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Sustainable Infrastructure Delivery in Red Sea Global Developments: A Vision 2030 Review of Quality, HSE, Procurement, and Stakeholder Governance

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Abstract- ***Saudi Arabia's Vision 2030 has placed large-scale tourism, infrastructure, and regional development projects at the centre of economic diversification. Red Sea Global (RSG) represents one of the most visible examples of this transition because its developments combine luxury tourism, environmental regeneration, local economic participation, and high delivery complexity. This review paper examines how sustainable infrastructure delivery can be strengthened in Red Sea Global-type developments through an integrated governance model that combines quality management, health, safety and environmental (HSE) control, procurement governance, and stakeholder engagement. The study adopts a structured narrative review of public Vision 2030 and RSG documents, international project governance standards, sustainability reporting frameworks, and recent construction-management practice sources. The review finds that the main delivery challenge is not the absence of individual systems, but the fragmentation between them. Quality control often focuses on specifications and non-conformance closure; HSE governance focuses on hazard prevention and compliance; procurement governance focuses on supplier performance and material availability; and stakeholder governance focuses on coordination, approvals, and community expectations. In giga-project conditions, these domains must operate as one decision system supported by stage-gates, digital dashboards, risk registers, supplier traceability, lessons-learned mechanisms, and transparent reporting. The paper proposes an integrated governance framework and lifecycle workflow for sustainable infrastructure delivery in RSG-style projects. The contribution is a practical review model that links Vision 2030 objectives with construction execution discipline, making sustainability measurable at site, package, programme, and portfolio levels.***

Keywords- ***Saudi Vision 2030, Red Sea Global, Sustainable Infrastructure, Construction Governance, HSE, Quality Management, Procurement, Stakeholder Management, Giga-Projects, Regenerative Tourism***

I. INTRODUCTION

Saudi Arabia's Vision 2030 has transformed the strategic meaning of infrastructure delivery. Construction is no longer only a technical activity aimed at producing buildings, utilities, resorts, roads, or public-realm assets. It is also a national delivery mechanism for economic diversification, tourism growth, employment creation, local supplier development, environmental stewardship, and global competitiveness. Red Sea Global illustrates this shift clearly. Its destinations are designed to support the Kingdom's tourism ambitions while demonstrating a regenerative approach that protects coastal and marine ecosystems, reduces carbon intensity, and creates long-term socioeconomic value (Vision 2030, 2025; Red Sea Global, 2024). In such an environment, project success cannot be measured by time, cost, and scope alone. It must also include safety performance, quality resilience, stakeholder confidence, procurement integrity, environmental protection, local-content outcomes, and asset readiness for operations.

The selected topic is important because RSG-type developments contain the main tensions of contemporary giga-project delivery. They are high-value, multi-package, multi-stakeholder programmes executed in remote or sensitive environments, often under intense schedule pressure. They require civil works, hospitality assets, utilities, public-realm infrastructure, logistics, specialist finishes, safety systems, digital coordination, and commissioning to progress together. These projects also involve many contractors, consultants, client representatives, statutory entities, communities, suppliers, and future operators. Under these conditions, a weakness in one governance area quickly becomes a weakness in the

whole programme. Poor procurement planning can create material shortages that trigger schedule compression and unsafe work. Weak design coordination can produce rework that affects quality, cost, and environmental performance. Inadequate stakeholder communication can delay approvals, increase claims, and damage trust. A sustainable infrastructure system therefore requires integrated governance rather than isolated departmental controls. This review paper examines sustainable infrastructure delivery in Red Sea Global developments from the perspective of four interdependent governance domains: quality, HSE, procurement, and stakeholder governance. These domains were selected because they directly influence construction reliability and long-term value. Quality governance protects specifications, design intent, inspection discipline, material compliance, and handover readiness. HSE governance protects workers, communities, ecosystems, and corporate reputation. Procurement governance determines whether the right materials, subcontractors, specialists, and equipment are available at the right time and in line with sustainability commitments. Stakeholder governance ensures that client requirements, regulatory approvals, community expectations, contractor interfaces, and operational needs are aligned through the project lifecycle.

The paper contributes to the literature and practice by proposing an integrated delivery-governance model suitable for Vision 2030 giga-projects. The model is not limited to Red Sea Global, but RSG provides a useful context because its public sustainability commitments, regenerative tourism approach, partnership model, and development scale create a clear case for integrating technical delivery with sustainability governance. The review is especially relevant to project directors, construction managers, HSE leaders, procurement managers, quality teams, planners, consultants, and client-side programme managers who need to convert high-level sustainability strategies into practical construction controls.

II. VISION 2030 AND THE RED SEA GLOBAL DEVELOPMENT CONTEXT

Vision 2030 positions tourism, quality of life, infrastructure, investment, environmental sustainability, and private-sector development as key pillars of national transformation. RSG is presented as one of the flagship companies supporting this transformation by delivering destinations that combine economic diversification and sustainable growth (Vision 2030, 2025; Red Sea Global, 2026a). The Red Sea destination is notable for its planned hotels, residential assets, airport connectivity, renewable energy infrastructure, marine conservation approach, and staged openings across several years (Red Sea Global, 2026b). Public RSG materials describe the development as a regenerative tourism destination where sustainability is not a secondary compliance topic but a core design and operating principle.

This context changes how infrastructure delivery should be interpreted. Conventional construction management often separates execution into technical packages: civil structures, finishes, mechanical and electrical systems, utilities, public realm, logistics, and operations. In regenerative tourism projects, each package must also be assessed against environmental, social, governance, and operational objectives. A road, marina, resort, golf facility, staff accommodation, utility corridor, or public-realm asset must satisfy technical performance while reducing ecological harm, protecting workforce wellbeing, enabling future maintenance, and supporting the guest experience. Sustainable infrastructure delivery therefore requires a governance system that can translate strategic commitments into procurement choices, daily site controls, inspection records, digital coordination, and stakeholder decisions.

RSG's public reporting highlights environmental regeneration, renewable energy, biodiversity protection, community empowerment, local economic contribution, and sustainable procurement as recurring themes (Red Sea Global, 2024; Red Sea Global, 2026c). These themes are directly relevant to construction governance because they depend on contractor behavior, supplier choices, materials logistics, quality assurance, HSE performance, and

stakeholder discipline during construction. A sustainability report can declare ambition, but the programme achieves that ambition only when drawings are coordinated, method statements are reviewed, inspections are completed, hazards are controlled, procurement decisions are traceable, non-conformances are closed, and affected stakeholders remain informed.

For project leadership, the implication is that sustainable infrastructure delivery must be managed as a lifecycle system. The lifecycle begins with strategic brief and design development, continues through tendering and procurement, becomes visible during site execution, and is verified during commissioning, handover, and operations. A failure to involve HSE, quality, procurement, and stakeholders early will create problems during execution. Conversely, an integrated system can reduce rework, improve workforce safety, support environmental outcomes, stabilize supply chains, and improve confidence among clients and communities.

III. REVIEW METHODOLOGY

This paper applies a structured narrative review methodology. A narrative review is appropriate because the topic spans construction project management, sustainability governance, quality management, HSE systems, procurement, stakeholder theory, and Saudi giga-project delivery. The aim is not to produce a meta-analysis of a single measurable effect, but to synthesize concepts and convert them into a practical framework for infrastructure delivery. The review was guided by three questions: first, which governance domains are most critical for sustainable infrastructure delivery in RSG-type developments? second, how do quality, HSE, procurement, and stakeholder systems interact across the project lifecycle? third, what practical framework can connect Vision 2030-level objectives with site-level delivery controls?

Sources were selected from four groups. The first group included official Saudi Vision 2030 and RSG sources to establish the national and project context. The second group included international standards and frameworks such as ISO 21502 for project management, ISO 19650 for information management using BIM, ISO 37301 for compliance systems, PMBOK guidance, GRI standards, IFRS sustainability disclosure standards, and TNFD recommendations. The third group included industry reports on digital construction, sustainable procurement, construction productivity, and project governance. The fourth group included recent academic and professional literature on construction HSE, stakeholder engagement, quality management, sustainable infrastructure, and procurement governance. Preference was given to sources from 2020 onward, while selected older standards were considered only where they remain active reference frameworks.

The review followed four analytical steps. First, key concepts were extracted from the sources and grouped into the four domains of quality, HSE, procurement, and stakeholder governance. Second, the relationships between the domains were mapped using typical construction failure pathways, such as procurement delay leading to schedule compression, which then increases HSE exposure and quality risk. Third, lifecycle controls were identified for strategy, design, procurement, construction, and handover phases. Fourth, the controls were synthesized into a stage-gate governance model that can be used by project directors and programme teams. The method is therefore interpretive but structured, and its output is a framework that can be tested in future empirical studies.

IV. LITERATURE REVIEW

4.1 Sustainable Infrastructure delivery:

Sustainable infrastructure delivery refers to the management of infrastructure assets in a way that balances technical performance, environmental protection, social value, resilience, and long-term operational efficiency. In Vision 2030 projects, sustainability is strongly connected to national outcomes, including tourism growth, local capability, quality of life, and economic diversification. The literature emphasizes that sustainability must be embedded in decision-making rather than added as a reporting layer after construction decisions have already been made. For RSG-type developments, this means that sustainability criteria must influence

design reviews, value engineering, supplier selection, construction methods, waste management, logistics planning, and handover documentation.

4.2 Quality Governance:

Quality governance in construction includes the policies, responsibilities, inspection systems, approval workflows, and improvement processes that ensure works conform to design requirements and intended performance. In large programmes, quality failures often emerge from interface complexity rather than from a single technical error. Civil, architectural, structural, mechanical, electrical, landscaping, and specialist packages may each meet their own requirements but still create conflicts when integrated. BIM coordination, inspection and test plans, mock-ups, material submittals, factory acceptance tests, non-conformance reporting, and lessons learned are therefore essential. Quality governance also needs escalation discipline: recurring defects must not remain at site level when they indicate design, procurement, supervision, or supplier-system weaknesses.

4.3 HSE governance:

HSE governance covers hazard identification, risk assessment, method-statement control, permit-to-work systems, emergency preparedness, incident investigation, worker welfare, environmental controls, and leadership engagement. Construction HSE is particularly critical in remote, hot, coastal, or environmentally sensitive locations because the risk profile includes logistics, heat exposure, lifting operations, temporary works, marine interfaces, traffic management, dust, waste, and accommodation conditions. Modern HSE thinking also emphasizes leading indicators, such as safety observations, training completion, near-miss reporting, high-risk activity audits, and corrective-action closure. In sustainable infrastructure projects, HSE performance should be treated as a value-delivery measure rather than merely a compliance obligation.

4.4 Procurement governance:

Procurement governance determines whether a project obtains the right capacity, materials, equipment, subcontractors, and specialist knowledge to deliver the required outcomes. In giga-projects, procurement is not only a commercial function. It is a sustainability, schedule, quality, and risk function. Supplier prequalification must include quality capability, HSE record, ethical compliance, environmental performance, local-content contribution, logistics reliability, and ability to provide digital documentation. Sustainable procurement requires life-cycle thinking, material traceability, waste reduction, carbon awareness, and fair supplier engagement. RSG's public reference to sustainable procurement certification demonstrates the strategic relevance of procurement governance in regenerative tourism development (Red Sea Global, 2023).

4.5 Stakeholder governance:

Stakeholder governance refers to the processes used to identify, prioritize, engage, and align the parties affected by or able to affect project outcomes. In RSG-style infrastructure delivery, stakeholder groups include the client, developer, contractors, consultants, suppliers, government authorities, local communities, employees, visitors, operators, environmental specialists, finance teams, and future asset managers. The literature indicates that stakeholder misalignment is a common cause of delays, claims, rework, and reputation risk. Effective stakeholder governance requires clear responsibility matrices, decision rights, communication protocols, meeting discipline, issue escalation, interface registers, and transparent reporting. It also requires respect for local socioeconomic objectives, including supplier participation, workforce development, and community impact.

4.6 Integrated governance:

The four domains are often managed by separate teams, but sustainable infrastructure delivery requires integration. Quality cannot be separated from procurement because material selection and supplier capability influence defect rates. HSE cannot be separated from scheduling because acceleration and overcrowded work fronts increase incident exposure. Stakeholder governance cannot be separated from quality because late changes in client or operator requirements can produce rework. Procurement cannot be separated from stakeholder governance because local-content objectives and supplier development are strategic commitments. Integrated governance therefore means using common data, shared risk registers, cross-functional stage-gates, and

leadership routines that make trade-offs visible before they become failures.

V. INTEGRATED GOVERNANCE FRAMEWORK FOR RSG-STYLE SUSTAINABLE DELIVERY

The proposed framework places Vision 2030 and regenerative infrastructure value at the centre of construction delivery. Around that centre are four governance pillars: quality, HSE, procurement, and stakeholder governance. Each pillar has its own tools, but the framework requires them to operate through shared stage-gates and integrated dashboards. The purpose is to prevent the project team from optimizing one area while damaging another. For example, a procurement team may reduce cost by selecting a lower-priced supplier, but if that supplier has weak quality records or poor HSE systems, the apparent saving may generate rework, incidents, and reputational damage. Similarly, a schedule team may accelerate activities, but if acceleration creates unsafe sequencing or incomplete inspections, the project may lose long-term value.

The first principle is lifecycle integration. Governance must begin before construction mobilization. During strategic brief and design, teams should identify sustainability requirements, environmental constraints, quality-critical elements, HSE risks, stakeholder approvals, and procurement lead times. During procurement, suppliers and subcontractors should be evaluated against technical, sustainability, HSE, and reporting requirements. During construction, daily and weekly controls should connect field activity to risk registers, inspections, and stakeholder commitments. During handover, asset data, commissioning evidence, O&M documentation, training, and lessons learned should close the loop.

The second principle is evidence-based control. Sustainable infrastructure delivery cannot depend only on meetings and verbal assurances. It requires reliable records: approved submittals, inspection reports, NCR logs, safety observations, permit records, supplier documentation, material certificates, environmental monitoring, BIM issue logs, meeting actions, and commissioning records. Digital tools such as common data environments, planning platforms, document-control systems, and dashboards can reduce fragmentation, but technology adds value only when data governance is clear. Each record must have an owner, status, review cycle, and escalation rule.

The third principle is proportionality. Not every construction activity requires the same level of governance. A risk-based approach should classify work packages by safety exposure, environmental sensitivity, design complexity, procurement criticality, stakeholder visibility, and operational importance. High-risk activities such as lifting operations, temporary works, confined spaces, high-temperature work, marine interfaces, public-realm interfaces, and critical equipment installation should receive higher control intensity. The same logic applies to quality-critical materials, long-lead items, specialist finishes, and systems that affect guest experience or long-term maintenance.

The fourth principle is learning. RSG-style developments unfold over multiple packages and phases. This creates a major opportunity to learn from one package and improve the next. Lessons learned should not be passive documents stored at project close. They should be converted into updated checklists, revised procurement requirements, improved method statements, better inspection templates, and more accurate schedules. A living lessons-learned system can reduce repeated defects, repeated incidents, and repeated stakeholder disputes across the programme.

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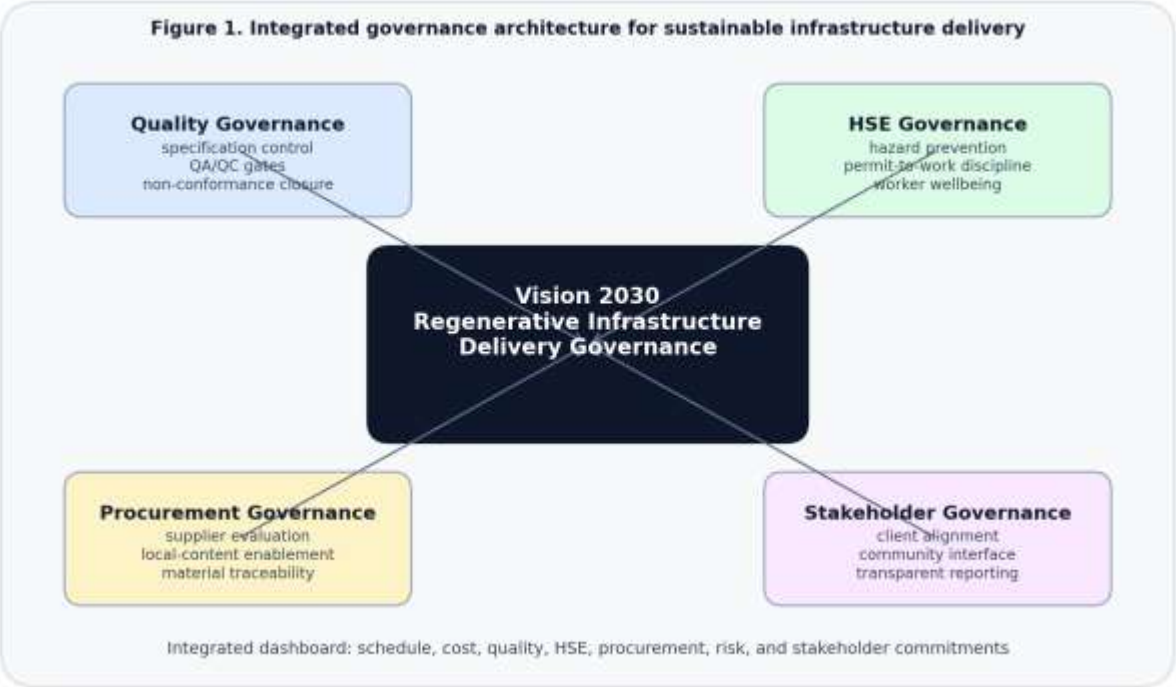

Figure 1. Integrated governance architecture for sustainable infrastructure delivery in RSG-style developments.

Table 1. Integrated governance domains for sustainable infrastructure delivery.

Governance domain	Primary objective	Key mechanisms	Sustainability value
Quality governance	Deliver assets that conform to design, specification, durability, and operational requirements.	Project quality plan; ITPs; mock-ups; BIM clash control; NCR root-cause analysis; commissioning records.	Reduces rework, material waste, defects, operating failure, and lifecycle cost.
HSE governance	Prevent harm to workers, communities, ecosystems, and project reputation.	Risk assessments; permit-to-work; high-risk audits; worker welfare; environmental monitoring; incident learning.	Protects people and nature while supporting productivity and social legitimacy.
Procurement governance	Secure capable suppliers and materials aligned with cost, schedule, quality, HSE, and sustainability goals.	Supplier prequalification; sustainable tender criteria; local-content checks; traceability; logistics planning.	Improves resilience, local economic contribution, ethical sourcing, and material compliance.
Stakeholder governance	Align client, contractor, consultant, authority, community, operator, and supplier expectations.	Stakeholder map; interface register; decision matrix; progress dashboard; escalation protocol.	Reduces delay, conflict, reputational risk, and misalignment with Vision 2030 outcomes.

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VI. QUALITY GOVERNANCE IN SUSTAINABLE INFRASTRUCTURE

Quality governance is the foundation of long-term asset value. For tourism infrastructure, quality is not limited to structural compliance. It also includes durability, guest experience, maintainability, interface performance, appearance, commissioning reliability, and environmental compatibility. In coastal and desert contexts, materials may be exposed to heat, humidity, salinity, dust, wind, transport stress, and intensive use. These conditions increase the need for proper material approvals, testing, protection during storage, workmanship control, and early defect detection. Quality governance should therefore be connected to environmental context and operational requirements, not merely to generic specifications.

A practical quality system should begin with a project quality plan that identifies inspection responsibilities, technical submittal workflows, hold points, witness points, mock-up requirements, factory inspections, and handover records. BIM coordination should be used to reduce design clashes before construction. Inspection and test plans should be aligned with the construction schedule so inspections occur at the correct time rather than after the work is concealed. Non-conformances should be categorized by severity and root cause. Repeated defects should trigger management review rather than endless corrective-action cycles. Quality dashboards should show open NCRs, overdue inspections, rejected submittals, material approval status, and recurring defect patterns. Quality governance also has a procurement dimension. Many defects originate before materials reach the site. Inadequate supplier evaluation, unclear specifications, unapproved substitutions, poor factory quality control, weak packaging, transport damage, and missing certificates can all become site quality issues. Procurement and quality teams should therefore share a material-risk register that identifies long-lead, high-value, or high-risk items. Supplier audits, sample approvals, mock-ups, and inspection requirements should be decided early. This reduces the risk that procurement urgency will override quality discipline.

VII. HSE GOVERNANCE AND WORKER WELLBEING

HSE governance protects human life, ecological systems, and programme reputation. In sustainable infrastructure, HSE should be treated as a strategic performance domain rather than a site-level support function. This is especially important for large developments where thousands of direct and indirect workers may be active across multiple work fronts. HSE governance must cover physical safety, occupational health, environmental controls, emergency response, welfare, logistics safety, and leadership accountability. In coastal tourism developments, environmental controls are also essential because construction activities can affect marine ecosystems, soil, water, air quality, and biodiversity.

The key to effective HSE governance is the use of leading indicators. Lagging indicators such as lost-time injuries are important, but they do not reveal whether the system is healthy before an incident occurs. Leading indicators include toolbox talk quality, training completion, permit-to-work compliance, high-risk activity audits, close-out of safety observations, near-miss reporting, heat-stress controls, emergency drills, environmental inspection scores, and supervisor engagement. These indicators should be reviewed by project leadership, not only by HSE teams. Leadership attention changes behavior because it signals that safety and environment are core delivery expectations.

HSE governance is also linked to schedule and procurement. Compressed schedules can create overcrowding, fatigue, poor sequencing, and shortcuts. Late procurement can force night work, rushed installation, or temporary substitutions. Stakeholder pressure can encourage teams to prioritize visible progress over safe systems of work. An integrated governance model addresses these risks by requiring HSE review during schedule acceleration, procurement changes, and major sequencing decisions. Method statements should be updated when site conditions change, and high-risk activities should not proceed without verified permits, competent supervision, and clear emergency arrangements.

Worker wellbeing is a particularly important part of sustainable infrastructure delivery. Vision 2030 developments seek to project international standards and long-term national value. This requires attention to welfare facilities, hydration, heat-stress prevention, rest arrangements, mental wellbeing, communication, training, and respectful treatment of the workforce. Worker wellbeing improves safety, productivity, retention, and reputation. It also reflects the social dimension of sustainability, which is increasingly evaluated by clients, investors, regulators, and the public.

VIII. PROCUREMENT AND SUPPLY-CHAIN GOVERNANCE

Procurement governance is one of the strongest levers for sustainable infrastructure delivery. Every procurement decision influences schedule certainty, quality outcomes, environmental impact, cost control, HSE exposure, and local economic contribution. In RSG-style developments, procurement must support regenerative and Vision 2030 objectives by balancing international expertise with local supplier development, environmental performance, reliable logistics, ethical compliance, and value for money. The procurement function therefore requires more than tender administration. It requires strategic category management, supplier intelligence, risk assessment, and lifecycle value evaluation.

A sustainable procurement process should begin with early identification of critical packages. Criticality should be based on lead time, technical complexity, safety impact, environmental sensitivity, interface dependency, and operational importance. High-criticality packages should receive stronger market engagement, supplier prequalification, factory inspection, quality planning, logistics planning, and contingency strategies. Supplier evaluation should include past performance, financial stability, quality systems, HSE record, sustainability practices, Saudization/local-content contribution, and digital reporting ability. This supports the Vision 2030 objective of building national capability while maintaining delivery reliability.

Material traceability is another essential component. Sustainable infrastructure projects need to know where materials come from, whether they meet specifications, how they were transported, whether they have required certificates, and whether substitutions have been approved. Traceability reduces quality risk, supports environmental reporting, improves claims management, and strengthens stakeholder confidence. A common data environment can store submittals, approvals, certificates, inspection records, and delivery status, but the governance rules must define who uploads, reviews, approves, and audits the information.

Procurement governance should also address circularity and waste reduction. Construction waste can be reduced through accurate quantities, off-site fabrication, modularization, careful storage, packaging reduction, reuse planning, and coordination between procurement and design teams. Environmental criteria should be included in tender documents and contracts, not introduced after award. Contractors and suppliers are more likely to deliver sustainable outcomes when expectations are specific, measurable, and linked to contract performance.

IX. STAKEHOLDER GOVERNANCE AND PROGRAMME ALIGNMENT

Stakeholder governance is the social and organizational infrastructure that allows complex projects to move. In Red Sea Global developments, stakeholder alignment is challenging because the programme involves developers, clients, consultants, contractors, suppliers, operators, authorities, communities, environmental specialists, and finance teams. These stakeholders have different priorities and time horizons. A contractor may focus on immediate work-front access; an operator may focus on long-term maintainability; an environmental team may focus on ecosystem protection; a client may focus on opening milestones; a local community may focus on employment and disruption. Stakeholder governance creates the process for reconciling these interests.

Effective stakeholder governance begins with stakeholder mapping. Each stakeholder should be classified by influence, interest, decision rights,

information needs, and potential impact on project outcomes. The project team should then develop an engagement plan that defines meeting frequency, reporting format, escalation pathways, approval timelines, and consultation requirements. Interface registers are especially useful because many delays occur at the boundaries between packages, authorities, and disciplines. An interface register should identify the issue, owner, required decision, due date, dependency, and impact if unresolved.

Transparency is central to stakeholder trust. Programme dashboards should not only report physical progress. They should also include quality status, HSE trends, procurement risks, environmental commitments, stakeholder approvals, and key decisions. When stakeholders can see the same information, disputes are reduced and decisions become more evidence-based. Transparent reporting also supports accountability because unresolved actions, overdue approvals, and repeated problems remain visible to leadership.

Stakeholder governance also supports local socioeconomic value. Vision 2030 emphasizes capability development, private-sector growth, and national participation. RSG's partnership model highlights collaboration across construction, operations, technology, finance, conservation, and community sectors (Red Sea Global, 2026d). Infrastructure delivery teams can support these objectives by incorporating local suppliers where feasible, mentoring contractors, supporting workforce training, and communicating opportunities clearly. Stakeholder governance therefore connects project execution with the wider economic and social purpose of Vision 2030.

X. DISCUSSION

The review shows that sustainable infrastructure delivery in RSG-style projects depends on the integration of governance domains that are often managed separately. Quality, HSE, procurement, and stakeholder management each have mature tools, but the value lies in how these tools interact. A project can have a quality plan, HSE plan, procurement plan, and stakeholder plan and still fail if the plans are not synchronized. For example, a delay in a long-lead material may require resequencing; resequencing changes safety risks; changed work fronts affect inspections; inspections affect handover; handover affects operator confidence. Integrated governance makes these connections explicit and forces decisions to consider system-wide consequences.

The proposed framework also reframes sustainability as a delivery discipline. In many projects, sustainability is perceived as a reporting requirement managed by a specialist team. In regenerative tourism infrastructure, sustainability is built or lost through everyday decisions: which supplier is selected, how materials are stored, how waste is handled, how workers are protected, how inspections are closed, how communities are engaged, and how lessons learned are applied. This is why project directors and construction leaders have a central role in achieving sustainability outcomes. They translate policy into workface behavior.

Digital systems can improve integration, but they cannot replace governance. Common data environments, BIM models, dashboards, Aconex-type document platforms, planning software, and PMIS tools are valuable because they create visibility and traceability. However, digital tools may also create data overload if the project team lacks clear rules for data ownership, approval authority, escalation, and decision-making. The key is to use digital tools to support stage-gates, not to assume that technology automatically creates control. A dashboard should help leaders ask better questions: Which work packages have repeated NCRs? Which supplier delays are creating HSE exposure? Which stakeholder approvals threaten the critical path? Which environmental commitments are not yet converted into site controls?

The discussion also highlights the importance of leadership behavior. Integrated governance requires leaders to break departmental silos. Quality managers, HSE managers, procurement teams, planners, construction managers, and stakeholder leads must review risks together. Project directors should ensure that weekly and monthly governance routines include cross-functional indicators rather than isolated reports. Leadership should also reward early reporting of

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problems. If teams fear blame, they will hide defects, near misses, procurement risks, and stakeholder concerns until they become crises. A sustainable governance culture treats early warning as a strength.

Figure 2. Lifecycle stage-gate workflow for RSG-style sustainable infrastructure delivery

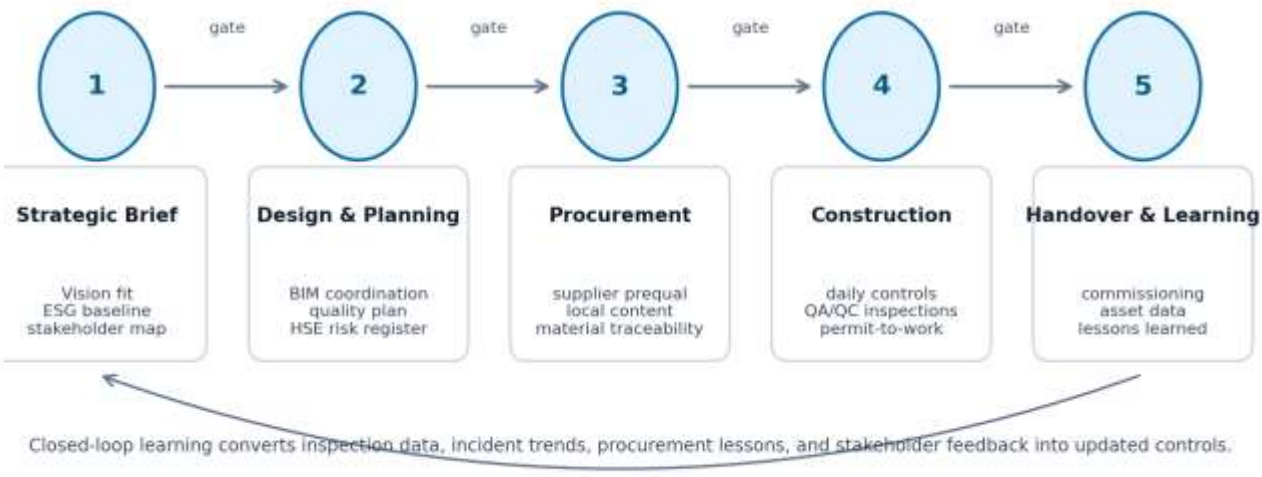

Figure 2. Lifecycle stage-gate workflow linking governance controls to delivery phases.

Table 2. KPI matrix for integrated governance dashboards.

KPI category	Example indicators	Review frequency	Leadership use
Quality	Open NCRs; rejected submittals; inspection pass rate; recurring defect types; commissioning punch-list aging.	Weekly / monthly	Identify packages needing technical support, supplier escalation, or design clarification.
HSE	Near misses; safety observations closed; high-risk audits; training completion; heat-stress controls; environmental inspection score.	Daily / weekly	Prevent incidents by acting on leading indicators before lagging events occur.
Procurement	Long-lead item status; supplier performance; material approval age; traceability gaps; local supplier participation.	Weekly	Protect the schedule and sustainability commitments through early escalation.
Stakeholders	Open approvals; overdue decisions; interface issues; community/authority	Weekly / monthly	Maintain alignment, reduce claims, and protect public confidence.

	actions; operator requirements closed.		
Sustainability	Waste diversion; energy/water efficiency actions; biodiversity protection controls; local content; worker wellbeing metrics.	Monthly	Connect site execution with regenerative and Vision 2030 objectives.

XI. PRACTICAL IMPLICATIONS FOR PROJECT DIRECTORS AND CONSTRUCTION LEADERS

The first practical implication is to establish a single integrated risk and commitment register. This register should include quality risks, HSE risks, procurement risks, stakeholder commitments, environmental controls, authority approvals, and operator requirements. It should be reviewed frequently and linked to the master schedule. The register should not be a static document; it should drive decisions on inspections, sequencing, supplier engagement, management attention, and contingency planning.

The second implication is to use stage-gates across the lifecycle. Before design release, the team should confirm that sustainability requirements, HSE risks, quality-critical elements, procurement lead times, and stakeholder approvals have been assessed. Before procurement award, supplier capability, HSE performance, material traceability, local-content potential, and digital reporting should be checked. Before construction start, permits, method statements, approved drawings, materials, access, inspections, and environmental controls should be ready. Before handover, commissioning, asset data, training, defects, and O&M documentation should be complete.

The third implication is to create cross-functional dashboards. A dashboard should combine progress, quality, HSE, procurement, stakeholder, and sustainability indicators. It should show trends, overdue actions, escalation items, and package-level comparisons. The purpose is not to create an attractive report, but to help leaders see connections. If one package has repeated quality defects, late procurement, increased safety observations, and unresolved stakeholder interfaces, it should receive immediate management attention.

The fourth implication is to convert lessons learned into standards. RSG-type programmes involve repeated packages and phases. Each completed package should improve the next one. Lessons should be translated into revised checklists, procurement templates, method-statement requirements, inspection points, BIM coordination rules, and training content. This allows the programme to mature over time and reduces the risk of repeating preventable failures.

XII. LIMITATIONS AND FUTURE RESEARCH

This review has three limitations. First, it is based on public sources, international standards, industry literature, and conceptual synthesis rather than confidential project data. Future research could test the framework using interviews with project directors, quality managers, HSE managers, procurement leads, and stakeholder managers involved in Saudi giga-projects. Second, the paper focuses on governance integration rather than detailed technical design. Further studies could examine specific packages such as public realm, hospitality buildings, renewable utilities, coastal infrastructure, or airport-related assets. Third, the proposed KPI matrix is conceptual. Future research could validate the KPIs using case studies, performance data, or maturity assessments across multiple Vision 2030 projects.

Future research should also explore how digital delivery platforms can integrate sustainability metrics with BIM, planning, procurement, HSE, and commissioning data. Another important area is local supply-chain development. As Saudi Arabia expands domestic capability, research is needed on how procurement governance can strengthen local

suppliers without compromising quality or schedule certainty. Finally, there is room for comparative research between Red Sea Global, NEOM, Diriyah, Qiddiya, ROSHN, and other major programmes to identify common governance patterns and project-specific adaptations.

XIII. CONCLUSION

Sustainable infrastructure delivery in Red Sea Global developments requires more than technical construction capability. It requires an integrated governance system that connects Vision 2030 objectives with quality discipline, HSE leadership, procurement integrity, stakeholder alignment, and continuous learning. The review shows that the main challenge in giga-project delivery is not the absence of individual management systems, but the fragmentation between them. When quality, HSE, procurement, and stakeholder governance operate in silos, delays, rework, incidents, claims, and reputational risks become more likely. When these domains operate through shared stage-gates, dashboards, risk registers, and leadership routines, infrastructure delivery becomes more reliable and sustainable.

The proposed framework positions RSG-style sustainable infrastructure delivery as a lifecycle process. It begins with strategy and design, continues through procurement and construction, and closes through commissioning, handover, and learning. The model highlights the role of project directors and construction leaders in converting regenerative and Vision 2030 ambitions into daily project controls. By integrating quality, HSE, procurement, and stakeholder governance, Saudi giga-projects can improve delivery performance while supporting environmental regeneration, local economic participation, workforce wellbeing, and long-term asset value.

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