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Integration of Sustainability Considerations into the Implementation of Output and Performance-Based Road Contracts in Emerging Economies: Lessons from Ghana.

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ABSTRACT
The study examines the integration of sustainability considerations into the implementation of Output and Performance-Based Road Contracts (OPBRCs) in Ghana and draws lessons for emerging economies. Using a qualitative case study approach, the research analyses documentary evidence from Ghana's Transport Sector Improvement Project (TSIP), particularly the Project Completion Report and the World Bank Implementation Completion and Results Report, through a thematic sustainability integration framework. The findings show that sustainability was embedded in OPBRC implementation through policy alignment, multiyear maintenance obligations, environmental and social safeguards, grievance redress systems, road safety provisions, road asset management systems, and performance monitoring arrangements. However, the integration was uneven and often constrained by limited institutional capacity, unstable financing, incomplete operationalisation of data and asset management systems, procurement and design delays, weak occupational health and safety compliance, and uncertainty surrounding post-project maintenance financing. The Ghana case, therefore, demonstrates that OPBRC may better support sustainable road asset management in comparison with traditional contracting, however only when supported by strong governance, institutional readiness, reliable financing, and effective monitoring. The study contributes to the literature by reframing OPBRC implementation through a sustainability integration lens rather than viewing it only in terms of implementation barriers.
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Keywords: Procurement; Output and Performance-Based Road Contracts; Sustainability Integration; Road Asset Management; Emerging Economies..
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LIST OF ABBREVIATIONS

Abbreviation	Meaning	Abbreviation	Meaning
BoQ	Bill of Quantities	CHPS	Community-based Health Planning and Services
EIRR	Economic Internal Rate of Return	HSWIM	High-Speed Weigh-In-Motion
ICR	Implementation Completion and Results Report	IDA	International Development Association
IRI	International Roughness Index	OHS	Occupational Health and Safety
OPBRC	Output and Performance-Based Road Contracts	RAP	Resettlement Action Plan
RAMS	Road Asset Management System	TSIP	Transport Sector Improvement Project

INTRODUCTION:

In emerging economies, roads are central to economic growth, integration of territories, access to markets, as well as provision of social services. They link the zones of production with the centres of consumption, mobility, trade, and accessibility to schools, health facilities, and government. Contemporary literature also underscores the importance of not considering road infrastructure solely as a physical network, but as a development system with the quality, resilience, and long-term functionality defining broader economic and social results (Alhjouj et al., 2022; Walther et al., 2025). In Ghana, this point is especially relevant since the accessibility of transport

continues to be highly dependent on the inequality within the regions, agricultural marketing, and the capacity of governmental institutions to provide services efficiently. Consequently, the problem does not only lie in the building of roads, but also in maintaining road assets over time in such a manner that preserves its serviceability, guards its investment value and ensures inclusive development.

The sustainability issues that arise in road contracting relates to the fact that most road projects are still executed under the traditional Bill of Quantities (BoQ) contracts. In this model, remuneration is typically linked to the completion of quantified work items and not the long-term state of the road. This can provide incentives to contractors to maximise quantities delivered rather than concentrating on lifecycle efficiency, durability and sustained performance of the asset. The research on the sustainability of road infrastructure and pavement maintenance continues to reveal that the sustainability of long-term service performance relies on how lifecycle planning, performance monitoring, environmental factors, and the efficiency of maintenance are incorporated into the process of decision making (Arshad et al., 2021; Liu et al., 2022). Where these factors are loose, there is a disconnect between the road delivery and sustainable road asset maintenance. This gap has revived discussions on Output and Performance-Based Road Contracts (OPBRCs) as being a more sustainable-friendly model of contracting. The design of OPBRCs is to ensure that both technical performance and maintenance responsibility are integrated over time, and that the quality assurance, user-focused service standards, and risk allocation are enhanced, as well as ensuring the results are accountable. They are especially applicable in situations where governments aim at shifting short-term construction logic to lifecycle infrastructure management. The latest research on sustainable road network maintenance also implies that efficiency and environmental performance increase when the maintenance of roads is planned using integrated and optimised systems and not reactive interventions (Guan et al., 2022). In this regard, OPBRC does not only present an alternative procurement system, but also a possible alternative philosophy of road asset management.

Conceptually, OPBRC refers to multiyear road contracts in which payment is tied to outputs, service levels, and road condition rather than to input quantities. Guidance on road asset management and performance-based contracting emphasises the expectation that the contractor is to deliver and maintain agreed service standards across the contract period, with greater flexibility in methods but also greater responsibility for performance outcomes (Asian Development Bank, 2021; World Bank, 2026). This distinguishes OPBRC from traditional BoQ contracts in several ways: the basis of payment changes from quantities to performance, risk is allocated more directly to the contractor, design–rehabilitation–maintenance functions are more integrated, contractor incentives shift toward asset preservation, and outcomes become more important than isolated activities. Earlier lessons from road maintenance contracting also underscore the fact that these contracts are most effective where monitoring, financing, and institutional oversight are strong enough to support long-term compliance (Bull et al., 2014).

Conventional contracting is, however, still predominant in most developing economy situations, though it is constrained in its sustainability. It tends to have low long-term performance incentives, dysfunctional responsibility, quality-control challenges, cost and time wastage, inadequate lifecycle planning and little innovation and value-for-money space. It has been observed in Africa that performance-based contracts can succeed not just based on the form of the contract itself, but also on institutional preparedness, the dependability of financing and the capacity to implement the contract (Minster et al., 2025). This particularly applies to Ghana, in which both the ambition of reform and structural factors have, over the years, influenced transport policy, road accessibility, and infrastructure management (Walther et al., 2025).

Most of the current discourse on OPBRC emphasises obstacles, failures in implementation, or technical limitations. Although the literature is significant, it falls short of explaining the actual process of integrating sustainability considerations into implementation and how this integration influences results. This study thus takes a different perspective. It looks at OPBRC as more than just a contract reform; it is a system of sustainability implementation that relies on institutional, environmental, social, technical and financial integration. It relies on the experience of Ghana to estimate how the considerations of sustainability have been integrated in the system of governance and preparedness of the industry, environmental and social risk management, and procurement and performance management. By so doing, the paper adds to the literature by changing the focus from a barriers-only approach to the wider view of sustainability integration in road contracting. It is also a is a reaction to broader discussions about innovation, digitalisation, and the system of government delivery that propose that contemporary infrastructure management is more and more reliant on integrated technologies, institutional coordination, and risk-based delivery practices (Zakharkin et al., 2026; Lancelot et al., 2026). This research seeks to evaluate how sustainability issues have been integrated into OPBRC implementation in Ghana, as well as to draw lessons to be learned by the emerging economies.

Research Objectives:

To define OPBRC and distinguish it from traditional BoQ contracts in sustainability terms

To identify and assess the sustainability dimensions embedded in Ghana's OPBRC implementation across governance, environmental-social-risk, and procurement-performance domains

To draw lessons for strengthening sustainability integration in future OPBRC practice in emerging economies

2. Methods

2.1 Research Design

The qualitative case study design was used in this study to investigate the ways in which sustainability issues were integrated into the implementation of the Output and Performance-Based Road Contracts (OPBRC) in Ghana. The qualitative approach was suitable since the study was concerned with institutional processes and governance arrangements, safeguards practice, issues of financing and performance management as opposed to numerical testing. The case study design enabled the study to explore the OPBRC in the real-life policy and practice setting, and the interplay between various actors and systems. The methodology is aligned with the accepted case study research that focuses on situational exploration of the complex modern phenomena within the natural environment (Stake, 1995; Yin, 2018).

2.2 Case Study Selection

Ghana was picked as a case study due to its ability to provide a good empirical ground to explore first-generation OPBRC implementation in an emerging economy. Ghana utilized OPBRC through the Transport Sector Improvement Project (TSIP) in the trunk, feeder, and farm roads, which produced a wide implementation environment comprising rehabilitation, maintenance, safeguards, safety and strengthening of institutions. This renders the case particularly valuable in the examination of sustainability incorporation on technical, social, environmental, and governance levels. The case of Ghana is also representative of most of the situations that affect developing economies, such as lack of infrastructure, financial limitations, institutional disintegration and shortage of capacity. The peculiar features allow conclusions about sustainability-focused road contracting in Ghana and other developing economies.

2.3 Data Sources

The research was based on documentary evidence since the main objective was to explain how the concept of sustainability was incorporated into the project design and execution. The main sources were the TSIP Project Completion Report and the World Bank Implementation Completion and Results Report (Agyekum, 2025; World Bank, 2026). The documents included the elaborated data on contract structure, implementation processes, safeguards compliance, institutional reforms, financing arrangements, performance results, and sustainability risks. Documentary evidence was suitable as it presented both descriptive and evaluative data based on official documents and allowed the study to capture the experience of the implementation in detail. This is in line with document analysis as an accepted qualitative technique in deriving meaning, context and patterns on written documents (Bowen, 2009).

2.4 Analytical Approach

Thematic document analysis was employed to analyse the chosen records in the study. This methodology has been adopted since it facilitates the systematic identification and classification of recurrent themes in documentary evidence. Instead of establishing a list of barriers, the analysis followed the development of the sustainability considerations manifested in the policy alignment, institutional structure, safeguard systems, safety measures, asset management, procurement, and monitoring structures. The papers were reviewed and coded based on the concepts of the study objectives and the sustainability framework. The coding process thus reflected the practice of intended integration as well as actual implementation. This allowed for differentiating between the stronger and weaker forms of sustainability integration throughout the Ghana case. Thematic analysis was also useful to take the study beyond description, as it categorised evidence into analytically significant groups in relation to the overall research questions and objectives.

2.5 Sustainability Integration Framework

The discussion was organised in terms of a sustainability integration model, having three clusters of factors. The first cluster included governance and industry readiness, such as policy and legal framework, political support, financial feasibility, institutional buy-in, asset management knowledge, datasets, technology, capacity building, road agency competence, and private-sector readiness. The second cluster dealt with environmental, social and risk control issues, such as environmental and social stewardship, safety, risk management, traffic control, axle-load enforcement and grievance management. The third group dealt with procurement and performance factors that included project need, design and duration, performance indicators, procurement processes, dispute resolution, payment model, cash flow, monitoring, and incentive. This framework was employed to determine the extent to which sustainability in the implementation of OPBRC in Ghana was highly, partially, or poorly incorporated in the key areas that define long-term maintenance of road assets and service provision.

3. Results

3.1 Sustainability-Oriented Features of OPBRC as Implemented in Ghana

The Output and Performance-Based Road Contract (OPBRC) model was adopted in Ghana as a wider asset-preservation model as opposed to a traditional civil works contract. OPBRC amalgamated design, rehabilitation, maintenance, safety installations, safeguards compliance, and additional social interventions under the Transport Sector Improvement Project (TSIP) terms of long-term contractual agreements. This rendered the model radically different as compared to the traditional contracts that are more focused on the performance of defined work items. The case of Ghana indicates that OPBRC was to maintain the road condition in the long-term in addition to enhancing user services, accountability, and lifecycle

efficiency. The contracts included trunk, feeder and farm roads and included environmental and social compliance duties, routine and periodic upkeep, and some benefits in infrastructure at the community level, including schools, clinics and boreholes. This combined framework provided the contracts with sustainability orientation since they related physical delivery with long-term serviceability, road-user deliverables and institutional learning, thus bringing Ghana road contracting nearer to a lifecycle road asset management approach. Table 1 shows that the Sustainability-focused OPBRC elements were integrated into Ghana's TSIP.

Table 1. Sustainability-oriented OPBRC features implemented under Ghana's TSIP

Feature Variable	Indicator	Value	Source Basis	Sustainability Significance
Contract coverage	Number of OPBRC / PBC contracts introduced	6	ICR	Demonstrates full adoption of performance-based contracting across project packages.
Geographic scope	Project regions covered	3 regions	PCR/ICR	Shows implementation across Northern, Bono East, and Upper West Regions.
Road asset preservation	Total rural roads rehabilitated	1,021.06 km	ICR	Indicates large-scale road asset preservation.
Road asset preservation	Trunk roads rehabilitated	167.40 km	ICR	Covers strategic interurban corridor infrastructure.
Road asset preservation	Feeder roads rehabilitated	861.35 km	ICR	Supports rural accessibility and agricultural connectivity.
Road asset preservation	Farm roads rehabilitated	7.00 km	ICR	Extends access to local production areas.
Road-user outcome	Trunk-road travel time reduction	41%	ICR	Indicates improved mobility and corridor efficiency.
Road-user outcome	Feeder-road travel time reduction	62%	ICR	Shows major rural access improvement.
Road condition	International Roughness Index (IRI) for paved trunk sections	2.95	ICR	Reflects improved road quality and serviceability.
Access benefits	People benefiting from improved access	219,143	ICR	Demonstrates the broad social reach of the OPBRC investment.
Access benefits	Female beneficiaries	109,572	ICR	Indicates gender-inclusive access gains.
Access benefits	Youth beneficiaries	122,720	ICR	Reflects strong developmental inclusion.
Employment and inclusion	Job opportunities created under PBCs	7,105	ICR	Shows local economic and employment effects.
Employment and inclusion	Share of employment for women	33%	ICR	Indicates meaningful female participation in project-related work.
Safety integration	Road signs installed	2,248	PCR	Demonstrates that safety was embedded in road delivery.

Feature Variable	Indicator	Value	Source Basis	Sustainability Significance
Safety integration	Road line markings	171.45 km	PCR	Supports safer and more regulated road use.
Safety integration	Speed humps installed	28	PCR	Reflects traffic-calming interventions.
Safety integration	Sidewalks constructed	21.83 km	PCR	Improves pedestrian safety and accessibility.
Safety integration	Pedestrian crossings installed	31	PCR	Supports safer crossing points on project roads.
School safety	Pedestrian crossings under the Lollipop Program	132	ICR	Shows partial implementation of school-zone safety objectives.
Complementary social interventions	CHPS compounds renovated	15	PCR	Reflects integration of local health-support infrastructure.
Complementary social interventions	Solar-powered mechanised boreholes provided	44	PCR	Indicates broader community service benefits.
Complementary social interventions	School buildings constructed	10	PCR	Shows educational co-benefits linked to road delivery.
Complementary social interventions	Clinics constructed	7	PCR	Demonstrates integration of social infrastructure into contracts.
Complementary social interventions	Office blocks for schools constructed	2	PCR	Reflects support for education-related facilities.

3.2 Comparative Sustainability Logic: OPBRC versus Traditional BoQ Contracts

The main sustainability logic of the comparative sustainability of OPBRC and traditional Bill of Quantities (BoQ) contracts is in the definition of performance, responsibility, and value by the two models. The BOQ system compensates for measured inputs and quantities of work executed, and therefore, it compensates for the volume of execution as opposed to the long-term status of the road. In comparison with this model, the OPBRC model in Ghana provided the payment with a greater attachment to outputs, adherence to the level of service, and the ability of the road asset to remain operational. This brought about greater incentives towards durability, maintenance planning and lifecycle thinking. It also broadened the accountability of the contractors by incorporating design, rehabilitation, and maintenance in a single contract and mandating long-term adherence to quality, safeguards, and safety standards. Due to the built-in nature of service-level monitoring and deductions, accountability was greater with the performance-based approach, as compared to traditional methods. The Ghana case, hence, indicates that OPBRC can better effectively integrate sustainability by linking payments, monitoring, and contractor requirements to long-term road conditions and user-focused results instead of short-term construction completion.

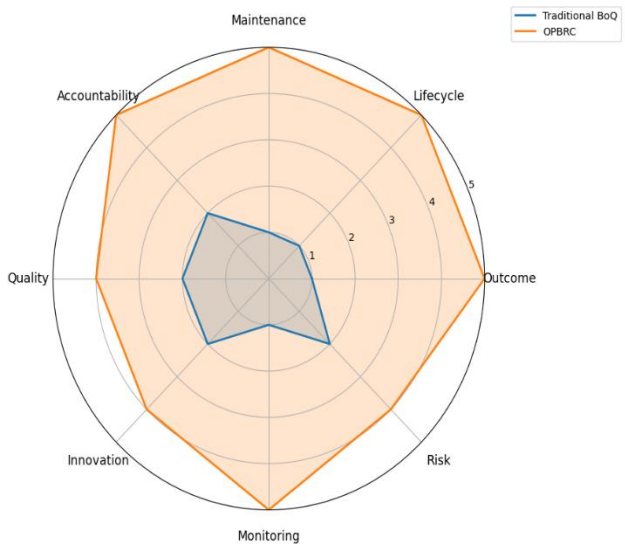

Figure 1. Comparative sustainability logic: OPBRC versus traditional BoQ contracts.

Note: The radar chart presents author-derived analytical scores on key contractual dimensions discussed in Section 3.2. A score of 1 indicates low alignment and a score of 5 indicates high alignment with sustainability-oriented contracting principles.

Figure 2 provides a comparative analysis of the output and Performance-Based Road Contracts (OPBRC) and conventional Bill of Quantities (BoQ) contracts on eight dimensions of sustainability-related outcomes: outcome orientation, lifecycle focus, maintenance integration, accountability, quality assurance, innovation flexibility, service-level monitoring, and risk transfer. It demonstrates that conventional BoQ contracts possess minimal correspondence to the principles of sustainability since they are primarily input- and quantity-oriented. Conversely, OPBRC scores well on almost all of the dimensions, as it focuses on long-term road condition, integrated maintenance, accountability of contractors, and performance monitoring. The broader OPBRC profile thus demonstrates a greater sustainability orientation and justifies the claim that OPBRC is better suitable in comparison with BoQ contracts for the long-term maintenance of road assets.

3.3 Integration of Sustainability Considerations into Ghana's OPBRC Implementation

The implementation of the OPBRC in Ghana dealt with sustainability integration that was extensive and extended past engineering delivery. The TSIP addressed sustainability in the policies, asset management systems, financial planning, safeguards, safety, grievance systems, performance monitoring and long-term maintenance commitments. This demonstrates that OPBRC was not only dealt with as a procurement reform, but also as a broader governance and service-delivery strategy. Nevertheless, the integration process was not even. Maintenance intent, safeguards, and citizen engagement were inbuilt at the beginning, whereas operational data systems, institutional continuity and secure post-project maintenance financing were not fully realised. The Ghana case reveals, therefore, that sustainability is determined by how well the institutions, contractors, monitoring mechanisms, and the financing packages translate the contractual intentions into reality. Table 2 shows the key governance and industry preparedness indicators that relate to the implementation of OPBRC in Ghana.

Table 2. Governance and industry readiness indicators under Ghana's OPBRC implementation

Governance and Readiness Dimension	Indicator	Target Planned	Actual Achieved	Interpretation
Policy and legal framework	Review of road subsector institutions	Yes	Yes	Institutional review was completed, showing governance reform intent.
Policy and legal framework	Update of National Transport Policy	Yes	Yes	Demonstrates policy-level support for transport-sector modernization.
Policy and legal framework	Update of National Tolling Policy	Yes	No	Indicates incomplete follow-through on road-financing reform.
Political and executive support	Additional financing approved for OPBRC expansion	US $37.48 million	US $36.43 million disbursed	Shows strong initial political and donor backing for scaling OPBRC.
Economic and financial feasibility	Total project financing	US $187.48 million	US $166.72 million disbursed	Reflects substantial financial commitment, though not full disbursement.
Economic and financial feasibility	IDA financing revised after cancellation	US $150.00 million original	US $133.44 million revised	Shows how macro-fiscal pressures affected financial sustainability.
Economic and financial feasibility	Ex-post EIRR for trunk roads	26–36 % (ex ante range)	30.4 %	Confirms the economic viability of core road investment.
Asset management knowle	RAMS implementation for trunk and	Yes	No*	System developed but not fully

Governance and Readiness Dimension	Indicator	Target Planned	Actual Achieved	Interpretation
dge and systems	feeder roads			operationalised for reporting
Asset management knowledge and systems	Annual asset management reporting for feeder roads	Yes	No	Indicates incomplete institutional use of RAMS.
Asset management knowledge and systems	Annual asset management reporting for trunk roads	Yes	No	Indicates incomplete evidence-based management continuity.
Reliable dataset and technology	Use of nationwide crash data recorded online	90 %	0%	Major weakness in data-system operationalization.
Reliable dataset and technology	Fibre optic cable installed on the trunk road corridor	168 km planned corridor coverage	164.92 km installed	Shows partial success in technology-enabled corridor support.
Reliable dataset and technology	Portable weigh pads supplied	4	4	Indicates support for data-based axle-load control.
Reliable dataset and technology	Mobile weighing vans supplied	2	2	Strengthened enforcement capability.
Reliable dataset and technology	HSWIM systems supplied and installed	2	2	Supports technology-based axle-load management.
Capacity building	Planned staff to participate in training	786 officers	402 officers	Capacity building occurred, but with limited reach.
Capacity building	Training participation rate	100 % of planned	51 %	Shows partial effectiveness of institutional capacity development.
Market readiness / contractor capability	Number of PBC/OPBRC contracts introduced	6	6	Demonstrates full rollout of the contracting model.
Market readiness / contractor capability	Job opportunities created under PBCs	38,000	7,105	Suggests market activity, but also reveals implementation constraints.
Market readiness / contractor capability	Share of employment for women	25 %	33 %	Indicates socially inclusive labour outcomes.
Institutional continuity	Project closing date	30 Jun 2025	30 Jun 2025	Project closed on schedule after extensions, but maintenance continuity remained an issue.
Post-project readiness	Trunk-road maintenance financing after closure	Expected continuation	Uncertain / vulnerable	Major governance and readiness gap affecting sustainability.

3.4 Specific Sustainability Integrations for Procurement and Performance

The sustainability under the OPBRC model in Ghana was based on procurement and performance integration. In contrast to the traditional contracts, which separate design, construction and maintenance, the OPBRC model associated long-term serviceability with procurement, payment, monitoring, and contractor responsibility. It implied that sustainability was integrated into the very structure of the contract: project design, service levels, cashflow arrangements, supervision systems and sanctions against non-compliance were to co-exist and ensure that the quality of the road would be maintained in the long-term. As the experience of Ghana demonstrates, this performance orientation was a factual transition to lifecycle road management. But its application decreased its uniformity in practice. The effectiveness of the model was undermined by a long procurement cycle, slow design completion, payment bottlenecks, inconsistent quality of monitoring, and an inability to sustain maintenance commitments. Its payment model was, in principle, output-based, but contractor performance and continuity of maintenance were compromised by delayed payment and cash flow limitations.

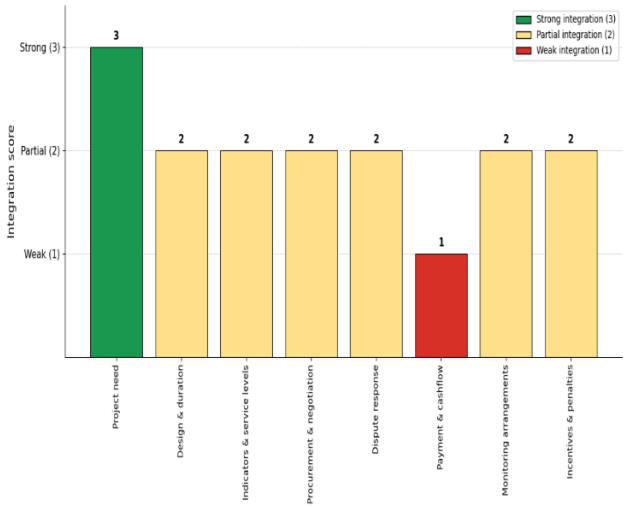

Figure 2. Procurement and performance integration scorecard under Ghana's OPBRC implementation Figure 2 shows the level of procurement and performance integration in the implementation of the Output, and Performance-Based Road Contract (OPBRC) in Ghana on an author-developed scoring scale, where 1 is weak integration, 2 is partial integration, and 3 is strong integration. As can be seen in the chart, there was a very strong integration of the project need, which demonstrates a development rationale of OPBRC adoption.

3.5 Sustainability Outcomes Emerging from Ghana's OPBRC Implementation

The implementation of the OPBRC in Ghana provided several sustainability outcomes that demonstrated contextual strengths and weaknesses of the model. On the positive side, the project enhanced the road conditions, cut down the travelling time and extended coverage of markets, schools, clinics and other facilities in the project regions. These results affirm that OPBRC has the capability to sustain longer user-oriented performance compared to traditional contracting. There were also social benefits that were created as a result of the project in the form of complementary interventions like schools, clinics, boreholes and community support on issues related to health. The institutional benefits were evident in the creation of RAMS, policy review procedures, and improved exposure to performance-based road management among the agencies. Nevertheless, the results of sustainability were not evenly distributed. The safety and data-driven management gains were partial as the crash-data systems were still underutilised and not all safety goals were achieved. More significantly, the risks that had not been resolved were related to the post-project maintenance financing and the institutionalisation of systems like RAMS and RADMS. This Ghana case thus reflects effective sustainability gains, but it also indicates that effective sustainability gains would need greater continuity following project completion, as shown in Table 3.

Table 3. Sustainability outcomes and residual risks

Outcome Variable	Numerical Result	Interpretation	Residual Risk
Road quality	IRI improved to 2.95 against the target of 3.50.	Great physical improvement in trunk-road condition.	Road quality may deteriorate without sustained maintenance.
Trunk-road mobility	41% travel time reduction against the target 25%.	Major efficiency gain on the strategic corridor.	Benefits may decline if maintenance continuity weakens.
Feeder-road mobility	62% travel time reduction against the target 20%.	Strong rural access improvement.	Feeder-road condition durability depends on routine maintenance and climate resilience.
Physical delivery	1,021.06 km rehabilitated out of the target 1,048 km.	Large-scale network improvement achieved.	Remaining gaps and maintenance needs may affect sustainability.

Outcome Variable	Numerical Result	Interpretation	Residual Risk
Beneficiary reach	219,143 people are benefiting from improved access.	Broad social impact of transport investment.	Access gains must be preserved through road-condition continuity.
Female beneficiaries	109,572 women benefited.	Positive gender inclusion in access outcomes.	Benefits may erode if service quality declines.
Youth beneficiaries	122,720 youth benefited.	Strong developmental reach.	Long-term benefit depends on sustained infrastructure performance.
Employment generation	7,105 jobs created; 33% women's share.	Social and local economic benefit achieved, especially for women.	Job gains were below target and may not be sustained post-project.
Road safety systems	132 pedestrian crossings were installed against the target of 400.	Partial delivery of the school-safety programme.	Incomplete safety rollout limits full social sustainability.
Crash-data digitalisation	0% online crash data use against the target 90%.	Safety-data institutionalisation failed by project close.	Weak evidence base for future road safety management.
Vehicle inspection reform	0 private garages integrated in project locations against the target of 15.	Safety-related institutional reform was not achieved locally.	Limits the sustainability of the vehicle-roadworthiness strategy.
Asset management system	RAMS has been developed, but the reporting outputs are still not operational.	Important institutional gain, but incomplete use.	Weakens evidence-based long-term maintenance planning.
Policy reform	National Transport Policy update achieved; Tolling Policy update not achieved.	Partial governance reform outcome.	Weak road-financing reform threatens long-term sustainability.
Maintenance continuity	Trunk road maintenance responsibility transferred to GoG after closure.	Shows transition attempt beyond project life.	Major risk because funding and supervision continuity were uncertain.

3.6 Summary Pattern of Integration

The general trend of sustainability inclusion in the implementation of OPBRC in Ghana can be summed up as a mixture and not uniform. Certain dimensions were closely incorporated, especially the long-term maintenance orientation of the model of contract, the introduction of safeguards obligation, the public grievance system, and the introduction of asset management and other relevant technical instruments. It partially integrated other dimensions, such as institutional change management, operational use of data systems, road safety outcomes, and financing provisions of post-project maintenance. A more limited group of areas was not well incorporated in practice, particularly where the implementation required political persistence, stable financing or comprehensive realisation of institutional changes. This trend implies that Ghana managed to incorporate sustainability into the logic of the design of OPBRC, although not necessarily in the entire operational and post-project environment needed to sustain the findings. A synthesis table based on the ratings of strongly integrated, partially integrated, and weakly integrated would thus assist in explaining the establishment of sustainability and its instability, contingency, or incompleteness in the three major factor clusters.

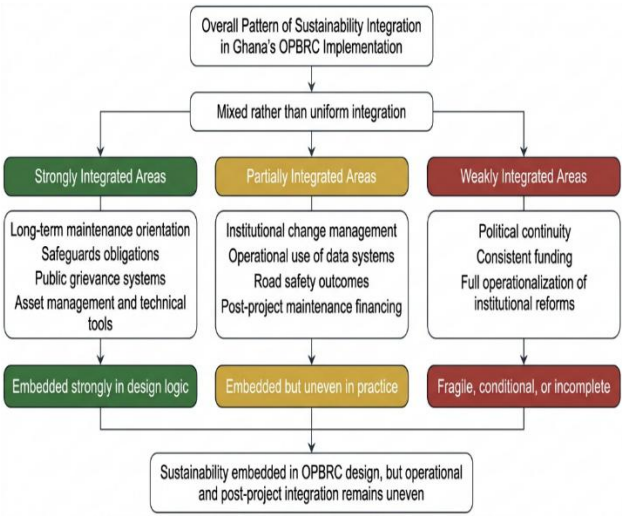

Figure 3. Conceptual summary of sustainability integration patterns in Ghana's OPBRC implementation

Figure 3 provides a conceptual map of the sustainability integration trend of the implementation of the Output and Performance-Based Road Contracts (OPBRC) in Ghana. Integration varied across variables, showing strong, partial, and weak integration.

4. Discussion

As the experience of Ghana demonstrates, Output and Performance-Based Road Contracts (OPBRC) cannot be regarded merely as an alternative contract type, but rather as a more comprehensive framework for the introduction of sustainable road infrastructure. Findings from the present research is consistent with the past research, indicating that the sustainability of infrastructure is not solely defined by engineering deliverables, but also by the design, coordination, and maintenance of operational systems throughout the years (Du et al., 2023). In this meaning, sustainable OPBRC can be more appropriately considered as a reflexive governance process where institutions have to adjust to the realities of practicality in a continuous manner (Ferrari, 2020). Sustainability integration thus becomes a major requirement for preparedness. This justifies the argument that sustainable infrastructure partnerships must be designed with the right institutional setting, performance incentives, and governance settings capable of coordinating the activities of both the public and the private entities in the long term (Adebayo et al., 2023; Kapatsa et al., 2023).

Another aspect of the case that is worth noting is the significance of environmental and social aspects as major implementation aspects and not merely a marginal compliance issue. Resettlement planning, safeguards, grievance redress, road safety measures, and occupational health and safety meant not only lessening the risks, but also increasing the project's legitimacy, accountability and acceptance by the public. This establishes that road sustainability is not merely a matter of sustaining pavement quality but also a matter of sustaining social responsiveness and institutional trust as part of more general arguments on the concept of collaborative delivery of transport provision between public and private parties (de Lange, 2023).

The presented study relies on documentary data of a single-country case, which restricts the broad extrapolation of the results. Further research must adopt comparative case studies in more than one developing economy to determine the generalizability of the results. They also need to include interviews or field-based data to give a more profound understanding of implementation issues and long-term sustainability.

5. Conclusion

The experience of Ghana demonstrates that, when sustainability considerations are inculcated throughout the system of governance, environmental and social protection, and procurement-performance provisions, the concept of Output and Performance-Based Road Contracts (OPBRC) can be more effectively integrated into the system of contracts than the traditional Bill of Quantities approach. It was discovered that OPBRC is more sustainability-oriented in nature since it connects design, rehabilitation, maintenance, monitoring, and accountability with long-term service outcomes instead of short-term quantities of work. Ghana incorporated numerous sustainability aspects into implementation, such as alignment of policy, long-term intent of maintenance, safeguards, grievance mechanisms, road safety mechanisms, and asset management tools. Nonetheless, this incorporation was not complete even in the key areas like maintenance funding, occupational health and safety, data-system operationalisation, and institutional sustainability following the project regulation. In practice, future OPBRC programmes must finance the maintenance upfront, enhance institutional change management, operationalise RAMS and safety data systems, entrench safeguards and OHS more deeply in contract enforcement and enhance procurement and monitoring architecture. The study adds a sustainability integration model to understand the implementation of OPBRC in developing economies. Future studies are advised to compare country experiences, investigate post-project maintenance sustainable practice and experiment with measurable indicators of sustainability integration in performance-based road contracting.

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