audit traceability. Trask et al. (2023) found growing evidence of digital OHS interventions in construction, while Zhang et al. (2023) argued that digital technologies can support situation awareness for hazard identification. Purushothaman et al. (2025) linked smart technologies to mitigation of major construction H&S factors such as falls, moving equipment, electrocution and pollutants. Yet digitalisation does not automatically improve safety. Poorly designed dashboards may create more data without better action. The practical lesson is that technology must strengthen human judgement, leadership accountability and corrective action closure.

VI. EFFECTS OF HSE AUDIT SYSTEMS ON PROJECT DELIVERY

HSE audit systems affect project delivery through several pathways. The first pathway is prevention of work stoppage. Serious nonconformities can lead to shutdowns, regulator intervention, client suspension, community complaints or contractor replacement. A well-planned audit identifies precursors before they escalate. Examples include incomplete edge protection, poor lifting plans, missing confined-space rescue arrangements, inadequate heat stress controls, uncontrolled runoff, unsafe traffic diversion, and poor storage of hazardous materials. When identified early, these issues can be corrected with limited schedule impact. When ignored, they can trigger incidents that consume management time and damage morale.

The second pathway is reduction of rework and quality failure. Safety and environmental problems often reveal weak planning. An excavation without adequate shoring may also lack utility verification. Poor waste segregation may indicate weak logistics planning. Uncontrolled dust may reflect inadequate work packaging. Audits that examine method statements, permits, supervision and field execution can therefore

expose delivery weaknesses before they appear as defects or claims. This aligns with recent work on digital quality management, which argues that compliance inspection and data-based monitoring can improve defect prevention and hidden work control (Luo et al., 2022).

The third pathway is productivity improvement. Safe sites are usually more organised sites. Clear access routes, equipment segregation, material storage, housekeeping, permit readiness and emergency planning reduce waiting time and uncertainty. HSE audits help standardise these conditions across contractors. When the audit process is collaborative rather than punitive, it also encourages supervisors to raise barriers that prevent safe production. Lingard and Pirzadeh (2025) show that client performance measurement regimes can influence contractor behaviour, but their design matters because autocratic, bureaucratic or collaborative control can produce different outcomes. For regional development projects, a balanced audit system should enforce minimum standards while encouraging joint problem solving.

The fourth pathway is cost control. Incidents produce direct costs such as medical treatment, equipment damage, clean-up, fines and replacement labour. They also create indirect costs through delay, investigation, retraining, insurance impacts and reputation loss. Environmental noncompliance can add remediation costs, permit delays and community disputes. Audits reduce these risks when findings are prioritised and integrated into commercial governance. Contract clauses should require audit participation, corrective action closure, transparent reporting and consequences for repeated critical failures.

The fifth pathway is stakeholder confidence. Regional projects are visible to communities, investors, ministries, lenders and future users. Transparent HSE audit systems demonstrate that the project is not treating safety and environment as public relations topics, but as operational commitments. Public monitoring research on environmental management plans in road construction shows the importance of meaningful performance indicators for assessing implementation and supporting oversight (Dahalan et al., 2023). This is especially important where projects affect traffic, water, biodiversity, noise, dust or local livelihoods.

VII. INTEGRATED HSE AUDIT FRAMEWORK FOR REGIONAL DEVELOPMENT PROJECTS

The proposed framework has six linked stages. Stage one is governance alignment. The project owner defines HSE policy, audit authority, reporting lines, minimum standards and escalation rules. These requirements are built into procurement, tender evaluation and contract conditions. Contractors submit HSE plans that are reviewed before mobilisation, and audit expectations are explained during kick-off meetings. This stage prevents the common problem of discovering after mobilisation that contractor systems do not match client expectations.

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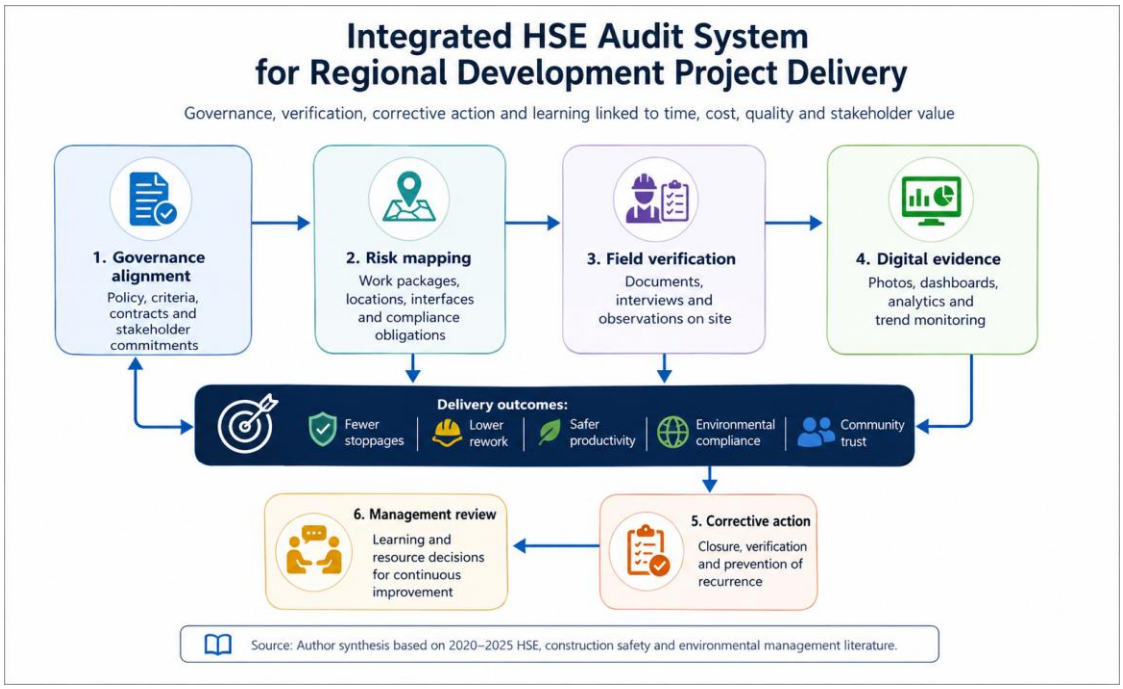
Figure 1: Integrated HSE Audit System for Regional Development Project Delivery



Source: Author synthesis based on 2020-2025 HSE, construction safety and environmental management literature.

Stage two is risk mapping. The project team develops an audit universe based on work packages, locations, contractors, legal permits, environmental receptors, community interfaces and critical activities. Each area is scored for risk exposure and audit frequency. The audit schedule remains flexible, allowing extra audits after incidents, seasonal changes, design revisions, acceleration measures or new subcontractor mobilisation. This reflects the risk-based approach used in environmental and social frameworks, where oversight must be proportionate and adaptive (World Bank, 2024).

Stage three is field verification. Audits combine document review, interviews, site observation, sampling and evidence testing. The auditor checks whether risk assessments match actual work, whether controls are engineered rather than improvised, whether workers understand hazards, whether supervisors verify controls, and whether environmental requirements are visible in daily planning. For example, a roadworks audit should test traffic management, plant segregation, dust suppression, noise control, spill kits, waste routes, emergency access and public protection. A utility corridor audit should test excavation permits, underground service scans, trench support, confined-space controls, water discharge, lifting plans and interface coordination.

Stage four is digital evidence management. Findings are recorded in a platform that captures photographs, location, contractor, risk category, responsible person, target date, status and verification evidence. Dashboards show open critical findings, aging actions, recurrence patterns, audit coverage, leading indicators and contractor rankings. Digital systems should also allow trend analysis across packages so that a recurring issue, such as poor lifting supervision, can trigger programme-wide intervention. However, data should be curated. Too many low-value findings can hide critical risks. The dashboard must serve decision making.

Stage five is corrective and preventive action. The project should distinguish correction from prevention. Replacing a missing guardrail is correction; revising the inspection regime, supervisor training and procurement standard is prevention. Root cause analysis should be mandatory for critical findings,

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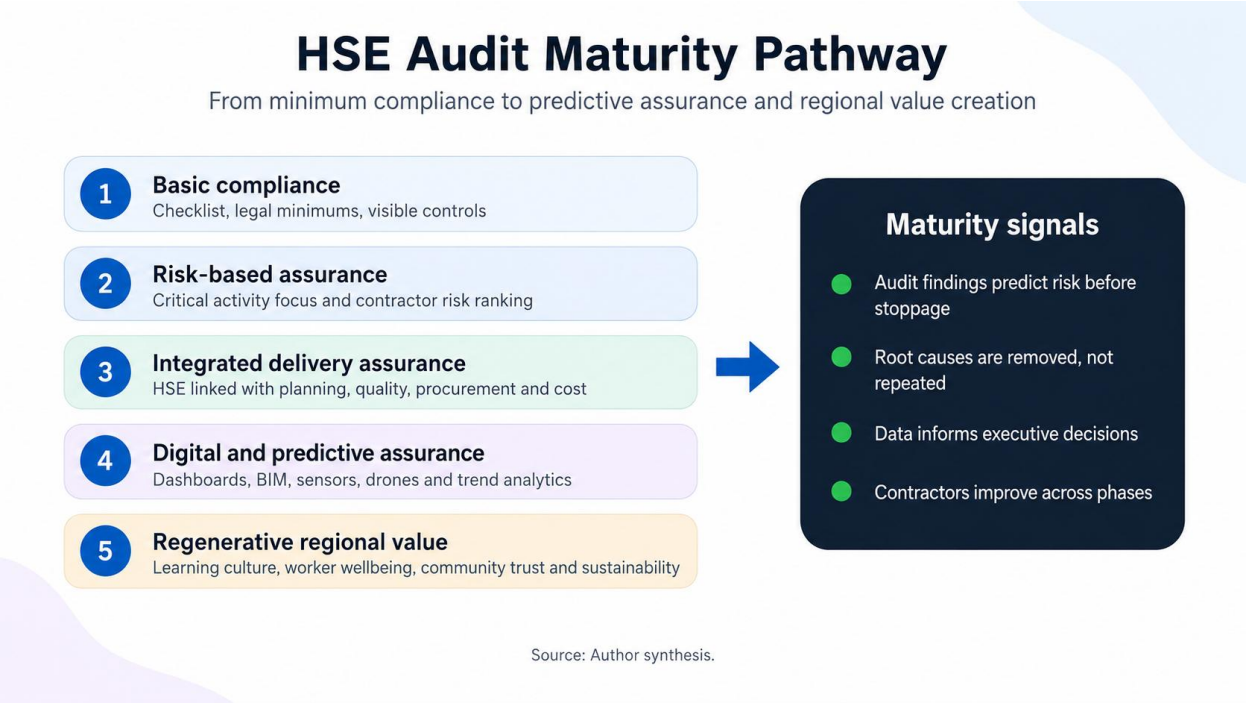
repeated nonconformities and high-potential near misses. Corrective action closure should be verified by competent personnel, not self-certified through unsupported photographs.

Stage six is management review and learning. Monthly HSE audit trend reviews should include the project director, construction manager, planning manager, procurement, quality, HSE, environmental specialists and key contractors. The review should ask: What are the top recurring risks? Which contractors require support or enforcement? Which work packages need redesign or additional resources? Which controls are working? What lessons should be shared across regions or future phases? This converts audit data into programme learning.

VIII. AUDIT MATURITY AND DIGITAL TRANSFORMATION

Audit maturity can be understood through five levels. Level one is basic compliance, where audits check whether documents and minimum site controls exist. This level is necessary but insufficient because it often reacts to visible nonconformities. Level two is risk-based assurance, where audit frequency and depth follow the risk profile of activities and contractors. Level three is integrated delivery assurance, where HSE findings are connected with planning, procurement, quality and commercial management. Level four is digital and predictive assurance, where dashboards, sensors, BIM, drones and AI-supported analytics help identify patterns before incidents occur. Level five is regenerative regional value, where audit systems support long-term safety culture, environmental stewardship, workforce wellbeing and community trust beyond the construction phase.

Figure 2: HSE Audit Maturity Pathway



Source: Author synthesis.

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Table 2: HSE audit maturity model for regional development projects

Level	Audit focus	Data sources	Delivery outcome	Governance action
1. Basic compliance	Legal and client minimums	Checklists, documents, visible controls	Avoids obvious breaches	Enforce minimum standards
2. Risk-based assurance	Critical activities and high-risk contractors	Risk registers, permits, incident trends	Reduces high-potential events	Target resources to priority risks
3. Integrated delivery assurance	HSE linked to programme controls	Schedule, quality, commercial and HSE data	Improves productivity and reduces rework	Review HSE trends with project controls
4. Digital and predictive assurance	Real-time visibility and trend analytics	Dashboards, BIM, sensors, drones, mobile audits	Prevents stoppage through early warning	Invest in interoperable data and analytics
5. Regenerative regional value	Long-term culture and stakeholder trust	Lessons learned, community data, wellbeing and sustainability indicators	Builds resilient regional value	Transfer lessons across phases and suppliers

Source: Author synthesis.

Digital transformation supports this maturity pathway by improving visibility, speed and traceability. Mobile audits can reduce delays between inspection and action. Drones can support environmental monitoring and work-at-height verification. BIM can help visualise temporary works, access routes, exclusion zones and emergency arrangements. Wearables and sensors can monitor heat exposure, proximity to plant and environmental conditions. Knowledge graphs and AI tools can help connect requirements with hazards, controls and lessons learned (Kong et al., 2024; Chong et al., 2025). Daniel et al. (2025) found that digital technology applications in construction safety frequently focus on models and simulations, while Purushothaman et al. (2025) identified smart PPE, mobile apps, BIM, VR, drones and sensors as technologies linked to risk reduction.

Nevertheless, digital audit systems can fail when they become a numbers game. A project may have hundreds of completed digital inspections but still tolerate unsafe behaviours if leadership ignores weak signals. Conversely, a smaller number of well-designed audits can create major improvement when they focus on critical risks, involve workers, and drive permanent corrective action. The audit maturity model therefore treats technology as an enabler rather than the centre of the system. The centre remains leadership, worker participation, competence, credible evidence and continuous improvement.

For Saudi regional development projects, digital HSE audit systems also support national goals by creating transparent delivery records, improving contractor capability and enabling data-driven governance across large portfolios. Vision 2030 emphasises government performance, economic diversification and quality-of-life outcomes; reliable HSE assurance helps protect those outcomes by reducing disruption, strengthening investor confidence and showing that rapid development can be delivered responsibly (Vision 2030, 2025).

IX. IMPLEMENTATION CHALLENGES AND MITIGATION MEASURES

Several challenges can weaken HSE audit effectiveness. The first is checklist fatigue. When auditors repeat generic questions, site teams treat audits as predictable paperwork exercises. Mitigation requires activity-specific audit protocols, rotating focus areas and periodic deep dives into critical controls. The second challenge is underreporting. Contractors may hide findings if audit scores affect

payment or reputation without a fair improvement pathway. A balanced regime should reward transparency and fast closure while applying consequences for repeated critical failures or deliberate concealment.

The third challenge is fragmented ownership. HSE departments often own the audit process, but many root causes sit outside their authority. Poor scheduling, late design information, inadequate procurement, weak subcontractor selection and insufficient supervision are management problems. Audit reports should therefore assign actions to the function that controls the cause, not only to the HSE manager. The fourth challenge is inconsistent competence. Large regional programmes need auditor calibration sessions, standard definitions, joint audits and peer reviews to ensure that findings are rated consistently across packages.

The fifth challenge is cultural and workforce diversity. Regional projects often employ multinational labour forces with different languages, experience levels and risk perceptions. Audit systems must therefore include worker interviews, multilingual evidence, welfare inspections and verification of practical understanding. Leadership site walks should be used to listen, not only to inspect.

The sixth challenge is environmental complexity. Regional projects interact with drainage networks, habitats, communities, archaeological resources, traffic systems and temporary utilities. Environmental audits should involve specialists and should test both physical controls and permit conditions. Bakkass et al. (2025) demonstrated that implementing an ISO 14001-based EMS on a construction site improved waste separation, recovery and environmental management skills. This supports the view that environmental audits can produce practical site improvements when linked to action plans and training.

Mitigation also requires governance rhythm. Daily supervision checks, weekly contractor inspections, monthly client audits, quarterly independent audits and annual management reviews each serve different purposes. Independent environmental, social, health and safety audit reports are increasingly used in international development projects to verify compliance and guide corrective actions (World Bank, 2025). Regional owners can adapt this logic by requiring both routine internal audits and periodic independent reviews for high-risk packages.

X. IMPLICATIONS FOR SAUDI VISION 2030 REGIONAL DEVELOPMENT

Saudi Arabia's regional development agenda is characterised by speed, scale and ambition. Tourism destinations, industrial zones, mobility corridors, urban regeneration, energy assets and public infrastructure are expected to contribute to economic diversification and quality of life. HSE audit systems can support this agenda in three practical ways.

First, they protect delivery continuity. High-performing audit systems reduce incident-driven stoppages, identify contractor capability gaps and create early escalation routes for critical risks. This is essential where multiple projects compete for labour, equipment and management attention. Second, they protect social licence. Communities and regulators are more likely to trust projects that can demonstrate systematic control of dust, noise, traffic, waste, water, worker welfare and emergency response. Third, they build national capability. When owners require strong audit systems, contractors improve documentation, supervision, training, environmental controls and data reporting. Over time, this raises the maturity of the local construction market.

A Vision 2030-aligned audit system should therefore include Saudi regulatory compliance, international good practice, Arabic-English reporting, heat stress controls, labour welfare, emergency preparedness, environmental monitoring, community interface management, supply chain oversight and sustainability indicators. It should also connect with Saudisation and skills development by training national auditors, HSE engineers and environmental specialists. The most advanced regional programmes can create shared audit lessons databases so that a solution developed on one package is rapidly transferred to others.

The proposed approach does not imply that audits alone can deliver safe and sustainable projects. Audits are part of a larger management system that includes design risk management, procurement, competent supervision, worker engagement, emergency planning and leadership accountability. However, audits provide the evidence loop that tells leaders whether those controls are actually working. Without that loop, project teams may rely on optimism until an incident reveals system failure.

XI. CONCLUSION

This review has shown that HSE audit systems can enhance regional development project delivery when they are designed as assurance and learning mechanisms rather than as routine compliance exercises. The evidence from recent safety management, environmental management and digital construction literature suggests that effective audits improve delivery through early risk identification, disciplined corrective action, stronger contractor accountability, improved environmental control, better stakeholder confidence and reduced disruption. The paper proposed an integrated framework consisting of governance alignment, risk mapping, field verification, digital evidence management, corrective and preventive action, and management review. It also presented a five-level maturity model from basic compliance to regenerative regional value. The central message is that audit maturity depends less on the number of inspections completed and more on the quality of evidence, relevance of audit criteria, competence of auditors, seriousness of leadership response and closure of systemic root causes.

For regional development projects in Saudi Arabia and comparable high-growth settings, HSE audit systems are strategically important. They support Vision 2030 by enabling safer construction, responsible environmental performance, resilient infrastructure delivery and public confidence in large-scale transformation. Future research should test the proposed framework using project case studies, contractor audit data, leading indicator performance and stakeholder outcomes. Practical development should focus on calibrated audit protocols, digital dashboards that prioritise critical risk, independent assurance for high-impact packages and stronger integration between HSE, project controls, procurement and executive decision making. When implemented in this way, the HSE audit becomes a driver of project certainty and sustainable regional value.

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