Journal of Good Governance and Sustainable Development in Africa (JGGSDA), Vol. 9, No 5, 2026. Available online at https://rcmss.transglobalacademic.com/jggsda/index. Covered in Scopedatabase- https://sdbindex.com/Sourceid/00000431, EuroPub, etc. ISSN: 2346-724X (P) 2354-158X (E)

Marion de Wet, Johan Burger & Martin De Wit,2026, *JGGSDA, 9* (5):14-31

Policy and Governance Barriers to Energy Security through Unconventional Gas Extraction and Sustainable Development Goals Alignment in South Africa

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Abstract

This paper examines the effectiveness of existing policy and governance frameworks for sustainable unconventional natural gas (UNG) extraction in South Africa, aligned with sustainable development goals and energy security. Amid a growing population and energy-generation challenges, transitioning from coal to natural gas offers emissions reductions and energy stability (UN, 2023a; Roelf, 2023). Environmental concerns and weak governance frameworks, however, complicate sustainable UNG development (DoE, 2018; Steyl & Van Tonder, 2013). An environmental, social, and governance (ESG) framework proves vital for balancing technological innovation, socioeconomic progress, and environmental stewardship (Anderson & Brown, 2011; Vasquez, 2013; De Wet, 2024). Despite the enactment of the Upstream Petroleum Resource Development Bill on 29 October 2024 to address regulatory gaps (SA Government, 2021), effective network governance remains necessary to navigate policy challenges and ensure sustainable development (Roberts, 2013; DMRE, 2022). The study advocates for cohesive policies that harmonise economic growth, environmental integrity, and societal well-being (NDP, 2013). The research methodology was grounded in a mixed-methods, theory-driven evaluation framework to assess the effectiveness of policies governing indigenous unconventional natural gas (UNG) extraction in South Africa and their alignment with sustainable development objectives. Drawing on thematic analysis of legal, policy, and scholarly sources, the study identifies regulatory and institutional gaps and advances a pragmatic governance framework to support the sustainable development of South Africa's emerging UNG sector.

Keywords: *Sustainability, sustainable development, unconventional natural gas, policy issue, network governance, stakeholder theory*

1. Introduction

This paper is the first in a series of three, based on research titled *Towards an enabling policy and governance framework for the sustainable extraction of unconventional natural gas in South Africa'* (De Wet, 2024). Together, these three papers provide a comprehensive exploration of the policy, stakeholder, and ESG considerations crucial to sustainable unconventional natural gas (UNG) extraction in South Africa. This paper evaluates current policy and governance

[1]Developed from De Wet, M. 2024. Towards an enabling policy and governance framework for the sustainable extraction of unconventional natural gas in South Africa. PhD dissertation supervised by Professor Johan Burger, Co-supervised by Professor Martin De Wit. Stellenbosch: Stellenbosch University.

barriers, identifying gaps in energy security, environmental protection, and regulatory frameworks that hinder alignment with sustainable development goals. The second paper, titled 'Stakeholder-centric rationality to enable ESG-aligned policy and governance decisions for sustainable unconventional natural gas extraction in South Africa', builds on this paper by emphasising the importance of stakeholder-centric governance to ensure that diverse interests are incorporated into ESG-aligned policy decisions, fostering inclusivity and regulatory compliance. The third paper, titled 'Evaluating Benefits and risks associated with sustainable natural gas extraction by means of a multidisciplinary ESG framework for informed policy decisions', integrates insights from Papers 1 and 2 through a multidisciplinary ESG framework. This framework assesses both the benefits and risks of UNG extraction, guiding informed policy decisions for a sustainable, resilient energy future in South Africa. Collectively, these studies underscore the importance of cohesive policies, stakeholder collaboration, and a robust ESG framework in responsibly and sustainably realising the potential of South Africa's natural gas resources.

As the national government endeavours to establish a natural gas economy to enhance energy security and facilitate a just energy transition, critical attention is directed towards the intersection of energy needs, environmental sustainability, and socioeconomic development. South Africa's population stood at 61 384 864 in May 2023, against an anticipated growth rate of 7.45% by 2050 (UN, 2023a). In a country plagued by electricity-generation limitations, a burgeoning population, and economic development, urgent energy security interventions are necessary, particularly in the realm of clean energy. South Africa's energy supply relies heavily on indigenous coal and imported crude oil and natural gas, while limited renewable capacity and aging coal-fired stations fail to meet current electricity demand. The country's electricity system has faced persistent supply constraints for more than a decade, largely due to declining reliability of ageing coal-fired generation assets and insufficient investment in new capacity, resulting in recurrent load shedding since 2007 (Eskom, 2023; International Energy Agency, 2023). Recent operational improvements under Eskom's Generation Recovery Plan have contributed to measurable gains in generation performance, reflected in a gradual increase in the Energy Availability Factor and extended periods of improved system stability during 2025–2026 (Eskom, 2026; South African Government News Agency, 2026). However, these gains primarily reflect improved utilisation of existing generation assets rather than a structural expansion of generation capacity. Long-term electricity planning in South Africa, therefore, continues to anticipate the need for significant additional capacity to meet future demand, support electrification and economic development objectives, and offset the progressive retirement of ageing coal plants, as outlined in the Integrated Resource Plan 2019 (Department of Mineral Resources and Energy, 2019). Consequently, while recent operational improvements indicate progress in stabilising the power system, they do not eliminate the structural requirement for diversified and additional generation capacity to ensure long-term energy security.

The transition from coal to natural gas as a viable, cleaner primary energy alternative can contribute significantly towards carbon emissions reduction (Da Silveira Cachola et al., 2020, p. 100102). South Africa has an estimated 13 trillion cubic feet (tcf) at the lower end, and 390 tcf at the higher end of technically recoverable UNG that has the potential to significantly contribute towards ensuring domestic energy security (Roelf, 2023). However, South Africa faces challenges in harnessing its indigenous UNG resources, primarily due to environmental conservation concerns and policy uncertainties. The sustainable extraction of UNG requires a delicate balance of technological innovation, socioeconomic development, and environmental conservation, necessitating alignment among government, private sector, and research entities.

This environmental, social, and governance nexus underpins the integration of unconventional natural gas into South Africa's energy landscape towards attaining sustainable development.

In this paper, theoretical conceptualisation relevant to UNG extraction, and regulatory and legal frameworks, focusing first on comparable international examples and second on relevant South African regulatory and legal content, are explored to answer the research question, draw conclusions, and make recommendations.

1.1 Background

As a transitional energy source, UNG is vital for energy security but faces environmental concerns, policy uncertainties, and socioeconomic challenges. Issues such as water contamination, methane emissions, and land use require stringent regulation. Achieving sustainable development in the UNG sector requires a comprehensive policy framework that integrates economic, environmental, and socioeconomic factors through collaboration and evidence-based policymaking. Effective governance is essential for mitigating these risks and promoting sustainability.

1.2 Research problem statement and policy issue

Empirical data indicate that sustainable benefits from natural resource exploitation require collaboration among political, community, and industry stakeholders (Anderson & Brown, 2011; Arellano-Yanguas, 2011; Vasquez, 2013). Sustainable economic development, as argued by Estrada et al. (1996), necessitates government involvement aligned with commercial and environmental interests. In South Africa, sustainably developing the nascent natural gas industry requires balancing economic gains with environmental integrity and social standards through equitable public-private-community partnerships (Chapman et al., 2015). While the recent enactment of the Upstream Petroleum Resources Development Bill (UPRDB) marks progress in establishing a regulatory framework for unconventional gas, existing literature still indicates gaps in governance structures that fully support sustainable exploitation (Steyl & Van Tonder, 2013; Du Plessis, 2015; DoE, 2018). This has led to serious contestation amongst stakeholders, as evidenced by several high-profile court cases, underscoring the need for comprehensive policies and regulations that foster sustainable development while ensuring energy security and societal benefits in South Africa's evolving natural gas sector (Roberts, 2013).

1.3 Research question

What is the impact of the existing policy and governance framework on unconventional natural gas extraction in promoting energy security and socioeconomic development, and in alignment with sustainable development goals?

1.4 Research objectives

The key objective of this paper is to evaluate the efficacy of existing policies and governance of indigenous UNG extraction in South Africa and assess their alignment with sustainable development goals, with a focus on promoting energy security and socioeconomic development while advancing environmental sustainability, amid high levels of contestation amongst stakeholders.

1.5 Research design and methodology

Given the complexity and interdisciplinary nature of the research question and objective, this study employed a mixed-methods research design to evaluate the effectiveness of current policies governing indigenous UNG extraction in South Africa and their alignment with sustainable development goals. Qualitative data were collected through a thematic document review of legal proceedings, legislative texts, and academic studies, with a focus on government departments, industry operators, stakeholders, and research institutes. The research integrated various data sources to enhance validity and provide actionable insights into UNG governance. A theory-driven evaluation approach was used, examining intervention theories, which include situation theory (context analysis), causal theory (impact of interventions), and normative theory (ethical considerations) (Hansen & Vedung, 2010). This framework offers a structured understanding of how enabling policies and suitable governance can lead to desired developmental outcomes. The study emphasised the need for a pragmatic policy and governance framework for South Africa's nascent UNG sector, currently lacking established regulations. It drew on contribution analysis, realist evaluation, and process tracing to uncover the mechanisms underlying policy outcomes (Mohammed & Bladon, 2017), justifying the need for policy changes and supporting sustainable development of the UNG industry. This comprehensive approach aimed to provide a best-practice benchmark for developing a robust governance structure to ensure the sustainable and orderly development of the UNG sector in South Africa.

2. Theoretical conceptualisation

This paper navigates towards sustainable UNG extraction aligned with environmental, social, and governance (ESG) principles. It emphasises effective stakeholder engagement, robust governance mechanisms, and supportive policy frameworks as essential elements for achieving sustainable development goals in the UNG sector. Through a systematic economic-ESG analysis, the paper assesses the economic viability of UNG extraction projects, considering externalities and societal costs. By addressing key themes such as the ESG-nexus, stakeholder engagement, governance, and policy instruments, the research contributes to a holistic understanding of sustainable UNG development in South Africa.

2.1. Sustainability and sustainable development

Exploitation of South Africa's UNG resources offers economic benefits, but poses significant environmental concerns (Steinmetz, 1992; Aguilera, 2013; Inman, 2014). Sustainability, as defined by the Brundtland Commission, requires balancing environmental, economic, and social dimensions (Brundtland Commission, 1987). South Africa's reliance on coal has driven interest in developing indigenous gas reserves in line with sustainable development principles to generate wealth while conserving resources (DMRE, 2020). The ESG nexus underscores the integration of environmental, social, and governance factors into business practices to support sustainable development (DMRE, 2020).

Effective policy frameworks that involve government, industry, and stakeholders are essential to achieving energy transition goals by 2030 (Tosun, 2017). International best practices should guide policies to balance economic benefits with environmental and societal well-being (Tosun, 2017). Robust governance structures are needed to address environmental impacts and maximise socioeconomic benefits, such as job creation and fiscal contributions (DMRE, 2020), ensuring sustainable development aligned with national objectives (NDP, 2013).

2.2. Policy issue contextualisation

The research problem focused on the policy and regulatory framework governing the sustainable extraction of unconventional natural gas, a critical policy issue where environmental, economic, and societal considerations converge. As the country's energy needs evolve, it is imperative to explore appropriate policy frameworks to address potential gaps that affect sustainable development. Public policy issues encompass government actions and decisions, including disputes between policymakers and stakeholders, the seriousness of problems, and the effectiveness of interventions (ICPSR, 2022; Dunn, 2018). However, limited research has been conducted on the analysis of policy issues concerning the sustainable extraction of unconventional gas in its entirety (Roberts, 2013; Chapman et al., 2015; Esterhuyse et al., 2018; DMRE, 2020). While the enactment of the UPRDB on 29 October 2024 marks significant progress in addressing these challenges (SA Government, 2021), a comprehensive examination of the existing policy framework and its impact on sustainability remains essential, given the complexities of the entire unconventional natural gas extraction value chain.

2.3. Scope of the policy issue

Empirical data show that sustainable benefits from natural resource exploitation require collaboration among political, community, and industry stakeholders (Anderson & Brown, 2011; Arellano-Yanguas, 2011; Vasquez, 2013). Sustainable economic development necessitates government involvement aligned with commercial and environmental interests (Estrada et al., 1996). In South Africa, the sustainable development of the nascent natural gas industry depends on balancing economic gains with environmental integrity and social standards through equitable public-private-community partnerships (Chapman et al., 2015). The Upstream Petroleum Resources Development Act (UPRDA) advances regulatory support for unconventional gas, but unless the complete policy and governance framework across the UNG value chain is reviewed, governance gaps will prevail that hinder sustainable exploitation. Ongoing stakeholder disputes and legal disputes relating to upstream development underscore the need for comprehensive policies to foster sustainable development, energy security, and societal benefits in South Africa's natural gas sector.

2.4. Governance theory

Network governance, characterised by collaboration, transparency, accountability and inclusivity, is essential for sustainable development. In resource-rich developing economies, issues such as a lack of transparency and corruption often hinder good governance and subsequently impede sustainable development (De Wet, 2024). The sector is heavily regulated and governed by sixteen legislative instruments from various administrative departments, often leading to administrative fragmentation that could result in challenges to effective network governance.

Meta-governance can address these failures by synchronising diverse governance modes (Gjaltema & Biesbroek, 2020). Effective governance is crucial to managing public resources without corruption, and coordinated policies are necessary for sustainable extraction. Poor governance deters investment and economic development (Mauro, 1995; Tanzi & Davoodi, 1997). Although the recent enactment of the UPRDB addresses a key policy gap, a comprehensive network governance framework remains necessary to ensure sustainable shale gas extraction (Ticci & Escobal, 2015). The following revised network governance theory

advocates for a governance framework that fosters transparency and multidisciplinary cooperation, instilling confidence in the established controls:

> *Network governance is the synchronised processes, interfaces, and collaborations between governments and the respective social actors and legal stakeholders towards inclusive and transparent policy and governance decision-making (sic) aligned with sustainable development, whereby government and its agencies are the ultimate accounting entities for ratifying, administering, regulating, enforcing, and monitoring relevant governance processes (De Wet, 2024:119)*.

2.5. Stakeholder theory

Sustainable stakeholder value creation in the upstream gas sector requires collaboration across science, technology, society, and policy through a process known as knowledge co-creation (Scholes et al., 2017a). This approach involves diverse stakeholders, including scientists, civil society, academics, policy makers, and industry, to tackle complex challenges. Stakeholder theory highlights the complexity of stakeholder definitions, advocating a nuanced understanding that accounts for power, legitimacy, and urgency (Miles, 2012; Mitchell, 2012).

Stakeholder capitalism emphasises long-term value creation and addresses issues such as climate change and social inequalities (D'Souza, 2020; WEF, 2020). As the cleanest-burning fossil fuel, natural gas is a transitional energy source crucial to achieving UN SDG 7 and to reducing global temperatures by 1.5°C (UN, 2015; EIA, 2022). Aligning stakeholders is therefore essential for sustainable gas extraction, with effective governance that incorporates their perspectives into policy frameworks (Dunn, 2018). Political stakeholder theory stresses ethical considerations in regulatory frameworks (Olsen, 2016). Managing stakeholder relationships through education and regulation fosters shared sustainability interests (Freeman et al., 2014). To this end, effective governance and stakeholder engagement are vital for sustainable development and for addressing policy and governance barriers in South Africa's unconventional gas sector (DMRE, 2022).

3. Regulatory and legal framework

3.1. International subsector policy reforms

Public policy and subsector reforms involve changes to the existing policies and structures of public-sector institutions to improve efficacy. The following section provides a comparative overview of the impact of subsector policy reforms in five of the largest global natural gas-producing countries on the sustainable development of unconventional gas extraction, from which South Africa can learn.

3.1.1 USA

The Safe Drinking Water Act (SDWA) of 1974, enforced by the EPA, initially covered hydraulic fracturing (fracking), but subsequent rulings exempted fracking unless diesel fuel is used (EPA, 2011; Brady, 2012). In 2005, Congress exempted certain underground injections related to oil and gas from SDWA regulations (Legal Information Institute, 2022). The Clean Water Act (CWA) restricts pollutant discharge but excludes oil and gas activities from stormwater permitting under the Energy Policy Act of 2005 (USC, 2022). The Clean Air Act (CAA) regulates air pollutants, but hazardous emissions from gas wells are often exempt due to

threshold limits (GPO, 2006). The Resource Conservation and Recovery Act (RCRA) excludes most oil and gas wastes unless deemed hazardous (EPA, 1976).

US regulatory exemptions for oil and gas reveal governance challenges in balancing resource use and environmental protection, underscoring the need for robust frameworks in South Africa's unconventional gas sector.

3.1.2 Russia

Russia's upstream petroleum tax reforms introduced a revenue-added tax (RAT) in 2018, replacing the mineral extraction tax (MET) for mature fields, and expanded it to 48% of total production by 2020 (Zhan et al., 2020). The 2019 amendments aimed to simplify subsoil licensing but faced delays, which impacted technology adoption and financing (Josefson & Rotar, 2021). These proposed legislative changes aim to attract investment through flexible licence terms and joint venture models and highlight the need for effective policy frameworks to balance resource development and investment, as well as for streamlined governance to support sustainable industry growth.

3.1.3 Qatar

Although no regulatory reforms to accommodate sustainable gas extraction exist in Qatar, the country's 2018-2022 Second National Development Strategy introduces new policies that align with the country's Vision 2030 to address environmental preservation, sustainable economic development and diversification, responsible management of the state's natural resources, and energy efficiency. Additionally, the government launched several initiatives to diversify the economy away from virtually full reliance on the fossil fuel industry by lifting a 12-year self-imposed ban in April 2017 on the development of the North Field, the world's biggest natural gas field, in anticipation of increased competition from Iran's re-entry into the global gas market (Mahmood & Early, 2019).

3.1.4 Iran

The Iranian regulatory reform aimed to rectify shortcomings in Environmental Impact Assessment (EIA) guidelines for the petroleum industry, notably in addressing socio-environmental risks and meeting international standards. Introduced in 2012 and amended in 2016, the framework mandates EIAs as part of project feasibility assessments for obtaining permits (SEPC, 2011; Cabinet Decree, 2016). However, ambiguities remain, including unclear definitions of safety, health, environmental, and social considerations that fail to safeguard communities from exploration and production (E&P) activities. Despite efforts by the Supreme Environmental Protection Council in 2014 to clarify these issues, implementation has made little regulatory progress, leaving discretion to adopt industry best practices on a voluntary basis rather than as a legal requirement.

3.1.5 Canada

Canada's Bill C-69 replaced the Environmental Assessment Act with the Impact Assessment Act (IAA) in 2019, introducing an Early Planning Phase to enhance stakeholder and indigenous engagement (Winfield-Lesk, 2019). The IAA's 'One Project – One Assessment' framework streamlined processes, setting an 180-day maximum for planning and reducing assessment durations, thereby expanding jurisdiction to indigenous governing bodies, empowering them in

decision-making and prioritising the public interest, environmental protection, and comprehensive impact assessments (Canadian Government, 2023).

Effective regulatory frameworks such as the IAA promote sustainable development through improved governance, inclusive decision-making, and strengthened stakeholder engagement in resource sectors.

3.2. An overview of South Africa's legislative, regulatory, and policy frameworks relating to unconventional gas extraction

Upon exploring the theoretical concept of policy coordination, a causal relationship exists between coherent policy instruments and strategic planning for the development of this nascent domestic industry characterized by techno-commercial, geophysical, socio-economic, and environmental complexity (Braun, 2008, pp. 227-239). Currently, over 15 broad policy and regulatory instruments govern upstream UNG activities, encompassing both petroleum and non-petroleum products, underscoring the need for more specific UNG-focused legislation. The enactment of the Upstream Petroleum Resource Development Bill is a step in the right direction towards providing policy certainty, paving the way for investment to drive the commercialization of South Africa's abundant UNG reserves. Effective, targeted policies are crucial to harnessing UNG's potential for economic growth, social benefits, and energy security in South Africa (Chapman et al., 2015, pp. 69-88). Lessons from the USA underscore the importance of cohesive policy frameworks and inter-departmental collaboration to ensure sustainable UNG extraction amidst environmental and regulatory challenges (Steyl & Van Tonder, 2013; Gordon, 2013; Goldsmith, 2014).

3.2.1 Income Tax Act (ITA), No. 58 of 1962

The Income Tax Act (No. 58 of 1962) governs income and capital gains taxes in South Africa, overseen by SARS (the South African Revenue Service). Policy issues arise from Schedule 10, which addresses oil and gas taxation and allows the Finance Minister to set fiscal stability agreements with companies. Decision-making biases, as noted in political theory, can influence these decisions (Turpin & Marais, 2004, pp. 143-160). Recommendations include transparent decision-making processes involving stakeholders, robust conflict of interest guidelines, independent oversight of fiscal agreements, clarification of the role of the Department of Mineral and Petroleum Resources (DMPR), formerly the Department of Minerals and Energy (DMRE), and fostering multi-stakeholder dialogue to ensure inclusive and ethical policy outcomes in unconventional gas extraction governance.

3.2.2 Arbitration Act, No. 42 of 1965

The Act establishes statutory dispute-resolution procedures for the entire natural gas value chain, ensuring accountability among government and industry stakeholders. It aligns with political stakeholder theory, emphasising ethical governance and stakeholder expectations within effective policy frameworks (Bayrakçı et al., 2012, p. 6; Olsen, 2017). Stakeholders in arbitration include legal advisors, arbitrators, investors, government entities, industry experts, witnesses, and public/civil society. Recommendations include an independent dispute body, capacity building, multi-stakeholder committees, a natural gas industry code of ethics, and compliance audits to ensure fair resolution and policy stability (Bayrakçı et al., 2012, p. 6).

3.2.3 Legal Proceedings against Certain Organs of State Act, 2002

The Act governs enforcement of judgments and legal proceedings against government authorities, including state-owned entities operating under the DMPR. Due to representation primarily by multinational companies, concerns arise over potential bias or influence peddling in local courts. To mitigate this potential risk, complex disputes involving multinational operators should ideally be adjudicated by an independent international court specialising in upstream legal matters (Kang et al., 2012, pp. 1124-1186).

Policy recommendations include establishing industry-specific guidelines for international litigation between local state-owned enterprises (SOEs) and multinational oil and gas operators. This ensures transparency, accountability, and fairness. Measures include establishing an independent oversight body, building capacity for legal professionals, enforcing a code of conduct, public reporting of cases, stakeholder engagement, benchmarking against international standards, and protecting whistleblowers. These guidelines aim to uphold governance integrity, address potential corruption risks, and ensure equitable outcomes in resolving disputes within the industry (Transparency International, 2022; World Data, 2023).

3.2.4 Mining Titles Registration Amendment Act, No. 24 of 2003 (MTRAA)

Until the recent promulgation of the UPRDA, the MTRAA governed all exploration and production rights registration, with the aim of ensuring enforceability under the MPRDA (Mineral and Petroleum Resources Development Act) against third-party claims. However, it lacks provisions tailored to UNG extraction, necessitating regulatory reform. Specific policy recommendations that would make this Act an effective statute for upstream gas development include comprehensive land-use planning, community engagement, streamlined permitting, sustainability planning, adaptive management, enhanced financial provisions, recognition of indigenous and landowner rights, rigorous social impact assessments, and transparency enhancements.

3.2.5 Occupational Health and Safety Act (OHSA), No. 85 of 1993

The Act mandates CEOs to ensure safe workplaces and comply with health and safety regulations. While it does not specifically reference unconventional natural gas, recommendations for policy reform include industry-specific regulatory instruments, risk assessments, training, emergency planning, health monitoring, and environmental protection to address unique hazards associated with natural gas development (OHSA, 1993).

3.2.6 Mine Health and Safety Act, No. 29 of 1993 (MHSA)

The Department of Labour oversees the Occupational Health and Safety Act (OHSA), while the Department of Mineral Resources manages the Mine Health and Safety Act (MHSA). Unique operational challenges in upstream petroleum, especially in deep-sea exploration, warrant the integration of guidelines from both acts. Legislative reforms should tailor health and safety regulations specifically to unconventional gas activities under DMRE administration, aligning with OHSA and MHSA reforms.

3.2.7 Competition Act, No. 89 of 1998

The Competition Tribunal and Competition Appeal Court, established by the Competition Act, regulate competition in South Africa's oil and natural gas sectors. Dominated by international

giants, the industry risks monopolisation due to a lack of local expertise. Policy recommendations include investing in skills development, promoting research, establishing local content requirements, fostering public-private partnerships, supporting SMEs, ensuring fair competition, engaging communities, and planning for sustainable development to address these challenges.

3.2.8 Mineral and Petroleum Resources Royalty Act, No. 28 of 2008 (MPRRA, as amended by Act, No. 17 of 2009) and Mineral and Petroleum Resources Royalty Administration Act, No. 29 of 2008 (MPRRAA)

The MPRRA mandates, among other things, royalties on mineral resource transfers, exempting small businesses based on turnover and registration criteria. To align petroleum legislation under a single department, guidelines from MPRRA and MPRRAA should be integrated into a tailored legislative instrument for upstream UNG activities, managed by the DMRE for unified legislative oversight.

3.2.9 Mineral and Petroleum Resources Development Act (MPRDA) and Upstream Petroleum Resource Development Act (UPRDA)

The MPRDA provides for sustainable development and equitable access to the country's mineral and petroleum resources, as well as related concerns. Parliament rejected the Mineral and Petroleum Resources Development Amendment Act in 2017 on the grounds of its unconstitutionality and insufficient public participation. In 2020, a Draft UPRDB was published to separate upstream petroleum legislation from mineral resources. In 2020, the Draft UPRDB was introduced to separate petroleum legislation from mineral resources. Recently enacted, the UPRDA now ring-fences upstream petroleum activities, addressing prior policy gaps identified in the MPRDA for E&P activities. This represents significant progress, providing a more targeted regulatory framework for UNG exploration and extraction methods not covered by the MPRDA. However, recommendations for potential policy alternatives can only be made once the resilience and effectiveness of the UPRDA have been evaluated over a reasonable time frame.

3.2.10 The National Environment Management Act, No. 107 of 1998 (NEMA)

The NEMA governs environmental decision-making and institutional collaboration but lacks specific provisions for unconventional gas. Section 24(N) holds company directors individually liable for environmental impacts. Policy reform recommendations include training directors on NEMA responsibilities, integrating environmental considerations into corporate governance, implementing robust monitoring, engaging stakeholders, and collaborating with legal authorities to ensure compliance and sustainable practices.

3.2.11 National Water Act, No. 36 of 1998 (NWA)

The NWA aligns with constitutional rights to a sustainable environment and to sustainable development, which are crucial for regulating large-scale unconventional gas extraction, such as fracking in the Karoo basin. Current environmental laws lack specific provisions for well casing, water management, chemicals disclosure, and site rehabilitation. Recommendations for policy reform include a dedicated regulatory framework, ecological standards, transparency, water and wastewater management, seismic monitoring, and collaborative expert input for effective regulation and industry advancement.

3.2.12 The Companies Act, No. 71 of 2008

The Companies Act (No. 71 of 2008) mandates directors to act in the company's best interests with due care, diligence, and expertise [Section 76(3)]. While it does not specify director qualifications, competency is essential for fiduciary duties. Policy recommends assessing and mitigating corporate risks, leveraging skills, knowledge, and experience to benefit the organisation, ensuring directors meet requisite standards.

3.2.13 The Companies Regulations (the Regulations) of 2011

The Regulations were developed in terms of section 223, and Item 14 of Schedule S of the Companies Act, No. 71 of 2008, to guide the functions of the Companies Commission, the Takeover Regulation Panel, and the Companies Tribunal, and other matters relating to the regulation of companies, to take effect at the same time as the Companies Act, 2008. The Regulations, including Regulation 43, mandate the establishment of a social and ethics (SEC) board subcommittee to oversee corporate activities related to social and economic development; (ii) consumer and stakeholder relations; (iii) good corporate citizenship; (iv) environmental protection; (v) health and public safety; (vi) labour and employment matters; and (vii) anti-corruption monitoring, reporting and compliance.

Recommendations for policy efficacy include integrating explicit environmental duties for directors, enhancing stakeholder engagement, and requiring sustainability reporting to align company interests with sustainable practices in unconventional gas extraction.

3.2.14 National Development Plan (NDP)

The NDP outlines a vision to eliminate poverty, reduce inequality, and foster an inclusive economy by 2030, and acknowledges natural gas as a potential energy source. However, it lacks specific policies for the natural gas industry. Aligning upstream petroleum policies with NDP recommendations is crucial to combat corruption and ensure governance integrity, proposing anti-corruption guidelines and capacity-building initiatives for ethical governance.

3.2.15 International environmental agreements (IEA)

The Benguela Current Convention and Kyoto Protocol guide environmentally responsible practices. These IEAs are treaties between multiple governments to regulate and manage the impact of human activities on the environment to protect environmental integrity.

The IEAs are protected by international law and, for the purpose of this paper, the following alternative to the guidelines is recommended: The treaties that are relevant to local UNG exploitation should be separated and incorporated into local legislation, preferably a single policy instrument administered by the DMRE for the sake of policy certainty and stability.

3.2.16 King IV Code on Good Corporate Governance

King IV outlines corporate governance standards, emphasising directors' roles in overseeing impacts on corporate citizenship. SMART (sustainable, measurable, attainable, realistic, timed) targets ensure continuous performance evaluation covering environmental stewardship, community welfare, and economic activities. It aligns with ethical leadership and governance principles, promoting sustainable development. Recommended reforms to King IV for the upstream unconventional natural gas industry involve specific ESG reporting criteria,

environmental stewardship, community engagement, risk management, and ethical supply chain practices, fostering responsible growth and aligning with global energy transition goals.

4. Conclusions and recommendations

An effective public policy plays a pivotal role in advancing economic growth, skills development, foreign investment, energy security, clean technologies, and environmental protection (Khan & Pillay, 2014; Lowell, 2002). To achieve sustainable unconventional gas exploration, South Africa requires an ESG-aligned policy that addresses these variables. While the government aims to increase cleaner energy use, the lack of a robust regulatory framework could hinder this transition. Regular review and reform of regulations, along with public-private-academic collaborations, are essential for developing standards suited to South Africa's geology. Sustainable gas development must benefit all citizens, incorporating stakeholder expectations and environmentally friendly practices within a transparent governance framework. Stakeholder capitalism, which considers economic, social and ecological factors, enhances long-term value for all (Long & Foster, 2019). Insufficient stakeholder participation can lead to legal disputes and project delays, whereas inclusive and transparent engagement improves governance and policy making (OECD, 2006). Network governance, where multiple stakeholders collaborate through systematic evaluation, is key to enhancing transparency and accountability in the sector (Provan & Kenis, 2007). This approach supports sustainable development by aligning business operations with stakeholder and environmental needs.

4.1 Causality between good governance and sustainable development in developing economies

Economic growth and development, poverty alleviation, human life and environmental preservation are some of the UN's goals for sustainable development if future generations are to benefit from current developmental efforts. The concept of good governance in the context of sustainable development promotes inclusivity, transparency, accountability, as well as administrative efficiency and competence in managing natural and financial resources for fair and equitable sustainable development to the benefit of all societies and future generations. Network governance in governments characterised by collaboration, transparency, and accountability is indicative of good governance, whereby government administrations can be held accountable for their respective regulatory and administrative functions. Therefore, good governance as a tenet for collaborative sustainable development facilitates development of the required regulatory interplays between government, society and industry.

4.2 Good governance lessons from major global gas producers' regulatory regimes

The USA employs a 'regional governance' model with state-specific policies tailored to diverse prevailing economic, geological, socioeconomic, and ecological conditions as applicable to the respective states. South Africa can adopt a similar approach to strengthen national upstream gas policies with regional by-laws to meet localised sustainable development goals.

Qatar's poor performance on the Resource Governance Index (45/100) highlights governance weaknesses, including inadequate transparency, environmental regulations, and fiscal frameworks (NRGI, 2021). Despite its natural gas wealth, these governance challenges could potentially impact long-term economic sustainability, particularly in relation to broader economic diversification.

Iran's regulatory framework shows reluctance to engage directly in environmental impact assessments (EIAs), delegating this responsibility to secondary parties. Although safety, health and environmental considerations are required by decree, the lack of specific regulations leaves communities vulnerable during exploration and production (E&P) activities, highlighting a regulatory gap. The reliance on discretionary adoption of industry standards indicates a need for regulatory reform to protect social welfare.

Russia's gas policies are strong, but transparency issues undermine governance, as evidenced by delays in the Russia Energy Strategy 2035 due to stakeholder misalignment and lack of collaboration (Mitrova & Yermakov, 2019).

Canada's inclusive network governance, involving federal and provincial collaboration, exemplifies good governance, promoting investment while holding governments accountable for regulatory functions. This decentralised approach contrasts with the governance challenges faced by Qatar, Iran, and Russia, emphasising the need for transparent, inclusive policies to ensure sustainable development in the gas sector.

4.3 Impact of existing policy and governance regimes relating to unconventional gas extraction in South Africa

South Africa's natural gas industry is heavily regulated across the entire value chain, with multiple bodies involved: PASA oversees upstream activities; the UPRDA regulates reconnaissance and exploration; NERSA manages production rights, gas production, importation and pricing under the Piped Gas Regulations and Gas Act (48/2001); while local governments manage gas reticulation. This fragmented regulatory framework risks confusion, delays and additional costs due to misalignment and overlapping mandates. Currently, no fewer than sixteen legislative instruments, each administered by different government departments with competing objectives, govern the industry. These regulations, developed under varying political and economic conditions, contribute to ineffective governance and lack policy certainty, hampering the sector's growth.

Given the underdeveloped state of South Africa's natural gas industry, governance processes and systems remain immature, further weakening oversight and accountability. Meta-governance, which synchronises different governance modes through various processes and strategies, could address these failures (Gjaltema & Biesbroek, 2020).

Effective governance should monitor and measure resource management to prevent abuse and ensure benefits for current and future generations. A coordinated and inclusive governance approach, integrating institutional, societal, market, and policy standards, is essential for sustainable unconventional gas extraction. Such a framework would streamline regulatory processes and support good governance, enabling South Africa to fully leverage its natural gas resources.

Declaration of interest

The authors report no competing interests to declare.

Acknowledgements

The authors would like to thank all the reviewers for their valuable inputs and comments during the peer review process.

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