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Environmental compliance governance in Saudi Arabia
(A legal and institutional assessment of national center for environmental compliance)

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ABSTRACT
This paper examines the legal mechanisms that regulate environmental compliance in Saudi Arabia through an institutional case study of the National Center for Environmental Compliance (NCEC), using a qualitative doctrinal and legal-analytical approach to assess the transparency, regulatory oversight, and accountability of Saudi environmental governance related to NCEC's compliance-monitoring mandate. The assessment distinguishes the existence of statutory and institutional mechanisms from evidence of their operational performance. The legal-institutional analysis identifies the importance of accessible environmental information, allocated supervisory responsibilities, consistent inspection and monitoring procedures, and credible responses to violations. For the NCEC case, these dimensions provide a framework for evaluating how reported information may support compliance verification and how inspection findings may be connected to corrective and enforcement action. Because this paper does not present independently verified NCEC-level data on inspections, violations, processing times, or environmental outcomes, it cannot establish NCEC's measured environmental effectiveness. It evaluates the legal and institutional conditions relevant to its performance and identifies evidence needed for future empirical assessment. This paper recommends improving environmental disclosure, inter-agency information sharing, inspection consistency, and transparent performance reporting to strengthen environmental compliance governance.

Keywords: Environmental compliance, Environmental law, national center for environmental compliance, legal mechanisms, Saudi Arabia, environmental governance.

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1. Introduction

Environmental compliance has evolved from a narrow obligation to satisfy statutory requirements into a multidimensional governance challenge involving legal rules, institutional capacity, disclosure, regulatory monitoring, and enforceable accountability (Gunningham, 2009). This transformation is critical in jurisdictions pursuing economic diversification while strengthening sustainability commitments, where environmental law mediates the relationship between development and ecological protection (Khater et al., 2025). Across Arab states, engagement with international environmental agreements has intensified the need for effective domestic mechanisms that translate environmental commitments into enforceable compliance practices (Abi Chedid, 2025). Saudi Arabia provides a significant context because environmental regulation has become connected with the Kingdom's transition toward a low-carbon economy and sustainable development (Alomari & Heffron, 2021). The environmental principles associated with Saudi Vision 2030 have further strengthened environmental governance's role in national development and climate ambitions (Alomari & Heffron, 2023, Elgammal et al., 2022).

Recent assessments indicate that Saudi environmental policies align with sustainable-development priorities, while their effectiveness remains dependent on implementation and institutional capacity (Alsiary, 2026, Algamdy & Elgammal, 2026). Saudi environmental legislation has acquired a prominent role in environmental protection and sustainability, making effective compliance mechanisms central to translating legal commitments into environmental outcomes (Albat et al., 2024). Despite this regulatory development, environmental legislation does not ensure effective compliance, because environmental outcomes depend on how legal obligations are communicated, implemented, and enforced (Ismaeel, 2026). The central research problem is whether Saudi Arabia's existing legal and institutional framework provides an integrated system for governing environmental compliance through transparency, regulatory oversight, and accountability. Evidence on Saudi companies suggests that environmental transparency remains a key governance issue regarding the availability and disclosure of environmental information (Charchafa & Kimouche, 2024). International environmental governance research demonstrates that transparency can enhance accountability by enabling regulators and stakeholders to scrutinize environmental decisions and performance (Fontaine et al., 2022).

However, transparency alone cannot ensure compliance; accountability requires mechanisms that establish answerability and consequences for breaches of environmental obligations (Kramarz & Park, 2016). Sustainability governance literature treats transparency and accountability as interconnected institutional processes (Mason, 2020). In Saudi Arabia, governance indicators have also been associated with environmental outcomes, including efforts to reduce carbon emissions (Sarwar & Alsaggaf, 2021). Regulatory governance and public awareness can further shape environmental safety, showing that formal legal requirements require effective institutional arrangements to support (Islam et al., 2026). The problem is not simply whether environmental rules exist, but whether disclosure, oversight, institutional responsibility, and enforcement function as a compliance system. Nevertheless,

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existing scholarship remains fragmented, creating several important research gaps. Research on internal governance mechanisms has demonstrated their influence on Saudi firms' environmental performance but concentrates on corporate governance (Alwadani et al., 2024).

Prior studies linking corporate governance characteristics to environmental sustainability and business performance pay less attention to how legal disclosure requirements, regulatory supervision, and enforcement interact (Alnor, 2024). Research concerning environmental management teams and carbon-emissions performance advances understanding of organizational environmental governance but does not explain how public regulators secure compliance (Alamoudi & Alahdal, 2026). Governance-audit research under ESG regulations offers valuable insights into monitoring, though auditing is one component of the broader environmental compliance architecture (Hashed et al., 2025). Prior research on ISO 14001 has identified organizational motivations and implementation barriers but has not examined the broader statutory accountability framework (Mariotti et al., 2014). Therefore, a significant integration gap remains in how transparency, oversight, and accountability interact; a legal-institutional gap persists in how regulatory responsibilities are allocated and coordinated; and an enforcement gap remains in whether monitoring and accountability mechanisms translate formal environmental duties into effective compliance.

Against these gaps, this paper examines the legal mechanisms governing environmental compliance in Saudi Arabia through the institutional case of the National Center for Environmental Compliance (NCEC). It assesses how the regulatory design governing environmental information, supervision, and enforcement shapes the conditions under which NCEC can perform its environmental compliance functions. This focus matters because developments in Saudi corporate law and governance have raised expectations for institutional responsibility and accountability (Rizvi & Hussain, 2022). Contemporary regulatory effectiveness also depends on institutional and technological arrangements that support supervision, information management, and implementation (Sarabdeen, 2023). Specifically, this paper identifies NCEC's relevant legal and institutional functions; examines transparency and access to compliance information; evaluates inspection, monitoring, and regulatory coordination arrangements; analyzes accountability and enforcement pathways; and identifies criteria for judging NCEC performance verified operational evidence becomes available. Sustainable environmental governance affects corporate environmental performance in Saudi Arabia (Soussi et al., 2025) and is shaped by evolving national regulatory frameworks (Alhejaili, 2024).

This paper asks: RQ1: Which legal and institutional mechanisms define the NCEC's role in Saudi environmental compliance governance? RQ2: How do environmental disclosure and information-access arrangements enable NCEC's compliance functions? RQ3: How are oversight, inspection, monitoring, and coordination mechanisms structured in relation to NCEC? RQ4: How can non-compliance findings are connected to accountability and enforcement within the wider institutional framework? RQ5: What evidence and performance criteria are needed to assess the

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effectiveness of NCEC's contribution to environmental compliance? This paper contributes an institutional application of the transparency–oversight–accountability framework, distinguishing legal design from demonstrated operational outcomes (Gunningham, 2009).

Analytically, it extends transparency scholarship by treating disclosure as a legal mechanism whose effectiveness depends on its relationship with regulatory scrutiny and accountability (Fontaine et al., 2022). It contributes to accountability scholarship by linking answerability and consequences to the monitoring and enforcement capacities needed to produce meaningful environmental action (Kramarz & Park, 2016). In the Saudi context, it complements legal research on environmental protection and sustainable development by focusing on the coherence and practical governance functions of the compliance framework (Hegazy et al., 2024). It also contributes to scholarship on Saudi Arabia's sustainability transition by explaining how legal and institutional mechanisms can support wider sustainable-development transformation (Sultan et al., 2025).

2. Literature review

2.1. Legal and regulatory foundations of environmental compliance

Environmental compliance is understood as a governance process in which legal obligations, regulatory institutions, and complementary governance mechanisms interact to translate environmental objectives into standards of conduct for regulated actors (Gunningham, 2009). Contemporary environmental regulation extends beyond conventional command-and-control approaches by incorporating institutional supervision and broader governance arrangements designed to influence environmental behavior and regulatory performance (Mason, 2020). In Saudi Arabia, environmental law has grown in significance as a policy and regulatory instrument for reconciling economic transformation with environmental protection and the transition to a low-carbon economy (Alomari & Heffron, 2021). This legal orientation is reinforced by environmental principles associated with Vision 2030, which link national economic ambitions to environmental and climate responsibilities (Alomari & Heffron, 2023). Saudi environmental laws and regulations provide a developed legal foundation for environmental protection and the pursuit of national sustainability objectives (Albat et al., 2024).

The development of Saudi environmental policy demonstrates a closer relationship between regulatory strategies and the country’s broader sustainable-development agenda (Alsiary, 2026). Nevertheless, achieving environmental objectives requires more than adopting substantive environmental rules because their effectiveness depends on implementation, institutional capacity, and credible enforcement mechanisms (Ismaeel, 2026). Governance mechanisms complement the legal foundations of environmental compliance by operating within regulated organizations and interacting with external regulatory requirements (Alnor, 2024). Internal corporate governance mechanisms can influence Saudi firms' environmental performance by embedding environmental responsibility in organizational structures and decision-making processes (Alwadani et al., 2024). Environmental management

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teams affect corporate carbon-emissions performance, suggesting that organizational arrangements can help translate regulatory and sustainability expectations into environmental practices (Alamoudi & Alahdal, 2026).

Environmental accounting and sustainability-reporting frameworks add another legal dimension by establishing mechanisms to document, disclose, and subject environmental performance to regulatory and stakeholder scrutiny (Almaqtari et al., 2025). Governance audit mechanisms under ESG regulations further strengthen environmental scrutiny by connecting organizational environmental performance with verification and monitoring processes (Hashed et al., 2025). At the operational level, implementing environmental management standards shows how formal environmental requirements interact with organizational motivations and implementation barriers in Saudi establishments (Mariotti et al., 2014). Governance quality also has broader environmental implications, as evidence from Saudi Arabia indicates an association between governance indicators and efforts to reduce carbon emissions (Sarwar & Alsaggaf, 2021). Therefore, environmental compliance in Saudi Arabia can be conceptualized as multilayered legal-governance architecture in which legislation, institutional enforcement, corporate governance, and monitoring shape regulated establishments' capacity to meet environmental obligations (Soussi et al., 2025).

2.2. Transparency and environmental compliance

Transparency constitutes a fundamental component of environmental governance because access to reliable environmental information enables regulatory institutions and stakeholders to evaluate environmental conduct and compliance performance (Mason, 2020). Environmental transparency can strengthen public accountability by reducing informational asymmetries and making environmental decisions and organizational practices more visible to external scrutiny (Fontaine et al., 2022). In Saudi Arabia, research on corporate environmental transparency shows the growing importance of environmental information disclosure while highlighting differences in how companies communicate their environmental practices and performance (Charchafa & Kimouche, 2024). Environmental accounting and sustainability-reporting frameworks further institutionalize transparency by establishing mechanisms to generate, report, and communicate environmental information to relevant stakeholders (Almaqtari et al., 2025). Corporate governance arrangements also influence environmental performance, suggesting that internal governance quality can shape how organizations respond to environmental responsibilities and related disclosure expectations (Alwadani et al., 2024).

Environmental management structures contribute to carbon-emissions performance, reinforcing the importance of organizational responsibility and information systems in supporting environmental decision-making (Alamoudi & Alahdal, 2026). Transparency should be regarded as a substantive compliance mechanism because it provides an informational basis for evaluating whether regulated establishments are meeting environmental expectations (Alnor, 2024). The regulatory value of transparency depends on whether disclosed environmental information is linked to

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mechanisms for verification, scrutiny, and accountability (Ali & Kamraju, 2025). Governance audit mechanisms under ESG regulations illustrate this relationship by linking environmental information to processes that assess sustainability and emissions performance (Hashed et al., 2025). Accountability in environmental governance requires information that enables responsible actors to be identified, questioned, and held answerable for environmental decisions and outcomes (Kramarz & Park, 2016).

Governance quality is also linked to environmental outcomes in Saudi Arabia, suggesting that disclosure operates within a broader institutional setting that can shape environmental effectiveness (Sarwar & Alsaggaf, 2021). Regulatory governance and public awareness can further affect environmental safety, showing that information availability matters more when it interacts with institutional oversight and societal awareness (Islam et al., 2026). Saudi Arabia's evolving environmental policies also place environmental governance within a broader sustainable-development framework, where effective implementation depends on coherent regulatory and institutional mechanisms (Alsiary, 2026; Nazneen et al, 2023). Therefore, transparency provides the informational foundation for environmental compliance, but its regulatory effectiveness depends on integration with monitoring, oversight, verification, and enforceable accountability mechanisms.

2.3. Regulatory oversight and environmental compliance

Regulatory oversight is central to environmental governance because legal obligations require institutional mechanisms to monitor regulated activities, assess compliance, and respond to environmental risks (Gunningham, 2009). In Saudi Arabia, environmental law's effectiveness depends on enforcement capacity, as achieving sustainable development objectives requires translating environmental requirements into effective regulatory practices (Ismaeel, 2026). Saudi environmental legislation provides an expanding regulatory basis for environmental protection, increasing the importance of oversight mechanisms that ensure regulated establishments comply with applicable environmental requirements (Albat et al., 2024). Governance indicators are also linked to environmental outcomes in Saudi Arabia, underscoring the broader relevance of institutional and regulatory quality in controlling carbon emissions (Sarwar & Alsaggaf, 2021). Regulatory governance is a key factor in environmental safety and technological performance and public awareness (Islam et al., 2026).

Governance auditing under ESG regulations further shows how structured oversight mechanisms can help assess environmental sustainability and emissions performance (Hashed et al., 2025). Effective oversight is an institutional process that links environmental rules to monitoring, verification, regulatory intervention, and measurable compliance outcomes (Alsiary, 2026). Regulatory oversight also operates through the interaction between external supervision and governance mechanisms embedded within regulated organizations (Alwadani et al., 2024). Environmental management teams can influence corporate carbon-emissions performance, indicating that internal monitoring capacity can complement regulatory expectations and

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external environmental supervision (Alamoudi & Alahdal, 2026). Corporate governance characteristics likewise affect environmental sustainability and organizational performance, reinforcing the importance of assigned responsibilities within environmental governance structures (Alnor, 2024).

Environmental accounting and sustainability-reporting frameworks provide regulators with information to assess corporate environmental conduct and strengthen compliance monitoring (Almaqtari et al., 2025). The implementation of ISO 14001 in Saudi Arabia further shows that organizational motivations and barriers can shape effective environmental management and influence the practical implementation of environmental requirements (Mariotti et al., 2014). Saudi Arabia's transition toward a low-carbon economy requires legal and regulatory institutions that can align environmental supervision with broader national transformation objectives (Alomari & Heffron, 2021). Therefore, regulatory oversight is most effective when institutional mandates, environmental information, organizational monitoring, inspection, and enforcement operate (Soussi et al., 2025).

2.4. Accountability and environmental enforcement

Accountability is a fundamental element of environmental governance because compliance requires regulated actors to be answerable for their environmental conduct and to face consequences when they breach legal obligations (Kramarz & Park, 2016). Environmental accountability extends beyond formal responsibility by requiring institutional arrangements that connect environmental information, decision-making authority, regulatory scrutiny, and corrective responses (Mason, 2020). Transparency can reinforce this process by making environmental performance and regulatory decisions visible and subject to public and institutional scrutiny (Fontaine et al., 2022). In Saudi Arabia, effective environmental enforcement matters because credible implementation mechanisms support regulatory obligations and advance sustainable development (Ismaeel, 2026). Saudi environmental laws and regulations establish a legal basis for environmental protection, while their contribution to sustainability depends on effective regulatory application (Albat et al., 2024).

Environmental accountability requires a regulatory architecture in which legal duties are accompanied by monitoring, institutional responsibility, and mechanisms capable of addressing detected violations (Gunningham, 2009). From this perspective, enforcement is the operational dimension of accountability, linking non-compliance to regulatory intervention and consequences (Ali & Kamraju, 2025). Governance arrangements also shape accountability by determining how regulated organizations allocate, monitor, and evaluate environmental responsibilities (Alwadani et al., 2024). Governance audit mechanisms under ESG regulations can strengthen environmental accountability by subjecting sustainability and emissions performance to structured assessment and verification (Hashed et al., 2025). Environmental accounting and sustainability-reporting frameworks further support accountability by documenting environmental performance and providing information that can facilitate regulatory and stakeholder evaluation (Almaqtari et al., 2025).

Corporate governance characteristics can influence environmental sustainability,

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showing that internal responsibility structures matter for the effectiveness of broader environmental accountability arrangements (Alnor, 2024). Governance quality also matters at the institutional level, as governance indicators have been linked to carbon-emission outcomes in Saudi Arabia (Sarwar & Alsaggaf, 2021). Saudi Arabia's evolving environmental policy framework requires accountability mechanisms that support implementation of its broader sustainability priorities (Alsiary, 2026, Elgammal et al., 2023). Therefore, effective environmental enforcement depends on integrating clear legal responsibilities, reliable disclosure, regulatory oversight, and proportionate responses to non-compliance within a coherent accountability framework (Alomari & Heffron, 2021).

2.5. Integrating transparency, oversight, and accountability

Although transparency, regulatory oversight, and accountability are recognized as important elements of environmental governance, their effectiveness depends on the institutional relationships that connect information, monitoring, and regulatory consequences (Mason, 2020). Transparency can facilitate accountability by making environmental information and regulatory conduct accessible for scrutiny. However, disclosure does not produce effective environmental outcomes without mechanisms to evaluate and act on that information (Fontaine et al., 2022). Accountability requires more than formal reporting because meaningful environmental governance depends on institutional arrangements that establish answerability and consequences for environmental conduct (Kramarz & Park, 2016). Contemporary environmental regulation involves interconnected governance architectures (Gunningham, 2009).

In Saudi Arabia, existing research has separately examined corporate environmental transparency (Charchafa & Kimouche, 2024), internal governance mechanisms and environmental performance (Alwadani et al., 2024), governance auditing under ESG regulations (Hashed et al., 2025), and legal frameworks for environmental reporting (Almaqtari et al., 2025). This fragmentation reveals an integration gap in how transparency, oversight, and accountability function, as well as a legal-institutional gap in how regulatory responsibilities and compliance mechanisms interact within Saudi environmental governance (Alomari & Heffron, 2023). To address these gaps, this paper conceptualizes transparency, oversight, and accountability as connected and reinforcing components of environmental compliance governance. Transparency provides the informational foundation that makes environmental performance visible and assessable, as environmental disclosure grows in importance in Saudi corporate practice (Alnor, 2024; Elgammal & Al-Modaf, 2023). Oversight provides the institutional capacity to verify environmental information and assess whether establishments satisfy applicable environmental requirements, reflecting the broader significance of regulatory governance for environmental outcomes (Islam et al., 2026).

Accountability completes this governance relationship by linking identified non-compliance to answerability, corrective intervention, and enforcement, supporting the practical effectiveness of environmental law (Ismaeel, 2026). This integrated perspective matters for Saudi Arabia's transition toward sustainable development,

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where environmental legal mechanisms interact with broader economic and institutional transformation (Alomari & Heffron, 2021). Sustainable environmental governance can also influence corporate environmental performance, reinforcing the importance of examining institutional mechanisms as interconnected components (Soussi et al., 2025). Therefore, this analytical framework treats transparency as enabling visibility, oversight as enabling verification, and accountability as enabling regulatory consequences, providing an integrated basis for assessing the strengths and gaps in environmental compliance governance in Saudi Arabia (Ali & Kamraju, 2025).

3. Method

3.1. Research design and legal-analytical approach

This paper uses a qualitative doctrinal and legal-analytical case-study design, focusing on NCEC as an institutional actor in Saudi Arabia's environmental regulatory system. It examines how transparency, regulatory oversight, and accountability are legally structured and how these mechanisms bear on NCEC's capacity to support environmental compliance. The doctrinal approach identifies and interprets the relevant legal rules, regulatory instruments, institutional mandates, and enforcement arrangements. This paper considers the relationship among environmental duties, access to compliance information, inspection and monitoring, institutional coordination, and regulatory responses to non-compliance. Its conclusions concern institutional design and plausible performance conditions.

The legal-analytical component applies the three dimensions developed in the literature review as the principal analytical lenses through which legal and regulatory materials are examined. Transparency is assessed in relation to environmental disclosure requirements, reporting arrangements, and the accessibility of compliance-related information; oversight is examined through institutional competences, monitoring powers, inspection arrangements, and mechanisms for verifying compliance; and accountability is evaluated through enforcement authority, corrective measures, sanctions, and other legal consequences associated with environmental non-compliance. These dimensions are not independent categories but reinforcing components of a compliance cycle in which transparency enables regulatory visibility, oversight facilitates verification and detection, and accountability provides mechanisms to respond to identified violations. This analysis combines doctrinal interpretation with a governance-oriented assessment of how the relevant mechanisms interact in practice in regulatory designs.

3.2. Legal and regulatory sources

This paper examines Saudi environmental legislation, implementing regulations, institutional mandates, regulatory guidance, and other documents relevant to NCEC's environmental compliance functions. It examines requirements governing reporting and disclosure, inspection and monitoring, responsibility allocation among competent agencies, and responses to environmental non-compliance. This framework focuses on NCEC's legal and institutional setting and its interactions with regulated

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establishments and other authorities. Academic literature provides conceptual and comparative context but cannot substitute for official NCEC-specific documentation. This document does not provide a traceable dataset of NCEC inspections, permits, violations, enforcement decisions, staffing levels, or measured environmental outcomes; this analysis is not an empirical performance audit.

Sources are organized according to their relevance to the three analytical dimensions. This paper examines materials on disclosure, environmental information, and information accessibility under transparency, while provisions on regulatory authority, institutional competence, inspection, monitoring, verification, and supervision fall under oversight. Accountability covers legal provisions on violations, corrective actions, sanctions, liability, enforcement powers, and the consequences of non-compliance. When a legal or regulatory provision performs more than one function, it is considered across the relevant dimensions. This approach lets This framework assess whether individual legal mechanisms exist and how interconnected they are within the regulatory architecture.

3.3. Document selection and scope of analysis

We selected documents based on their relevance to NCEC's role in the Saudi environmental compliance system. Relevant materials include legal obligations imposed on regulated establishments; information and reporting arrangements; institutional competences; inspection and monitoring powers; referral and enforcement pathways; and provisions defining relationships among competent authorities. This paper prioritizes primary legal and institutional sources; secondary scholarship supports interpretation of transparency, oversight, accountability, and environmental governance. Because the document corpus does not enumerate NCEC-level operating records or an explicit sampling frame of NCEC decisions, the case study is bounded as a qualitative institutional and legal analysis. It is not a comparative ranking of government agencies or a causal estimate of NCEC's effect on air, water, or other environmental indicators.

The jurisdictional scope is Saudi Arabia and the institutional focus is NCEC. Therefore, this framework asks whether the relevant legal mechanisms support a coherent chain from information availability to inspection, verification, and corrective or enforcement response. Actual operational performance would require additional NCEC-specific evidence, including inspection coverage and frequency, risk-based targeting, confirmed violation rates, time to corrective action, closure and recurrence rates, publication practices, and independently validated environmental indicators. Such indicators are identified as future evaluation requirements.

3.4. Analytical framework

This paper develops an integrated analytical framework based on three interdependent dimensions of environmental compliance governance: transparency, regulatory oversight, and accountability. Therefore, this framework conceptualizes environmental compliance as a regulatory process in which information must first be available, compliance must be verified, and identified violations must prompt

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appropriate regulatory responses. Thus, transparency represents the informational dimension and captures environmental disclosure, reporting requirements, accessibility of environmental information, and the visibility of environmental performance. Regulatory oversight represents the supervisory dimension and encompasses institutional mandates, regulatory competences, inspection and monitoring powers, compliance verification, and coordination among competent authorities. Accountability is the consequential dimension and includes enforcement powers, corrective measures, sanctions, institutional responsibility, and mechanisms that make regulated establishments answerable for environmental non-compliance.

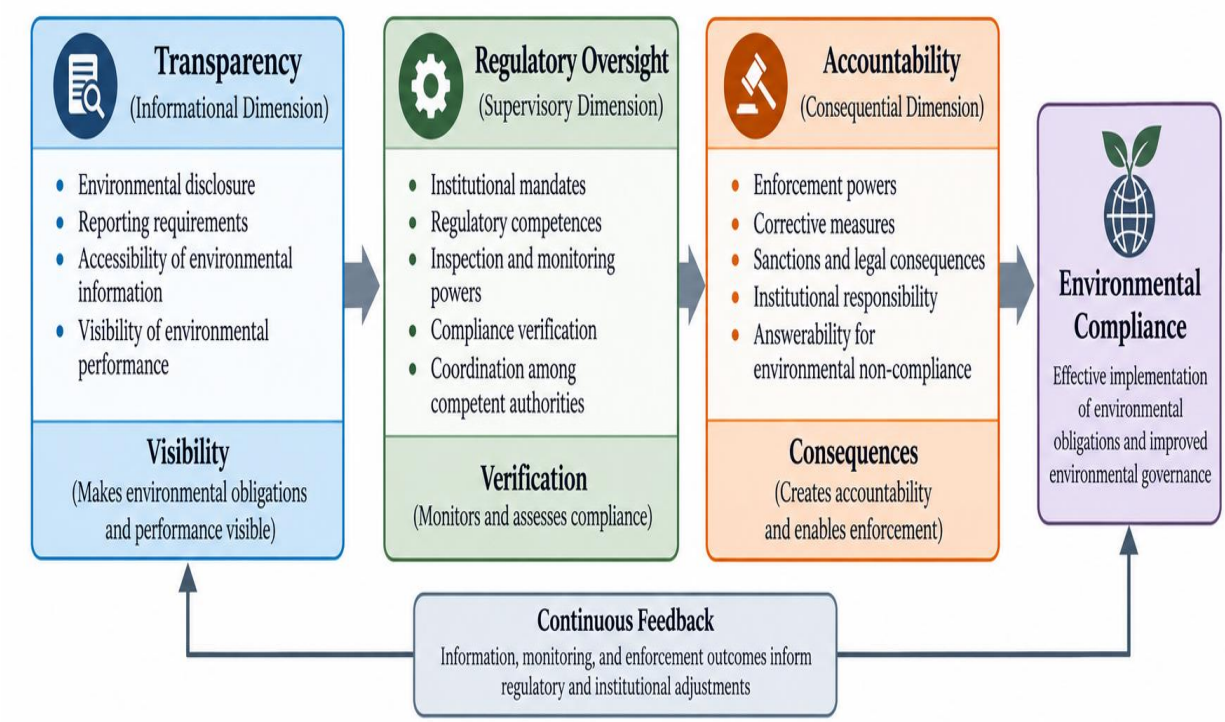

Figure 1. Analytical framework for transparency, regulatory oversight, accountability, and environmental compliance in Saudi Arabia

As Figure 1 illustrates, this framework establishes a sequential, reinforcing relationship among the three dimensions. Transparency enables visibility by making environmental obligations and performance accessible to regulatory and stakeholder scrutiny; oversight enables verification by allowing competent institutions to monitor conduct and determine whether applicable requirements have been satisfied; and accountability enables consequences by linking identified non-compliance with corrective or enforcement responses. However, the relationship is not linear because monitoring findings and enforcement outcomes can generate feedback that improves subsequent disclosure requirements, supervisory practices, and institutional arrangements. This framework incorporates a continuous feedback mechanism through which information, monitoring results, and enforcement experiences can

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contribute to regulatory and institutional adjustment.

The analytical framework also recognizes that these mechanisms operate within Saudi Arabia's specific legal and institutional context. Therefore, this framework treats the legal and regulatory framework, institutional capacity, governance arrangements, and sustainable-development objectives as contextual conditions that may strengthen or constrain transparency, oversight, and accountability. For example, a disclosure requirement may provide limited compliance value when information is inaccessible or unverifiable. At the same time, extensive inspection powers may deter violations when credible enforcement mechanisms are linked to detected violations. Similarly, accountability mechanisms may remain ineffective when fragmented institutional responsibilities or inadequate information constrain the identification of non-compliance. This framework evaluates each mechanism's adequacy and the coherence of their interaction, enabling this paper to identify legal gaps, institutional overlaps, coordination weaknesses, and implementation deficiencies within Saudi Arabia's environmental compliance architecture.

3.5. Legal document analysis procedure

The legal document analysis followed a structured, multi-stage procedure aligned with the analytical framework. In the first stage, we reviewed the selected legal and regulatory materials to identify provisions relevant to the three interdependent dimensions of environmental compliance governance: transparency, regulatory oversight, and accountability. We classified provisions addressing environmental disclosure, reporting requirements, accessibility of environmental information, and visibility of environmental performance under transparency as the informational dimension. We classified provisions on institutional mandates, regulatory competences, inspection and monitoring powers, compliance verification, and coordination among competent authorities under regulatory oversight as the supervisory dimension. We classified provisions addressing enforcement powers, corrective measures, sanctions, institutional responsibility, and mechanisms through which regulated establishments become answerable for environmental non-compliance under accountability as the consequential dimension. When individual provisions performed functions across multiple dimensions, this framework examined them across the relevant categories, reflecting the interdependent structure of the analytical framework.

In the second stage, we interpreted provisions within each dimension based on their legal clarity, regulatory scope, allocation of institutional responsibility, and relationship to other environmental compliance mechanisms. This framework examined connections among the three dimensions along the compliance sequence: transparency enables visibility, regulatory oversight enables verification, and accountability enables consequences. Therefore, the transparency analysis assessed whether relevant information could make environmental obligations and performance visible for regulatory and stakeholder scrutiny. The oversight analysis examined whether competent authorities possessed the institutional mandates and supervisory mechanisms necessary to verify compliance through monitoring, inspection, and

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assessment. The accountability analysis evaluated whether verified non-compliance could activate credible corrective measures, enforcement powers, sanctions, or other regulatory consequences. The cross-dimensional analysis determined whether these mechanisms reinforced environmental compliance governance or whether weak linkages between visibility and consequences created regulatory or institutional deficiencies.

In the final stage, this framework assessed how these mechanisms operated within the Saudi legal and institutional context identified in the analytical framework. This framework gave particular consideration to the legal and regulatory framework, institutional capacity, governance arrangements, and sustainable-development objectives as contextual conditions that can strengthen or constrain the effectiveness of transparency, regulatory oversight, and accountability. This framework also examined whether information generated through transparency mechanisms supported subsequent oversight, whether verification outcomes activated accountability mechanisms, and whether monitoring and enforcement experiences generated continuous feedback capable of informing regulatory and institutional adjustment. Therefore, findings are organized around the same three dimensions, ensuring methodological consistency between the analytical framework, document analysis, and interpretation of environmental compliance governance in Saudi Arabia.

3.6. Analytical reliability and research limitations

This framework remained consistent by applying the same interpretive criteria to all legal and regulatory materials. This framework examined each relevant provision through the three dimensions established in the analytical framework: transparency as the informational dimension, regulatory oversight as the supervisory dimension, and accountability as the consequential dimension. This framework assessed whether arrangements supported visibility, verification, and consequences, and considered the relationships among these functions. To strengthen analytical reliability, this framework interpreted legal provisions within their broader regulatory and institutional context.

This framework paid particular attention to how institutional responsibilities were allocated, how regulatory mechanisms related, and the extent to which the three dimensions formed a coherent compliance sequence. This framework also considered the contextual conditions, including the legal and regulatory framework, institutional capacity, governance arrangements, and sustainable-development objectives. Secondary academic literature supported conceptual interpretation and contextual understanding, while primary legal and regulatory materials remained the primary basis for evaluating Saudi Arabia's environmental compliance architecture. Maintaining consistent analytical categories throughout document selection, classification, interpretation, and synthesis enhanced the transparency and traceability of the analytical process.

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4. Results

4.1. NCEC as an institutional case within environmental compliance governance

The legal document analysis indicates that Saudi Arabia's environmental compliance is structured through a multi-layered legal and institutional architecture in which environmental obligations, regulatory competences, monitoring functions, and enforcement mechanisms operate as interconnected governance components. This framework treats environmental compliance as an obligation imposed on regulated entities. It establishes corresponding regulatory functions that enable competent authorities to supervise environmental conduct and respond to non-compliance. Within this architecture, environmental legislation provides the normative basis for environmental protection, while implementing regulations and related regulatory instruments translate general legal obligations into more specific requirements concerning environmental performance, permitting, monitoring, inspection, and enforcement. Institutional mandates further determine which competent authorities administer these requirements. Consequently, the formal compliance architecture comprises a substantive component that defines environmental obligations and an institutional-procedural component that establishes mechanisms to supervise and enforce them. Article 47 of the Saudi Environment Law requires implementing regulations to specify requirements for environmental inspection, assessments, audits, and permitting. It therefore provides a statutory basis for the procedural framework examined here (Saudi Environment Law, 2020).

Analyzing the selected documents shows that this architecture's effectiveness depends on the relationship between regulatory obligations and the institutional mechanisms established to implement them. Environmental requirements have limited regulatory value when the corresponding responsibility for supervision, verification, or enforcement is unclear. Conversely, institutional powers become meaningful when their objects of supervision and relationship with applicable environmental obligations are defined. Findings showed that institutional allocation is central to the Saudi environmental compliance framework. Competent authorities perform different but related functions, including regulatory administration, inspection, monitoring, compliance assessment, and responses to identified violations. This distribution of functions creates a comprehensive compliance structure, but it also makes institutional coordination and clear regulatory competences essential.

The informational dimension is reflected in provisions that require the production, reporting, disclosure, or availability of environmental information, establishing a legal basis for visibility. The supervisory dimension is reflected in institutional mandates and provisions on inspection, monitoring, assessment, and verification, which provide the legal basis for verifying compliance. The consequential dimension emerges through corrective measures, enforcement powers, sanctions, and other responses to violations, establishing the formal basis for regulatory consequences. These mechanisms are legally distinguishable but functionally interdependent. Information supports monitoring and inspection; monitoring can reveal non-compliance; and verified violations can trigger corrective or enforcement responses.

This framework also indicates that the formal presence of these mechanisms should

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not automatically be interpreted as evidence of their effective integration or implementation. The key analytical question is whether the legal and institutional arrangements link transparency, regulatory oversight, and accountability to create a coherent compliance process. For example, a disclosure or reporting obligation supports environmental compliance when the resulting information is accessible and can withstand regulatory scrutiny. Similarly, inspection and monitoring powers strengthen compliance when institutions define responsibilities and can translate findings into appropriate regulatory action. Enforcement provisions likewise depend on the preceding stages' capacity to identify and verify violations. Findings distinguish between the formal availability of regulatory mechanisms and their functional coherence within the wider compliance architecture. This distinction helps identify institutional overlaps, coordination weaknesses, implementation gaps, and weak links between different stages of environmental regulation.

Overall, Findings showed a formal legal and institutional foundation that can support environmental compliance by reinforcing informational, supervisory, and consequential mechanisms. At the same time, the architecture shows that effective compliance depends not simply on individual legal provisions but on the strength of their connections and the contextual conditions in which they operate. Legal and regulatory clarity, institutional capacity, governance arrangements, and coordination among competent authorities influence whether the formal architecture produces an integrated compliance process. In NCEC, this architecture is relevant because NCEC is the named institutional focus of This framework. The key case-study question is whether its assigned compliance functions are supported by usable environmental information, legally clear inspection and monitoring procedures, reliable channels to other competent bodies, and mechanisms linking verified violations to appropriate responses. The paper does not infer from these mechanisms that NCEC has achieved specific environmental improvements. That distinction between statutory capacity and observed performance governs how transparency, oversight, and accountability are interpreted thereafter.

4.2. Transparency and environmental information relevant to NCEC

Findings showed transparency as an established but unevenly operationalized component of Saudi Arabia’s environmental compliance architecture. Across legal and regulatory materials, transparency appears as requirements to generate, report, disclose, and make available environmental information associated with regulated activities. These requirements provide competent authorities with the information they use to understand environmental performance and assess whether regulated entities meet their environmental obligations. Environmental information performs a regulatory function beyond general public disclosure: it provides evidence that can support permitting, compliance assessment, monitoring, and subsequent regulatory intervention. Within this analytical framework, these mechanisms constitute the informational dimension of environmental compliance because they establish the conditions under which competent authorities, and, where information is accessible, external stakeholders, can see environmental obligations and performance. Article

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47(4)(j) expressly includes the publication of environmental information and data among matters to be specified by implementing regulations. This provides a statutory basis for disclosure, while its practical scope depends on the applicable regulations (Saudi Environment Law, 2020).

Nevertheless, this framework reveals an important distinction between producing environmental information and making it accessible. This framework includes mechanisms to generate and communicate environmental information for regulatory purposes. However, information availability within the regulatory system does not mean it is accessible beyond the competent authorities that receive it. This distinction matters for environmental compliance because information may meet a formal reporting requirement while offering limited transparency when its accessibility, consistency, or subsequent use remains restricted. Findings indicate that Saudi environmental transparency functions as a mechanism for regulatory visibility, whereas broader access to compliance-related information remains less embedded in the overall governance architecture. Transparency's analytical value depends on whether environmental information exists and whether relevant actors can obtain, interpret, and use it to scrutinize and assess compliance.

A further finding concerns the relationship between disclosure and institutional responsibility. Environmental information is distributed across a regulatory architecture involving different authorities, mandates, and compliance functions. Consequently, the usefulness of reported information depends on whether it reaches the institutions responsible for monitoring and whether those institutions can incorporate it into their supervisory activities. Findings identified this relationship as a potential vulnerability in the compliance architecture. When information-generation obligations lack integrated arrangements for information exchange, regulatory visibility can become fragmented across institutions. In such circumstances, one authority may hold information relevant to a compliance issue without connecting it to the monitoring or enforcement responsibilities exercised elsewhere in the regulatory system. Transparency must be assessed between regulated entities and competent authorities, and through the circulation of compliance information among institutions performing interconnected regulatory functions.

This framework also identifies the consistency and usability of environmental information as key conditions that affect transparency. Reporting and disclosure mechanisms support environmental compliance when the information produced can be compared, assessed, and linked to applicable regulatory requirements. By contrast, differences in reporting practices, fragmented information channels, or limited accessibility can reduce regulators' and other stakeholders' ability to obtain a coherent picture of environmental performance. Findings suggest that the central transparency challenge is not the absence of environmental information mechanisms, but how well existing mechanisms provide accessible, coherent, and compliance-relevant visibility. This distinction matters because formal disclosure cannot ensure effective environmental scrutiny when information remains dispersed, hard to access, or disconnected from the processes that verify compliance.

Lastly, findings show that the Saudi framework establishes the first stage of the

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environmental compliance sequence. However, the strength of this relationship depends on the accessibility, integration, and regulatory usability of the information generated. The formal framework provides channels for environmental information to enter the compliance system. However, limited access to information and limited institutional information sharing may weaken the transition from visibility to effective regulatory scrutiny. This finding also demonstrates why transparency cannot operate independently from the other two dimensions of the analytical framework. Information becomes consequential for compliance when competent authorities can use it to verify environmental conduct and when verified deficiencies can trigger appropriate regulatory responses.

Transparency provides the informational foundation of the Saudi environmental compliance architecture, while its practical regulatory value depends on its connection with the supervisory mechanisms of regulatory oversight. Applied to NCEC, the transparency dimension calls for examining what compliance information NCEC receives or produces, how it records that information, which authorities can access it, and what NCEC can disclose to the public. Publishing statistics on inspection activity and follow-up would allow external scrutiny of NCEC's work. The materials do not establish whether such NCEC-specific data exists or is of sufficient quality, so transparency is evaluated as an institutional requirement and a proposed performance criterion.

4.3. Regulatory oversight and monitoring relevant to NCEC

Findings identified regulatory oversight as the primary mechanism that transforms environmental obligations from formal legal requirements into matters subject to regulatory verification. The Saudi legal and regulatory framework allocates supervisory functions to competent environmental authorities through institutional mandates covering regulatory administration, inspection, monitoring, assessment, and responses to suspected or identified non-compliance. These arrangements constitute the supervisory dimension of the analytical framework because they provide the institutional capacity to examine information on environmental conduct against applicable requirements. Findings show that oversight serves an intermediary function within the compliance architecture: transparency makes environmental conduct visible, while regulatory oversight determines whether that conduct meets relevant environmental obligations. In this respect, environmental standards or reporting requirements do not establish compliance; compliance becomes institutionally meaningful when competent authorities have the legal authority and procedural mechanisms to verify it.

A central finding concerns the importance of institutional mandates and regulatory competences. Article 37 assigns the Ministry of Interior, in coordination with the competent authority, security monitoring, apprehension and referral of violators, and support for inspectors upon request. This illustrates the importance of inter-agency coordination in connecting inspection with enforcement (Saudi Environment Law, 2020). Documents establish distinct regulatory responsibilities for environmental administration and supervision, indicating that oversight is distributed across a

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broader institutional architecture. Such distribution can strengthen environmental governance by allowing specialized authorities to perform functions within their respective areas of competence. At the same time, this structure's effectiveness depends on how responsibilities are allocated. When institutional mandates intersect, distinguishing complementary responsibilities from overlapping competences becomes critical. Unclear boundaries may create duplicated supervisory activities, uncertainty about which authority is responsible for particular compliance matters, or gaps where responsibility is insufficiently assigned. Therefore, this framework identifies institutional competence as an organizational issue and a substantive condition affecting the regulatory framework's capacity to verify environmental compliance.

Inspection and monitoring powers represent the operational core of this supervisory dimension. The legal and regulatory materials examined provide mechanisms that allow competent authorities to move beyond information supplied by regulated entities and independently assess environmental conduct. Inspections let regulatory authorities assess whether activities and facilities comply with applicable environmental requirements. At the same time, monitoring provides an ongoing basis for observing environmental performance and identifying potential deviations from regulatory obligations. These mechanisms matter because they link documentary or reported information to regulatory assessment. Findings distinguish between reported compliance and verified compliance: information submitted by a regulated entity may indicate conformity with environmental requirements, but supervisory mechanisms must establish whether that information matches actual environmental conduct. Inspection, monitoring, and assessment provide the primary link between visibility and verification in the analytical framework.

Nevertheless, this framework indicates that supervisory powers do not ensure consistent verification. Their effectiveness depends on institutional capacity, procedural consistency, access to relevant environmental information, and competent authorities' ability to coordinate their activities. This is critical where environmental compliance requires information or regulatory action involving more than one institution. Findings identified coordination among competent authorities as a critical component of regulatory oversight. Effective coordination can facilitate information exchange, clarify supervisory responsibilities, and allow monitoring findings to move through the compliance system. Conversely, fragmented institutional arrangements or weak connections among information, inspection, and monitoring functions can reduce the coherence of regulatory verification. This framework's principal challenge is whether inspection and monitoring powers exist and whether coordinated institutional arrangements enable them to produce consistent, usable compliance determinations.

Another finding concerns the link between verification and subsequent regulatory action. Oversight achieves its full compliance function when it can communicate and use monitoring or inspection findings within the wider regulatory architecture. However, when monitoring identifies deficiencies or violations, findings must trigger corrective or enforcement mechanisms. This creates an important interface between

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the analytical framework's supervisory and consequential dimensions. Weakness can lead to situations where non-compliance is detected but does not trigger an adequate regulatory response. The effectiveness of oversight depends on inspection and monitoring mechanisms and the capacity to move verified findings into accountability processes. Overall, findings show that the Saudi environmental compliance framework includes the essential legal and institutional components required for regulatory oversight and verification, including institutional mandates, regulatory competences, inspection and monitoring powers, compliance assessment, and coordination functions. However, the coherence of this supervisory architecture depends on clear institutional responsibilities, consistent monitoring practices, accessible compliance information, and effective coordination among competent authorities.

Regulatory oversight represents the critical link between the informational and consequential stages of environmental compliance governance. Transparency provides the information required to make environmental conduct visible, while oversight determines whether that conduct complies with applicable requirements. non-compliance has been verified, the effectiveness of the overall system depends on whether the regulatory framework provides credible corrective measures, sanctions, enforcement powers, and institutional responsibility. For the NCEC institutional case, oversight performance would need to be established through documented evidence of inspection coverage, risk prioritization, consistent inspection protocols, follow-up after detected non-compliance, and the handling of referrals or coordinated cases. The doctrinal findings identify these as relevant functions and potential weaknesses; they do not quantify NCEC inspections, identify verified monitoring failures, or demonstrate changes in environmental quality attributable to its activities.

4.4. Accountability and enforcement in the NCEC institutional setting

Findings showed accountability as the consequential dimension of Saudi Arabia's environmental compliance architecture, translating verified non-compliance into regulatory responses. This legal and regulatory framework establishes mechanisms to address violations through enforcement powers, corrective measures, sanctions, and assigning responsibility for environmental conduct. These mechanisms distinguish accountability from preceding stages of transparency and regulatory oversight. While transparency makes environmental conduct visible and oversight lets competent authorities verify whether regulated entities meet applicable requirements, accountability determines what happens when they do not. Without this consequential stage, information and monitoring may identify environmental deficiencies but remain insufficient to create meaningful incentives for compliance or correction of unlawful environmental conduct.

A central finding concerns the relationship between enforcement powers and corrective measures. This framework indicates that regulatory responses to environmental non-compliance are not limited to punitive sanctions but may also involve measures intended to correct deficiencies and restore conformity with applicable requirements. This distinction matters because environmental enforcement

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serves corrective and deterrent functions. Corrective mechanisms aim to bring regulated activities back into compliance, while sanctions impose legal consequences for violations and strengthen the credibility of environmental obligations. Different forms of regulatory response give competent authorities a formal basis to respond to varying types and levels of non-compliance. However, the analytical significance of these mechanisms depends on their connection to findings from inspection, monitoring, and compliance verification. Enforcement powers matter when verified deficiencies can translate into appropriate regulatory action.

This framework further identifies sanctions and legal consequences as essential components of environmental accountability. Their regulatory importance lies not in the formal possibility of punishment but in their capacity to demonstrate that environmental obligations are enforceable. A compliance architecture that can detect violations but fails to trigger credible consequences risks weakening the deterrent effect of environmental regulation. This framework addresses this requirement by providing mechanisms that allow identified violations to trigger regulatory consequences. Nevertheless, Findings showed the importance of applying these mechanisms. The presence of sanctions does not indicate whether regulators apply enforcement responses across regulated activities or cases. Therefore, findings distinguish between the formal availability of enforcement mechanisms and their practical implementation, an issue doctrinal document analysis cannot determine.

Institutional responsibility and answerability add another dimension to the accountability findings. Effective environmental enforcement requires that regulated entities are answerable for non-compliance and the competent institutions responsible for administering environmental regulation have clear responsibilities for initiating and implementing regulatory responses. The first concerns regulated entities' responsibility to comply with environmental obligations and respond to identified deficiencies. The second concerns competent authorities' institutional responsibility to exercise their assigned regulatory powers. When enforcement responsibilities are dispersed or insufficiently linked to supervisory functions, the path from verified non-compliance to regulatory consequences can become fragmented. Clear institutional mandates and coordination are essential for oversight and for ensuring that verified violations reach authorities that can initiate an appropriate enforcement response.

Findings also demonstrate that accountability cannot be evaluated independently from transparency and regulatory oversight. Enforcement depends on reliable information about environmental conduct and on supervisory mechanisms that can establish whether a violation has occurred. In this sense, the consequential dimension is dependent on the preceding informational and supervisory dimensions. Weak environmental information can constrain the identification of potential violations, while inconsistent monitoring can reduce the reliability of compliance determinations. Conversely, strong transparency and oversight mechanisms have limited regulatory value when verified non-compliance is not followed by corrective or enforcement action. Findings showed that visibility without verification is insufficient, verification without consequences is incomplete, and consequences require reliable visibility and verification. Accountability ends the compliance sequence and reinforces the

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credibility of the preceding stages. Another finding concerns the analytical framework's built-in continuous feedback function. Enforcement outcomes can reveal recurring violations, weaknesses in existing regulatory requirements, monitoring difficulties, or areas where institutional responsibilities need clarification.

Such information can inform subsequent regulatory and institutional adjustments. Accountability can end the compliance process, and outcomes can feed back into transparency requirements, monitoring priorities, supervisory practices, and institutional arrangements. At the same time, this dimension's effectiveness depends on how enforcement mechanisms are linked to verified violations and on the clarity of institutional responsibility for regulatory action. In evaluating NCEC, an accountability assessment should trace the path from an inspection finding to notification, corrective requirements, competent-authority action, and, where applicable, documented closure. Relevant outcome measures include the proportion of confirmed violations that receive follow-up, completion of corrective action, recurrent non-compliance, and consistency of responses across regulated establishments. This analysis does not use NCEC-level administrative records to calculate these measures, so conclusions about enforcement effectiveness remain institutional and conditional.

4.5. Transparency, oversight, and accountability

The integrated framework of the three dimensions reveals that the effectiveness of Saudi Arabia's environmental compliance architecture depends less on the isolated existence of transparency, regulatory oversight, and accountability mechanisms than on the legal and institutional connections among them. This framework examined includes mechanisms that generate environmental information, supervisory arrangements that assess compliance, and enforcement mechanisms that respond to identified violations. These components correspond to informational, supervisory, and consequential dimensions. However, their collective regulatory value depends on whether supervisory processes can access environmental information, whether monitoring and inspection can determine compliance, and whether verified non-compliance can trigger appropriate corrective or enforcement responses.

This framework identifies the first critical interface between transparency and regulatory oversight. Environmental reporting, disclosure, and information-generation requirements create visibility, but their compliance value depends on whether competent supervisory authorities can access and use the resulting information. Findings indicate that the Saudi framework provides mechanisms to produce environmental information, but effective oversight depends on integrating that information across regulatory functions. Fragmented information channels, differences in accessibility, or insufficient institutional exchange may weaken the movement from visibility to verification. Consequently, the central issue is not simply the quantity of environmental information generated but whether that information is coherent, accessible, and connected to inspection, monitoring, and compliance-assessment processes. The transparency–oversight interface emerges as a potential point at which formal disclosure may fail to produce equivalent regulatory visibility across the institutional architecture.

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The second critical interface occurs between regulatory oversight and accountability. Inspection, monitoring, and compliance assessment enable competent authorities to identify deficiencies and verify non-compliance, but these supervisory outcomes become effective when they can trigger corrective measures or enforcement action. Findings showed that the legal architecture includes supervisory and consequential mechanisms; however, their effectiveness depends on procedural and institutional relationships between detection and response. When monitoring findings are not transferred to the enforcement authority, or when responsibilities for responding to violations are poorly coordinated, verification may not produce consequences. This interface is central to the environmental compliance system's deterrent and corrective capacity. Findings suggest that strengthening environmental compliance requires effective inspection and a clear regulatory pathway that links inspection findings to accountability mechanisms.

Across these interfaces, institutional coordination emerges as a cross-cutting condition that shapes the coherence of the three dimensions. Distributing environmental responsibilities among competent authorities can build specialization, regulatory capacity, and requires clear mandates, information exchange, and procedural coordination. This framework identifies potential institutional overlaps and fragmented responsibilities as relevant when multiple authorities participate in information management, compliance verification, or enforcement. Such fragmentation does not constitute a legal deficiency; multiple institutions may perform complementary functions. The regulatory concern arises when those relationships are insufficiently clear to ensure continuity across the compliance process. Findings distinguish between institutional plurality, which may support specialized environmental governance, and institutional fragmentation, which may weaken the transfer of information, compliance findings, or enforcement responsibilities across the regulatory system.

The integrated framework further distinguishes between formal regulatory completeness and functional regulatory coherence. At the formal level, this architecture includes components corresponding to each stage of the analytical framework (i.e., mechanisms for environmental information and disclosure, institutional powers for inspection and monitoring, and enforcement mechanisms capable of imposing consequences for non-compliance). However, formal completeness does not show that these components operate as an integrated system. Functional coherence requires reliable connections among the three dimensions, sufficient institutional capacity to perform assigned responsibilities, consistent monitoring and enforcement, and mechanisms for information and regulatory outcomes to circulate. Therefore, weaknesses in environmental compliance may stem from missing legal rules and weak linkages among otherwise existing regulatory mechanisms. This finding shifts the analytical emphasis from whether Saudi Arabia possesses environmental compliance mechanisms to how those mechanisms are legally and institutionally connected.

Enforcement outcomes and recurring patterns of non-compliance can inform future disclosure requirements, monitoring priorities, inspection practices, and regulatory

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design. Similarly, monitoring difficulties may reveal weaknesses in the accessibility of environmental information, while enforcement difficulties may expose ambiguities in institutional responsibilities or regulatory requirements. This feedback process helps adapt environmental governance to changing regulatory demands and sustainable-development objectives. Overall, the integrated findings indicate that Saudi Arabia has the key formal components of an environmental compliance system: transparency, regulatory oversight, and accountability.

Accessibility of environmental information, clarity of institutional competences, coordination among competent authorities, consistent monitoring practices, linking verified violations to enforcement mechanisms, and feedback from enforcement into regulatory improvement emerge as the main factors shaping that coherence. Therefore, findings support a shift from a mechanism-by-mechanism understanding of environmental compliance to an integrated governance perspective in which each dimension's effectiveness depends partly on the others. The case-study assessment is a structured appraisal of NCEC's legal and governance environment. Its distinctive contribution is to specify what to examine when assessing NCEC: the accessibility and comparability of compliance information, inspection quality and coverage, coordination with other authorities, the conversion of verified findings into action, and feedback from enforcement into targeting and regulation. These criteria create an auditable agenda for subsequent NCEC-specific empirical research.

5. Discussion and conclusion

5.1. General discussion

Findings showed that environmental compliance governance in Saudi Arabia rests on a developed legal and institutional architecture. However, its effectiveness depends on more than the formal existence of environmental rules and regulatory authorities. The results indicated that this framework incorporates mechanisms across three dimensions: transparency provides the informational basis for visibility, regulatory oversight establishes the supervisory capacity for verification, and accountability provides the legal basis for consequences following non-compliance. This finding aligns with Gunningham's (2009) argument that contemporary environmental governance depends on interconnected regulatory architectures and supports Alomari and Heffron's (2021) observation that law plays a central role in Saudi Arabia's transition toward stronger environmental governance. Similarly, the expanding environmental regulatory structure aligns with Albat et al. (2024), who emphasize the contribution of Saudi environmental laws and regulations to environmental protection and sustainability. These findings extend these perspectives by showing that regulatory development should not be evaluated by the number or breadth of environmental rules; the critical question is whether the mechanisms embedded in those rules operate as a coherent compliance process.

Regarding transparency, the results indicate that Saudi environmental governance includes mechanisms to generate, report, and communicate environmental information, establishing a formal informational foundation for compliance. However, this framework distinguishes between producing environmental information and

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making it accessible, integrated, and usable for regulation. This finding aligns with Charchafa and Kimouche (2024), who highlight the continued significance of environmental transparency in the Saudi context, and with Almaqtari et al. (2025), who demonstrate the importance of legal frameworks governing environmental accounting and sustainability reporting. It also aligns with Mason's (2020) broader argument that transparency in sustainability governance becomes meaningful when information supports accountability and stakeholder engagement. This paper advances the discussion by situating transparency within a specific compliance sequence. Environmental information does not automatically contribute to regulatory effectiveness simply because it is produced; its compliance value emerges when it creates sufficient visibility to enable scrutiny and subsequent regulatory verification. This interpretation aligns with Fontaine et al. (2022), who link transparency to stronger public accountability within the Saudi environmental compliance architecture; the transparency–oversight connection is critical.

Findings on regulatory oversight show that institutional mandates, regulatory competences, inspection, monitoring, and compliance assessment provide the formal supervisory mechanisms needed to verify environmental conduct. This result supports Ismaeel's (2026) emphasis on the relationship between environmental law, enforcement, and sustainable development in Saudi Arabia. It aligns with Sarwar and Alsaggaf's (2021) finding that governance quality relates to environmental performance. However, this analysis indicates that supervisory authority does not ensure effective verification. Institutional clarity, access to environmental information, consistency of monitoring practices, and coordination among competent authorities determine whether oversight mechanisms can operate. This finding also aligns with Islam et al. (2026), who emphasize the moderating role of regulatory governance in environmental outcomes. This paper contributes by showing that institutional coordination is an administrative concern and reflects a structural relationship between the informational and supervisory dimensions of environmental compliance. When environmental information is fragmented or institutional competences are poorly coordinated, the transition from visibility to verification may weaken when formal monitoring powers are available.

Regarding accountability and enforcement, results showed that the Saudi regulatory architecture includes enforcement powers, corrective measures, sanctions, and mechanisms to assign responsibility for environmental non-compliance. This supports Kramarz and Park's (2016) general proposition that accountability is meaningful when governance arrangements create mechanisms to hold actors answerable for their conduct. Findings also align with Ali and Kamraju's (2025) view of accountability and transparency as interconnected governance mechanisms and with Hashed et al. (2025), who show the importance of governance and audit mechanisms for environmental sustainability in Saudi Arabia. Nevertheless, this framework identifies an important distinction between the formal availability of enforcement mechanisms and their functional connection to verified violations. Accountability weakens when monitoring outcomes do not translate into corrective or enforcement responses. This interpretation extends existing Saudi environmental governance research by locating

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enforcement within a broader regulatory chain. Effective accountability requires a functioning transition from verification to consequences, supported by clear institutional responsibility and credible enforcement pathways.

The most significant finding emerges from the integrated framework of these three dimensions. The principal challenge is the absence of transparency, oversight, or accountability mechanisms, and the potential weakness of the interfaces connecting them. This result complements Alwadani et al. (2024), who demonstrate the importance of internal governance mechanisms for environmental performance, and Alamoudi and Alahdal (2026), who connect governance structures and environmental management arrangements with environmental performance in Saudi firms. This aligns with Alnor (2024), who identifies relationships between governance characteristics and environmental sustainability. However, this paper moves beyond organization-level governance by showing that similar interdependencies exist within the broader legal and regulatory architecture. Transparency without effective oversight may produce information without meaningful verification; oversight without accountability may identify violations without credible consequences; and accountability without reliable information and verification may lack an adequate evidentiary foundation. Environmental compliance should be understood as an integrated governance cycle.

This integrated interpretation also clarifies the significance of the continuous feedback mechanism incorporated into the analytical framework. Enforcement outcomes can reveal recurring compliance problems, weaknesses in existing environmental obligations, limitations in monitoring arrangements, or ambiguities in institutional responsibility. Such information can inform changes to disclosure requirements, supervisory priorities, institutional coordination, and regulatory design. This interpretation aligns with Alsiary's (2026) broader assessment of the relationship between environmental policy and sustainable development in Saudi Arabia and with Alomari and Heffron's (2023) analysis of environmental legal principles within the Kingdom's Vision 2030 transition. It also reinforces the wider governance proposition that transparency, accountability, and institutional capacity must operate (Mason, 2020; Gunningham, 2009). The feedback mechanism adds an adaptive dimension to this framework: visibility enables verification, verification enables consequences, and regulatory experience generated through those consequences can strengthen subsequent visibility and verification.

Overall, findings answer this paper's research questions and support its central proposition. Saudi Arabia has a formal legal and institutional architecture with the key mechanisms needed for environmental compliance, but its effectiveness depends on integrating its informational, supervisory, and consequential dimensions. Transparency creates environmental visibility, but its effectiveness depends on accessibility and regulatory usability; oversight provides verification, but its effectiveness depends on institutional clarity, capacity, consistent monitoring, and coordination; and accountability creates consequences, but its effectiveness depends on a credible link between verified violations and regulatory responses. These findings suggest that future development of Saudi environmental compliance

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governance should focus on introducing additional rules or enforcement mechanisms and strengthening the connections among existing mechanisms. The effectiveness of NCEC's contribution to environmental compliance depends on how information, verification, and regulatory consequences are joined in practice. The documentary approach identifies legal-institutional requirements and potential coordination risks, while it cannot determine whether NCEC has improved environmental conditions or outperformed alternative regulatory arrangements. Establishing that claim would require reliable NCEC-level administrative records, a specified assessment period, transparent performance indicators, and suitable environmental outcome data.

5.2. Theoretical contributions

This paper's primary theoretical contribution is not to introduce transparency, regulatory oversight, or accountability as new governance concepts, but to reconceptualize their relationship within a unified environmental compliance framework. Previous scholarship has established each mechanism as an important component of environmental governance, regulatory effectiveness, or institutional accountability (Gunningham, 2009; Kramarz & Park, 2016; Mason, 2020). This paper theorizes environmental compliance as a process of regulatory conversion: environmental information must become visible, visibility must be converted into verified regulatory knowledge, and verified non-compliance must be converted into consequences. This process-oriented formulation extends studies linking governance mechanisms to environmental performance (Alwadani et al., 2024; Hashed et al., 2025; Alamoudi & Alahdal, 2026) by identifying the interfaces between mechanisms as theoretically significant components of compliance governance.

A second theoretical contribution is introducing a distinction between formal regulatory completeness and functional regulatory coherence. Existing research on Saudi environmental governance has demonstrated the development and significance of environmental legislation, governance arrangements, institutional mechanisms, and regulatory frameworks (Alomari & Heffron, 2021; Albat et al., 2024; Almaqtari et al., 2025), while governance-oriented studies emphasize institutional quality and regulatory capacity in shaping environmental outcomes (Sarwar & Alsaggaf, 2021; Alnor, 2024; Islam et al., 2026). This paper extends those perspectives by arguing that a regulatory architecture may be complete yet incoherent: disclosure obligations, inspection powers, sanctions, and institutional mandates may exist. This framework identifies two theoretically important interfaces: the interface through which environmental information must become usable for regulatory scrutiny, and the verification–consequences interface, through which confirmed non-compliance must become actionable for enforcement. This interface-based perspective explains the potential gap between the apparent comprehensiveness of environmental regulation and its capacity to generate coherent compliance outcomes. Therefore, the appropriate theoretical unit of analysis is the individual regulatory mechanism and the quality of the institutional and procedural linkages connecting mechanisms.

The third contribution extends this sequential framework into a recursive compliance cycle through continuous regulatory feedback. This framework proposes that

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enforcement outcomes, recurring violations, monitoring results, and implementation difficulties generate regulatory knowledge that can reshape information requirements, inspection priorities, institutional arrangements, and enforcement practices. This interpretation complements the evolving relationship between environmental regulation and sustainable-development objectives identified in the Saudi context (Alomari & Heffron, 2023; Alsiary, 2026; Ismaeel, 2026) while offering a framework for examination in other regulatory settings. This paper's novelty rests on three linked theoretical advances: integrating previously separated governance mechanisms into a sequential compliance process, locating regulatory effectiveness at interfaces between those mechanisms, and incorporating feedback to explain how compliance governance can evolve. This framework shifts environmental compliance analysis from whether transparency, oversight, and accountability mechanisms exist to the more consequential question of whether, and how, they function as adaptive regulatory system.

5.3. Managerial contributions

At the national policy and legislative level, findings indicate that policymakers should prioritize strengthening the functional coherence of the existing environmental compliance architecture. Policymakers should periodically review environmental legislation and implementing regulations to map how disclosure obligations, monitoring responsibilities, inspection powers, and enforcement mechanisms connect across the full compliance cycle. Such reviews should identify regulatory gaps, overlapping competences, unclear institutional mandates, and points where information or compliance findings may fail to move between responsible authorities. A centralized or interoperable environmental compliance information infrastructure could further improve the transition from transparency to visibility by enabling relevant authorities to access consistent compliance information. Policymakers should establish periodic regulatory-review mechanisms that use recurring violations, inspection outcomes, enforcement patterns, and implementation difficulties to revise environmental requirements and regulatory priorities. These measures would institutionalize the proposed framework's continuous feedback component and support an adaptive compliance architecture aligned with Saudi Arabia’s broader sustainable-development objectives.

At the regulatory and institutional level, competent environmental authorities should strengthen the transition from visibility to verification through clearer responsibilities, coordinated monitoring, and consistent inspection procedures. Map institutional mandates so regulators can identify which authority receives environmental information, conducts inspections, verifies non-compliance, initiates corrective action, and imposes or refers enforcement cases. Regulatory authorities should also develop common inspection guidelines and risk-based monitoring criteria to promote consistency across facilities, sectors, and locations. Digital compliance records could link submitted environmental information to inspection histories, identified deficiencies, corrective actions, and enforcement outcomes, allowing regulators to track individual cases through the full compliance cycle. Performance assessment

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should move beyond counting inspections or enforcement actions and include the proportion of reported risks subjected to verification, time between detection and regulatory response, recurrence of previously identified violations, completion of corrective measures, and consistency of enforcement outcomes.

At the regulated-entity and managerial level, firms should treat environmental compliance as an integrated governance responsibility. Senior management should assign clear ownership of environmental obligations and establish internal procedures that connect environmental data collection, compliance reporting, operational monitoring, internal review, corrective action, and escalation of significant compliance risks. Environmental managers should maintain a compliance register that identifies each applicable requirement, the responsible organizational unit, required evidence of compliance, reporting deadlines, monitoring results, identified deficiencies, corrective actions, and closure status. Organizations should also verify internal environmental information before regulatory submission so transparency reflects reliable environmental performance. Boards and senior executives should review material environmental risks, repeated violations, unresolved corrective actions, and trends in regulatory findings.

At the cross-system and stakeholder level, practical improvement requires stronger connections among regulators, regulated entities, environmental information systems, and relevant external stakeholders. Authorities should make non-confidential environmental compliance information more accessible through standardized public reporting, searchable disclosure platforms, or periodic compliance reports that communicate regulatory priorities, aggregate inspection findings, common violation categories, corrective-action trends, and enforcement outcomes. Such disclosure would improve transparency and accountability while also helping firms learn from recurring compliance problems across sectors. Regulators and industry representatives should establish structured consultation mechanisms to identify recurring implementation difficulties without weakening regulatory independence or enforcement responsibility. Regulatory personnel and environmental managers should also receive training on reporting standards, inspection expectations, evidence requirements, corrective-action procedures, and changes in environmental regulation.

5.4. Limitations and directions for future research

This paper has several limitations to consider when interpreting its findings. First, this paper uses a qualitative doctrinal and legal-document analysis to evaluate the formal legal and institutional architecture of environmental compliance. The existence of transparency requirements, inspection and monitoring powers, enforcement mechanisms, and institutional responsibilities does not establish how these mechanisms operate in practice. Second, this framework depends on the accessibility and content of the legal, regulatory, institutional, and policy documents in the documentary corpus. Internal administrative procedures, detailed inspection records, enforcement decisions, inter-agency communications, and other non-public information may reveal implementation dynamics that available documents cannot capture. A central limitation of NCEC is the lack of independently verifiable,

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institution-specific operational and environmental outcome data. Future research should collect official NCEC reporting and administrative records, identify the relevant assessment years, document the legal instruments applied in inspected cases, and triangulate administrative results with environmental monitoring data before concluding achieved outcomes.

Third, while this paper focuses on Saudi Arabia, examining the country's evolving environmental governance architecture is necessary; however, institutional and regulatory differences limit the generalizability of findings to other jurisdictions. Finally, the analytical framework identifies relationships among transparency, regulatory oversight, accountability, and continuous feedback at the conceptual and legal-institutional levels but does not test causal relationships among these dimensions. Findings should be interpreted as evidence of regulatory structure and potential institutional linkages. These limitations create several directions for future research. Empirical studies could test the proposed framework through interviews with regulators, environmental managers, regulated entities, and other relevant stakeholders to determine whether transparency generates effective visibility, regulatory oversight converts that visibility into verification, and accountability translates verified non-compliance into regulatory consequences.

Quantitative research could operationalize these relationships by developing indicators of information accessibility, monitoring and inspection effectiveness, compliance verification, enforcement responses, corrective-action completion, and recurrence of violations. Longitudinal research could further examine whether enforcement outcomes and implementation experience generate continuous feedback that improves subsequent disclosure requirements, supervisory priorities, institutional coordination, and regulatory design. Comparative studies across Gulf Cooperation Council states, or other regulatory systems, could assess whether this framework remains applicable under different legal and institutional conditions.

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