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Africa's Leapfrog Opportunity and Global Implications on Green Industrialisation: How Africa Offers a Blueprint for Inclusive and Sustainable Growth Worldwide

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Abstract: Africa stands at a pivotal juncture where urgent development imperatives intersect with escalating climate vulnerabilities. Despite contributing less than 4% of global greenhouse gas emissions, the continent disproportionately bears the consequences of climate disruption. Yet Africa holds 60% of the world's solar irradiation potential, over 30% of globally critical transition minerals, and the youngest, fastest-growing labour force on earth. This paper analyses Africa's green industrialisation as a transformative development pathway that reconciles economic transformation with ecological preservation, drawing on qualitative, policy-oriented analysis of secondary literature, comparative case studies across five sub-regions, and policy documents. The study establishes that deliberately pursued green industrialisation – leveraging renewable energy, local value addition, and the African Continental Free Trade Area (AfCFTA) – could generate up to 14 million jobs and boost continental GDP by 6.4% by mid-century. However, if value addition and inclusive participation are not prioritised, the continent risks what this paper terms the green resource curse: the reproduction of extractive economic patterns under a green veneer. The study draws five key policy conclusions spanning climate finance, regional value chains, decentralised energy, skills development, and global trade reform. Africa's green industrialisation experience challenges the 'industrialise first, clean up later' paradigm, offering the global community a replicable model of inclusive, low-carbon growth.

Keywords: Green Industrialisation; Leapfrog Development; Africa; Critical Minerals; Green Resource Curse; Climate Finance.

INTRODUCTION

Africa's role in redefining industrialisation through a green, sustainable lens is both strategic and urgent. Unlike previous development models reliant on fossil fuels, green industrialisation harmonises technological progress with ecological resilience, rejecting the notion that economic growth must necessitate environmental degradation (Muigua, 2024). Before proceeding, two foundational concepts require definition. First, the green resource curse, coined in this paper, refers to a scenario in which Africa's mineral and renewable energy wealth is extracted and exported with minimal local processing, replicating the structural dependency of the traditional resource curse under a clean-energy framing. Second, onshore beneficiation denotes the domestic transformation of raw materials into higher-value processed goods – for example, refining cobalt into battery-grade precursors rather than exporting ore – thereby capturing greater economic value within the producing country.

Despite contributing less than 4% of global greenhouse gas emissions, Africa faces disproportionate climate vulnerabilities, including droughts, desertification, and flooding (Muigua, 2024). Yet these challenges have catalysed innovation. The continent holds 60% of the world's solar irradiation, vast reserves of transition minerals, and a youthful, entrepreneurial labour force (Medinilla *et al*., 2025). Green industrialisation thus serves simultaneously as an ecological necessity and an economic opportunity.

Africa's leapfrog approach offers a template for the global community. While advanced economies struggle with the costs of decarbonising legacy industries, Africa's model avoids stranded assets – investments that become obsolete or unprofitable before the end of their expected life – and builds agile, future-proof economies (Triki & Said, 2021). This paper examines how African nations can accelerate this trajectory, identifies systemic barriers, and draws lessons for global policy.

THE RATIONALE FOR GREEN INDUSTRIALISATION IN AFRICA

Green industrialisation seeks to decouple economic growth from environmental degradation by integrating clean energy, sustainable inputs, and green technologies into production systems (Triki & Said, 2021). For Africa, three strategic imperatives underpin this approach.

First, avoiding stranded assets is critical. Continued investment in fossil fuel plants and supply chains risks both financial losses and

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carbon lock-in, where economies become dependent on high-emission technologies that make future transitions costly. Proactive strategies – rapid renewable deployment, managed phase-outs of fossil infrastructure, and energy storage integration – shield consumers and national budgets from these risks (UNECA, 2016a).

Second, green industrialisation enhances resource efficiency. Digital tools such as precision agriculture and automated manufacturing systems reduce waste and emissions while increasing productivity. In Ethiopia's Hawassa Eco-Industrial Park – powered entirely by renewable energy – water use has been reduced by 90%, while attracting over USD 500 million in textile investments (Bouchene *et al*., 2024). This demonstrates that sustainability can be a driver of competitiveness rather than a constraint.

Third, Africa's natural capital endowment positions it as a global leader. The continent hosts 60% of the world's solar irradiation zones, 55% of global cobalt reserves, 48% of manganese, and 80% of platinum group metals (IEA, 2022; UNCTAD, 2023). Harnessing these resources through onshore beneficiation – processing minerals domestically rather than exporting raw materials – is central to capturing value and avoiding the green resource curse. Initiatives such as Kenya's Africa Green Industrialisation Initiative (AGII) and Senegal's green industrial clusters exemplify this shift, mobilising over USD 4.5 billion in investments (Roscoe, 2023; SMI Africa Council, 2024).

Green industrialisation also addresses equity imperatives. Over 600 million Africans lack reliable electricity, forcing reliance on polluting biomass and diesel generators (Muigua, 2024). Decentralised renewable solutions, such as Kenya's Lake Turkana Wind Power Project – which provides 15% of national electricity while funding local education and healthcare – demonstrate that social equity and sustainability can coexist (SMI Africa Council, 2024). The African Union's Agenda 2063 reinforces this by framing industrialisation as a catalyst for job creation and poverty reduction (SAIIA, 2025).

Finally, green industrialisation future-proofs African economies against shifting global norms. Carbon border taxes and supply chain sustainability requirements increasingly penalise emissions-intensive exports. Countries investing in green steel, lithium processing, and organic textiles – such as Namibia and Ethiopia – are positioning themselves as preferred suppliers in a decarbonising world (Bouchene *et al*., 2024). This pivot taps into a projected USD 3 trillion global green economy while mitigating climate risks (Triki & Said, 2021).

SYSTEMIC BARRIERS AND THE GREEN RESOURCE CURSE RISK

Despite its promise, Africa's green industrialisation faces systemic barriers that, if unaddressed, threaten to generate a green resource curse – the reproduction of extractive dependency patterns under a sustainable-development framing. The concept draws on classical resource curse theory (where mineral wealth paradoxically impedes development through Dutch disease, governance failures, and enclave economies), but extends it to a scenario where African countries supply processed green inputs to global markets while retaining minimal economic value, technology, or skilled employment locally.

Financing inequity is the most pervasive constraint. African nations pay 5–7 times more for green loans than advanced economies, limiting scalable renewable investment (Barchiche *et al*., 2024). High upfront costs mean that, absent concessional finance, countries are compelled to accept investment terms that prioritise foreign returns over domestic value chains. This structural imbalance is the primary mechanism through which the green resource curse materialises.

North Africa: Technological Dependencies

Morocco's Noor Ouarzazate Solar Complex, while globally acclaimed, illustrates the dependency risk. The country's limited domestic R&D capacity necessitates costly imports of electrolysers and battery storage systems (Triki & Said, 2021). Fossil fuel subsidies averaging 5% of GDP further distort energy markets and slow the transition to decentralised renewables (Medinilla & Byiers, 2023). Without deliberate technology transfer and local manufacturing investment, Morocco's solar leadership risks remaining an enclave economy.

West Africa: Energy Poverty and Fossil Fuel Lock-In

In Nigeria, over 90 million people lack electricity access, forcing industries to rely on diesel generators that emit 25 megatons of CO_2 annually (Muigua, 2024). The country's oil-dependent economy faces stranded asset risks as global demand shifts toward renewables, yet policy inertia continues to approve fossil-fuel-intensive

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projects (Okereke, 2025). Ghana's plastic waste-to-fuel initiatives, while innovative, are constrained by inconsistent policy enforcement and low private-sector participation (SMI Africa Council, 2024).

East Africa: Financing Gaps and Institutional Fragmentation

Kenya's geothermal and wind projects grapple with high-interest loans averaging 12% and currency volatility, inflating debt burdens (Barchiche *et al*., 2024). Tanzania's green manufacturing sector faces unclear tax incentives and low consumer demand, with 60% of firms citing high short-term costs as the primary deterrent (Tumaini, 2021). Regional rivalries complicate cross-border energy grids, delaying the East African Power Pool's integration (UNECA, 2016b).

Central Africa: Governance Deficits

The Democratic Republic of Congo (DRC) and Zambia's joint battery mineral initiative is hampered by infrastructure gaps, with only 15% of critical mining sites connected to paved roads (Medinilla & Byiers, 2023). Corruption in mineral licensing and weak environmental regulations exacerbate ecological degradation, undermining sustainable mining – the very conditions that give rise to the green resource curse. The Congo Basin's hydropower potential remains underutilised due to political instability (SAIIA, 2025).

Southern Africa: Carbon-Intensive Legacy Industries

South Africa's coal-dominated energy system – supplying 80% of electricity – faces resistance from labour unions fearing job losses in mining sectors (Bouchene *et al*., 2024). Mozambique's aluminium sector risks export cost increases of 20% by 2030 under the EU's Carbon Border Adjustment Mechanism (CBAM) (Medinilla & Byiers, 2023). Zimbabwe's solar initiatives struggle with unreliable grid connections and bureaucratic delays. These cases illustrate that without just transition planning, decarbonisation can generate social disruption that undermines the political feasibility of green industrialisation.

Cross-Regional Challenges

Beyond sub-regional specificities, three cross-cutting challenges require coordinated responses. Skills shortages are acute: only 12% of African universities offer specialised green technology programmes, constraining local innovation and making the continent dependent on foreign expertise (UNECA, 2016b). Policy incoherence under the AfCFTA hinders harmonised green standards, fragmenting regional markets and enabling regulatory arbitrage by multinational investors (Medinilla *et al*., 2025). Finally, the manufacturing sector alone emits 440 megatons of CO_2 annually, underscoring the urgency of decarbonising industries such as cement, steel, and textiles (Bouchene *et al*., 2024).

OPPORTUNITIES AND GLOBAL IMPLICATIONS

Socio-Economic Prosperity and the Green Labour Market

The scale of Africa's resource endowment is transformative. Sub-Saharan Africa holds 30% of global reserves of critical raw materials vital for clean technology value chains (Okereke, 2025). The continent hosts 60% of the world's best solar irradiation zones, yet accounts for barely 1% of installed solar PV capacity (IEA, 2022; UNCTAD, 2023). Closing this gap, combined with strategic industrialisation, creates the foundation for a green employment revolution.

Analysis by FSD Africa and Boston Consulting Group forecasts 1.5 to 3.3 million new direct green jobs by 2030 across solar, e-mobility, climate-smart agriculture, and waste management (FSD Africa & BCG, 2024). Solar energy is expected to account for up to 57% of these positions. Over the longer term, the Africa Renewable Energy Manufacturing Initiative (Africa REMI) projects 14 million jobs and a 6.4% continental GDP boost by mid-century (Africa REMI, 2024). McKinsey & Company identifies 24 specific green business opportunities that could yield USD 2 billion in revenues and approximately 700,000 jobs by 2030 (Bouchene *et al*., 2024). These projections are summarised in Table 1.

Table 1: Comparative Projections for Africa's Green Economy

Organisation / Initiative	Metric Type	Key Projection / Statistic	Timeframe
Africa REMI	Employment & GDP	14 million jobs; 6.4% GDP boost	By 2050
IMF	Revenue	USD 2 trillion in cumulative mineral revenues	By 2050
FSD Africa & BCG	Employment	1.5–3.3 million new direct green jobs	By 2030

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AGHA/GHO	Employment & GDP	4 million jobs; USD 126 billion added to GDP	By 2050
McKinsey & Company	Employment & Revenue	700,000 jobs; USD 2 billion in revenue	By 2030
IRENA & ILO	Current Employment	324,000 total renewable energy jobs (current)	2024
African Climate Foundation & LSE	Trade Risk	USD 25 billion potential GDP reduction due to EU CBAM	Long-term
BloombergNEF & UNECA	Value Chain Capture	DRC captures only 3% of the USD 46 trillion battery/EV market	By 2050

Source: *Compiled by author from cited sources.*

Breaking Commodity Dependence through Onshore Beneficiation

Africa's green industrialisation offers a pathway beyond commodity dependence. Currently, more than half of African nations depend on raw commodity exports for at least 60% of their export earnings (UNCTAD, 2025). Onshore beneficiation – domestically processing minerals such as lithium and cobalt into battery-grade components rather than exporting raw ore – is the primary mechanism for preventing the green resource curse.

The economic case is compelling. While the DRC produces 70% of global cobalt, it captures only 3% of the projected USD 46 trillion battery and electric vehicle value chain (BloombergNEF & UNECA, 2021). A feasibility study found that constructing a cathode precursor plant in the DRC would cost three times less than a comparable facility in the United States (African Development Bank [AfDB], 2023). Emerging hubs illustrate this shift: the DRC–Zambia transboundary battery Special Economic Zone; Morocco's 20 GWh Gotion gigafactory; Zimbabwe's ascent as the world's sixth-largest lithium producer; and the Africa Green Hydrogen Alliance's projection that green hydrogen could add USD 126 billion to member GDP by 2050 (AGHA/GHO, 2023; IRENA, 2022).

Global Trade Dynamics and Strategic Partnerships

Africa's green industrialisation carries profound global implications. As markets increasingly favour low-carbon products, African industries adopting green practices gain access to international markets (Medinilla *et al.*, 2025). However, the EU's CBAM poses risks: estimates suggest it could reduce Africa's GDP by 0.91% – approximately USD 25 billion – with aluminium exports to the EU potentially declining by 13.9% (African Climate Foundation & LSE, 2023). Navigating these dynamics requires Africa to negotiate from collective strength.

Under the IEA's net-zero scenario, demand for lithium will increase tenfold by 2050, placing Africa's mineral wealth at the centre of global supply chains (IMF, 2024). Sub-Saharan Africa alone could capture nearly USD 2 trillion in cumulative mineral revenues by 2050 if extraction and processing scale with demand (IMF, 2024). Initiatives such as the AGII and the BRICS Green Manufacturing Partnership are strengthening Africa's capacity to develop green supply chains and expand markets for sustainable products (African Climate Foundation, 2024).

REGIONAL INTEGRATION AND THE AFCFTA AS A GREEN INDUSTRIAL ENABLER

The African Continental Free Trade Area (AfCFTA) represents the most consequential institutional framework for advancing Africa's green industrialisation. By creating a single market spanning 54 African Union member states, covering 1.4 billion people and a combined GDP of approximately USD 3.4 trillion, the AfCFTA provides the scale necessary to transform fragmented national green initiatives into coherent, continent-wide industrial ecosystems (Energy Capital Power, 2026; ITRC, 2026).

Critically, the AfCFTA's rules of origin, agreed on 92.4% of tariff lines, create the economic architecture for cross-border green value chains. Minerals extracted in resource-rich nations such as the DRC or Zimbabwe can be transported tariff-free for refinement in industrial hubs such as South Africa or Ghana, while downstream battery assembly can occur in markets with stronger manufacturing infrastructure (SA Trade Desk, 2026). The African Union's African Green Minerals Strategy (AGMS), formally adopted in February 2025, reinforces this vision by mandating regional mineral corridors, harmonised environmental standards, and continent-wide recognition of local content (African Green

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Minerals Observatory, 2025). Coordinated regional action could boost Africa's GDP by USD 24 billion annually and create at least 2.3 million jobs (African Business, 2025).

In renewable energy, UNECA estimates that AfCFTA-aligned energy investments of USD 22.4 billion between 2025 and 2040, directed primarily at solar and wind, could increase intra-African trade by USD 276 billion and continental GDP by USD 141 billion by 2045 (UNECA, 2025). Africa currently imports more than 96% of its green technology goods – solar panels, battery storage systems, and energy-efficient appliances – from outside the continent, representing a vast import-substitution opportunity under preferential AfCFTA terms (APRI, 2025).

Institutional architecture is advancing. The Pan-African Payment and Settlement System (PAPSS) now connects over 150 commercial banks, saving approximately USD 5 billion annually in cross-border transaction costs (Energy Capital Power, 2026). A USD 10 billion AfCFTA Adjustment Fund managed by Afreximbank cushions tariff-revenue losses and finances industrial competitiveness upgrades. The AfCFTA's Protocol on Investment includes provisions that the World Economic Forum notes could anchor a competitive regional battery value chain emphasising low-carbon production (WEF, 2024).

Significant barriers persist nonetheless. Weak transport, energy, and logistics infrastructure inflate trade costs, while fragmented national green policies risk undermining collective bargaining power (ACEP, 2025). The AfCFTA's full potential as a green industrial enabler will only be realised through accelerated implementation, harmonised sustainability standards, and inclusive policies that ensure women and rural communities participate equitably in emerging value chains (Medinilla *et al*., 2025).

KENYA'S AFRICA GREEN INDUSTRIALISATION INITIATIVE: A CASE STUDY

Kenya's Africa Green Industrialisation Initiative (AGII), launched by President William Ruto at COP28 in Dubai, represents a flagship effort to accelerate sustainable economic growth by scaling green industries and promoting climate resilience across Africa (Roscoe, 2023). Building on the UAE's Africa Green Investment Initiative, AGII targets financing for 15 GW of renewable energy capacity in Africa by the end of the decade, aiming to unlock large-scale investments in green manufacturing, clean power, and climate-smart agriculture (CLG Global, 2024).

Kenya has already secured USD 4.48 billion in green manufacturing deals under the initiative, including a USD 1.5 billion partnership with Fortescue for green fertiliser production and a USD 1 billion agreement with Masdar for a 300 MW geothermal project at Suswa (Wanambisi, 2023). These projects exemplify the onshore beneficiation principle: rather than exporting geothermal steam or raw minerals, Kenya is converting natural endowments into high-value industrial outputs, directly countering the green resource curse dynamic.

AGII's emphasis on innovation – supporting green hydrogen production, geothermal-powered data centres, and green ammonia for agriculture – moves African economies up the value chain (Roscoe, 2023). International collaboration is central, with support from the UAE, UK, and international investors who recognise green industrialisation as integral to global climate ambitions (President of Kenya, 2023; UK Government, 2023).

However, AGII also illustrates structural challenges. Three risks warrant attention. First, financing sustainability: the reliance on international partnerships and blended finance models, while currently productive, may limit scalability if global concessional finance flows prove insufficient or politically conditional. Second, technology deployment at the targeted scale requires overcoming logistical bottlenecks, regulatory fragmentation, and skills gaps in specialised engineering. Third, inclusive development demands robust policy frameworks to ensure that benefits reach rural and marginalised communities rather than concentrating in urban industrial enclaves – failing which AGII itself could exhibit green resource curse dynamics at sub-national scale.

Kenya's experience offers a replicable model: visionary leadership, transparent international partnerships, and explicit value-addition mandates can position a single country as a continental green industrialisation anchor. The challenge is institutionalising these gains beyond individual presidential initiatives into durable national and regional policy frameworks.

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POLICY RECOMMENDATIONS

The following five policy recommendations emerge directly from the analytical findings of this study and are designed to address the specific barriers and risks identified, including the green resource curse.

Mobilise Equitable Climate Finance through Restructured Instruments

Overcoming financing inequity requires more than increased aid flows; it demands structural reform of the terms on which Africa accesses green capital. African governments and their international partners must prioritise concessional loans, green bonds, and risk-sharing mechanisms that reduce borrowing costs for renewable projects below the current 5–7x premium over advanced economy rates (Barchiche *et al*., 2024). South Africa's Just Energy Transition Partnership – which secured USD 8.5 billion in grants and low-interest loans – provides a scalable template, but must be matched by redirecting fossil fuel subsidies (averaging 5% of GDP in North Africa) toward decentralised solar and mini-hydro systems that extend benefits to rural economies (Muigua, 2024; Okereke, 2025).

Operationalise Regional Green Value Chains through AfCFTA Instruments

Rather than treating the AfCFTA as a trade facilitation instrument alone, policymakers should deploy it as an active green industrial policy framework. This requires establishing cross-border green industrial zones with harmonised tax incentives, sustainability standards, and binding local content requirements. The DRC–Zambia battery Special Economic Zone and Morocco's gigafactory point to what is possible, but these must be embedded in continent-wide rules that prevent multinational actors from using AfCFTA's tariff liberalisation to bypass local processing obligations. The African Green Minerals Strategy's mineral corridors and cumulation clauses provide the legal architecture; the political will to enforce them is the missing ingredient.

Accelerate Decentralised Renewable Energy Infrastructure

Energy poverty is both a development challenge and a green industrialisation barrier: industries cannot decarbonise if they lack reliable clean electricity. Governments must fast-track policies for mini-grid and community-owned solar deployment, targeting the 600 million Africans without reliable electricity (Muigua, 2024). Nigeria's Solar Naija Program – aiming to electrify 5 million households by 2030 through public-private partnerships – demonstrates how targeted rural energy programmes reduce diesel dependency and create local installation employment (Chukwu, 2022). Concurrently, modernising national grids to integrate variable renewables, as in South Africa's Battery Storage Initiative, stabilises industrial energy supply and reduces the diesel fallback that perpetuates carbon lock-in (Barchiche *et al*., 2024).

Invest in Green Skills and Enforce Technology Transfer

Addressing Africa's green skills gap requires integrating renewable energy curricula into vocational training and university programmes, moving beyond the 12% of institutions currently offering specialised programmes (UNECA, 2016b). Partnerships with institutions like Africa REMI could train 100,000 technicians annually in solar PV installation, e-waste recycling, and battery assembly (Africa REMI, 2024). Critically, technology transfer must be made binding rather than aspirational: international green investment agreements, including EU–Africa Green Alliances, should include enforceable technology licensing and co-manufacturing clauses as a condition of market access, directly countering the technological dependency that feeds the green resource curse.

Reform Global Trade Frameworks to Reflect Historical Emissions Responsibility

Africa's minimal historical responsibility for cumulative global emissions justifies differentiated treatment in global trade frameworks. African nations must negotiate, through collective AfCFTA bargaining power, for exemptions or extended phase-in periods under CBAM for industries undergoing green transition, and for fair pricing regimes for processed green minerals. Mozambique's aluminium industry, facing a potential 20% cost increase under CBAM, illustrates the stakes (Medinilla & Byiers, 2023). The formation of an African Critical Minerals Alliance – proposed at the 2025 Africa Climate Summit – would create the unified negotiating bloc necessary to press these demands at WTO and COP fora (Africa Renewal, 2025).

CONCLUSION

This paper has argued that Africa's green industrialisation is simultaneously a developmental necessity, a strategic global opportunity, and a governance challenge requiring active management to prevent the green resource curse.

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The continent's endowments – renewable energy potential, critical transition minerals, and a youthful workforce – constitute a genuine leapfrog opportunity, but only if deliberately harnessed through onshore beneficiation, equitable finance, and inclusive policy frameworks.

Five analytical conclusions emerge. First, green industrialisation can generate transformative employment and income gains – up to 14 million jobs and a 6.4% GDP boost by mid-century – but these outcomes are conditional on domestic value capture and skills investment. Second, the green resource curse is a present and analytically distinct risk that policy must explicitly target, not merely acknowledge. Third, the AfCFTA is the most consequential institutional instrument for scaling green industrialisation, but requires proactive deployment as an industrial policy tool beyond tariff liberalisation. Fourth, regional case studies across all five sub-regions reveal that despite varied endowments and constraints, the barriers to green industrialisation are structurally similar: financing inequity, infrastructure deficits, skills gaps, and governance weaknesses. Fifth, Africa's success in greening its industries could prevent 0.5°C of global warming by 2050, making this a global, not merely African, imperative (Barchiche *et al*., 2024).

For the global community, Africa's green industrialisation experience fundamentally challenges the industrialise first, clean up later paradigm. It demonstrates that economic transformation and ecological integrity are mutually reinforcing rather than trade-offs, and that inclusive, low-carbon growth is not only possible but economically imperative. Realising this potential requires the Global North to move from aid-based to equitable partnership frameworks: binding technology transfer, restructured climate finance, and reformed trade rules that reflect Africa's minimal historical emissions responsibility.

With strategic vision and the right international support, Africa can transition from a resource provider to a green industrial powerhouse – and in doing so, provide a replicable blueprint for sustainable, inclusive growth worldwide.

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All data used in this study are derived from publicly available secondary sources and published reports cited in the article. No new datasets were generated or analysed.

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