

Beyond Resource Extractivism and Comparative Advantages: The Case for Energy Transitions in Africa

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Abstract

Africa's abundant renewable and non-renewable resources provide the continent with significant comparative advantages to become a major player in the rapidly changing global energy transition landscape. This is underpinned by its stock of about 30% of the world's mineral reserves including critical energy transition minerals, high solar irradiance and significant wind speed, huge carbon sequestration potential, favorable carbon emission profile, and trade frameworks such as the African Continental Free Trade Area (AfCFTA). However, this abundance is marked by deepening levels of extractivism in the form of policies, range of natural resources, and political culture and practice, which have led to increasingly exploitative and destructive activities on the continent. In our commentary, we discuss the problematic of resource extractivism and the dependence and vulnerabilities it creates in resource-rich developing countries in Africa and articulate how the path to net zero offers a new opportunity for the continent to be a global powerhouse for resource-driven climate action and investment.

Keywords: Resource Extractivism, Comparative and Competitive Advantages, Energy Transitions, Nairobi Declaration, AfCFTA

Introduction

Natural resources - ranging from critical minerals and fossil fuels to water and biomass underpin global economies and societies. Their extraction and utilization are also central to advancing the global transition to cleaner energy and economic development, providing essential materials for industry, energy production, and human consumption. From electric vehicles to solar panels and wind turbines, the global transition to clean energy is resource intensive and dependent on critical minerals such as lithium, nickel, cobalt, manganese, and graphite (World Bank 2018; World Bank 2020; UNCTAD 2020), of which Africa has in abundance (IEA 2021; Cust & Zeufack, 2023). Concomitantly, the latest International Energy Agency (IEA) 2050 Net Zero Emissions (NZE) scenario (IEA 2023) (IPCC Sixth Assessment Report), projects that the demand for nickel and cobalt will double and triple, respectively, while the demand for lithium is expected to increase tenfold between 2022 and 2050. As such, Africa's rich endowment of renewable and non-renewable resources offer significant potential for driving economic growth and accelerating the achievement of the Sustainable Development Goals (SDGs) (UN, 2015; Pedro *et al.*, 2017; Sachs *et al.*, 2019), enabling the realisation of Africa's aspirations to promote resource-driven and trade-induced industrialization and economic diversification including in the battery and electric vehicles value chain (AMV, 2009; UNECA, 2015; IRENA, 2015; Pedro, 2016; World Bank 2023).

However, achieving these goals and breaking away from the perils of resource extractivism and rentierism (Gudynas, 2010; Acosta, 2013), the "Paradox of Plenty," and the "Resource Curse" remains a challenge (Pedro, 2006; UNECA, 2011; Pedro *et al.*, 2017; Cust, & Zeufack, 2023). All of these manifests in several ways, including booms-and-busts and economic instability as a result of fluctuating global commodity prices; crowding-out other economic sectors such as agriculture; inadequate growth; export intensity and overdependence on a single or few commodities (Collier, 2010; Auty, 1993) as well as heightened competition for resource rents (Collier & Hoeffler, 2005). Relatedly, the exploitation of these resources often leads to significant environmental degradation, including deforestation, habitat loss, pollution, and climate change (Bradshaw *et al.*, 2010; Zaehring *et al.*, 2024).

According to the Global Resources Outlook, natural resources extraction and use over the past five decades, have far surpassed initial targets,

surging by over fourfold and is set to rise by a further 60% by 2060, contributing significantly to greenhouse gas emissions and biodiversity loss, further triggering the triple planetary crises (Global Resources Outlook 2024). Likewise, the governance of natural resources in certain contexts has been marked by complex economic, political, and social dynamics, often resulting in unequal distribution of benefits and costs. This imbalance exacerbates economic and social inequalities, influences geopolitical power relationships, and has led to incidents of conflicts and social injustice (Bebbington *et al.*, 2008; Ross, 2012).

Concurrent with these realities, is an increasing global push for climate change action, leading to a variety of initiatives. Chiefly among them are the advancements of key international climate frameworks such as the United Nations Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement, and the recent Nairobi Declaration, all aimed at mitigating greenhouse gas emissions, decarbonizing global production systems, and promoting sustainable development. However, the promotion of low-carbon technologies could result in the reduction of demand for, and value of fossil fuels, while the actions to divest from fossil fuels by institutional investors, may lead to the stranding of substantial proportions of Africa's resource wealth and assets, further exacerbating existing problems in fossil-fuel rich African countries.

These dynamics and global shifts have placed Africa at a pivotal juncture, with challenging trade-offs to consider. At this crucial intersection, the commitment of resource-rich African states to use their natural resources as an engine to promote inclusive growth and development, create jobs, and accelerate structural transformation through industrialization and economic diversification must be climate-friendly. For several reasons, this would make African exports competitive and capable of meeting carbon border adjustment mechanisms being imposed in other jurisdictions. However, in the case where the achievement of Africa's aspirational goals is endangered, the ramifications would be multifaceted and profound, with far-reaching implications for the continent's society and economy, and in recent days, threats to regime survival.

Conversely, as demands for critical minerals expand, the decarbonization agenda offers African mineral-rich countries huge opportunities to drive sustainable and inclusive growth and development,

positioning them as potentially global hubs for green manufacturing. Yet, these advantages might not last forever. Efforts by several resource-poor countries to reduce supply-side exposure through diversification and investment in alternative minerals (e.g., aluminum), and exploration of virgin terrains (e.g., seabed resources and outer of space exploitation), may in the future reduce the comparative advantage of African countries rich in critical minerals. To counter this, immediate action is required to transform comparative advantages into sustainable competitive advantages.

In our commentary, the concept of moving beyond resource extractivism and comparative advantages appreciates the interconnectedness of these variables and the importance of adopting global practices for the planet and people. So, it advances a variety of prognoses of transformative strategies that may help resource-rich African states reduce their dependency on exporting raw materials, enhance local economic opportunities and improve domestic productivity. Central to this is the AfCFTA adopted in 2018, and the Africa Mining Vision, both constituting reference frameworks to achieve these goals.

The proposed pathways also hinge on the implementation of integrated policies that address climate, energy, minerals, trade, and industrial development imperatives (Collier, 2010; Kaplinsky, 2011; UNECA ERA, 2015; UNECA 2016; World Bank 2023). They call for more local value addition, development of regional value chains, and adoption of growth models underpinned on beyond GDP metrics and a broader set of indicators that reflect wellbeing, sustainability, and social progress.

The Problematic of Resource Extractivism

Extractivism, characterized by the exploitation of natural resources for economic gain in resource-rich countries is the dominant feature of most African economies (Elisa, 2020). Its manifestations include poorer development outcomes and economic growth, in comparison with countries with fewer natural resources. This contradictory coexistence according to Chagon *et. al.* (2022) is as a result of socio-ecologically destructive processes of subjugation, depletion, and non-reciprocal relations, occurring at all levels of practices, and is diametrically opposed to the concept and practices of ecological, social, and economic sustainability, which the (SDGs) espouses. In Africa, this is further accentuated by the fact that the extractive sector remains an enclave with limited linkages to the

local economy (Pedro, 2022) and by other structural factors which limit the options to drive structural transformation (Castel-Branco, 2014). Moreover, governance deficits in the management of the natural resources sector have largely created risks rather than wealth (Gylfason, 2001).

First among these risks is the “Dutch Disease,” which describes an economic phenomenon where the discovery and exploitation of natural resources such as oil and natural gas triggers the appreciation of local currencies, inflation, factor flows from other sectors such as agriculture to the oil and gas sector, to name a few. These distortions in the economy were observed during Nigeria's oil boom in the 1970s, where the overt dependence and investment in the oil sector led to massive influx of foreign currency from oil exports, and increased domestic income and spending. This stringing effect also recorded a labour flight and capital move from non-tradable sectors towards the booming resource sector. As a consequence, Nigeria, once a major agricultural exporter, became a net importer of food, due to the decline in the manufacturing and agricultural sectors, and experienced inflation and the redundancy of domestic industries, non-tradable goods, and services (Corden, 1984; Neary & van Wijnbergen, 1986; Acosta, 2013; Sala-i-Martin & Subramanian, 2013).

In addition to crowding-out resources from other sectors, resource extractivism is associated with significant governance and institutional challenges, which have the propensity to lead to rent-seeking behaviours, corruption, and weak institutions, as political elites and interest groups compete for control over resource revenues (Ross, 2012). These dynamics can undermine democratic processes and have led to authoritarianism, violent conflict and the display of hegemonic behaviors and attitudes.

Resource extractivism often leads to economic booms and busts driven by global commodity price fluctuations, which are largely beyond the control of producing countries in the global South. In resource-rich countries with high export intensity or dependence on few or single commodity exports, these fluctuations have significant impact on government revenues. When prices are high, revenues increase, often leading to increased public spending and investment. When prices fall, revenues decline sharply, forcing cuts in public spending and investment, harming economic growth and development (Bleaney & Greenaway, 2001). For example, Zambia's economy is heavily reliant on copper exports, and

the fluctuation in copper prices has had a direct impact on its economic stability (Fessehaie, Rustomjee, & Kaziboni, 2016).

Natural resource funds and sovereign wealth funds have been successfully established in several countries (e.g. Norway) as a stabilization mechanism, saving for future generations, curbing expenditure, and fostering investments. However, they are not a panacea, as many of such funds are non-performing and are badly managed (Bauer, 2014).

Likewise, the benefits of resource extraction are often unevenly distributed, with local communities bearing most of the costs and little of the benefits. This has led to social unrest, conflicts, and human rights abuses, further exacerbating social inequality and injustice (Bebbington *et al.*, 2008).

Added to these issues are the positions taken by institutions and investors to reduce greenhouse gas emissions and exert pressure for climate solutions, which have serious implications for fossil fuel resource-rich developing countries. These movements impact oil, gas, coal, energy infrastructure and other resource-based investments in resource-rich African countries, turning assets in these sectors obsolete and non-performing. (World Bank, 2023). For example, the Carbon Tracker Initiative (2017) estimates that a substantial portion of Africa's coal reserves could become unviable, leading to significant economic losses for countries such as South Africa, who rely on fossil fuel revenues. As such, fossil fuel-based infrastructure, such as power plants, pipelines, and refineries in these regions are at risk (Burton, Lott, & Rennkamp, 2018; Bos & Gupta, 2019). Evidence in this regard include the divestment of over \$6.24 trillion in assets from fossil fuels (Arabella Advisors, 2018), and in recent times, the enactment of exclusionary policies targeting various oil and gas organisations and stock portfolios (Bloomberg, 2024; The Church of England, 2017).

Even though still hypothetical, outer space exploitation could equally strand mineral resources in Africa. The case in point being Asteroid 16 Psyche, a metal-rich asteroid located in the asteroid belt between Mars and Jupiter, estimated to be worth US\$ 700 quintillion and contains vast quantities of valuable minerals, including gold, platinum group metals, and other rare metals. The introduction of these large quantities of minerals from asteroid mining could lead to a significant oversupply in global markets, drive down the prices of minerals and other rare metals (Kargel,

1994), and reduce foreign direct investment (FDI) in terrestrial terrains (Ogwueleka, 2013).

From Comparative to Competitive Advantages: The Way Forward for Africa

According to UNU-Wider, Africa hosts 42 of the 63 elements used in low carbon technologies and needed for the 4th industrial revolution. Moreover, its abundant renewable energy resources, such as high solar irradiance, significant wind speeds, huge green hydrogen potential, and massive carbon sink assets in tropical forests such as the Congo Basin and beyond, makes the continent an ideal location for the development of solar and wind energy projects (IRENA, 2015), including green manufacturing. Amidst these, Africa is also the continent with a burgeoning population, undergoing rapid urbanization and industrialization, worse hit by climate change, and more at risk to further environmental unsustainability if current consumption and production patterns persist. Catalyzed by the AfCFTA, the above-mentioned factors can enable the continent to use its comparative advantages in resource endowments, demographic profile, and development needs to pursue endogenous growth, with both an inward and outward focus. To achieve these aspirational goals, African member States must first put industrial policy at the centre of their development agenda (Ha-Joon Chang, 2002), with smart integration of climate, trade, infrastructure development, and energy action.

Beyond the economies of agglomeration that the AfCFTA enables, actions must be also taken to determine factor and demand conditions as well as the value proposition (Porter, 2011) of each of African member States, and articulate paths to building their competitive advantages and to make the most of the AfCFTA. For instance, data analytics such as growth diagnostic studies (Hausmann, Rodrik, & Velasco, 2005; Hausmann, Klinger, & Wagner, 2008), trade decision support modeling and product space analysis, (Hidalgo, Klinger, Barabási, & Hausmann, 2007), skills gaps assessments and GIS-enabled hotspot analysis would facilitate detailed country profiling, assessments of binding constraints, and evaluation of micro-economic capabilities to support decision making, investment decisions, targeting, and prioritization. The success of this agenda requires an ecosystem for transformational change supported by sound governmental and firm strategies, well-designed and sequenced step-by-step multidimensional interventions to transform Africa's comparative

advantages into lasting competitive advantages (Morris *et al.*, 2012; Saleem *et al.*, 2018; Cherif & Fuad 2019; Oqubay *et al.*, 2020; Pedro, 2022).

Below are some of the most immediate opportunities and critical areas of intervention:

The Battery and Electric Value Chain

The battery and electric vehicle (BEV) value chain can be localized on the continent on the strength of Africa's superior cost and emissions profile (BloombergNEF, 2021). Building on the ongoing initiative to develop a BEV transboundary special economic zone between DRC and Zambia, this action should be prioritized to enable African States tap into a market estimated to reach US\$ 60 trillion by 2050. Such effort would address "the paradox of plenty" (USGS 2023; IEA 2021; Nichols, 2018; Pegg, 2006) and support the implementation of SDGS 7, 9, 11, 12, 13, 8, 3 (United Nations, 2015; Nhamo Nhamo & Nyahunda 2020; Van den Bossche, *et al.*, 2013; Mulugetta & Urban, 2010; Bertheau, Oyewo & Cader 2021; Mudenda, Zulu, & Gumbo, 2020).

The African Continental Free Trade Area

The African Continental Free Trade Area (AfCFTA) should catalyze the emergence of globally competitive regional value chains. With the creation of an integrated market of 1.5 billion people, the AfCFTA strengthens business fundamentals for "Made in Africa", and invest in Africa (UNECA, 2018; World Bank, 2023). The Protocols on Investment, Competition and Intellectual Property adopted by the African Union Heads of State and Government in February 2023 strengthen this argument. To be effective, these protocols must be ratified and domesticated in relevant national policies, laws, rules and regulations.

Carbon Credit Markets

The development of carbon credit markets in Africa would strengthen the continent's comparative advantages as a low carbon emissions destination for green manufacturing. The Africa Carbon Markets Initiative (ACMI) suggests that with carbon credits valued at roughly \$2 billion globally and potentially growing 5-50x by 2030, high-integrity carbon markets could provide significant benefits to African member States and be a critical source of climate finance for the continent, helping to push

the average price for carbon credit in Africa from about \$10 USD per tonne to more than \$100 USD per tonne as sold in other jurisdictions. At the latter prices, Africa could earn about US\$ 82 billion a year, much more than what it receives through overseas development assistance.

Moreover, the creation of high-integrity registries would facilitate price discovery, strengthen investor confidence, boost transparency, and market stability (Michaelowa *et al.*, 2018; Reinsberg & Vanhala, 2020). It would also enable their acceptance in global markets, build trust and prevent fraud, (Olsen, 2019), while ensuring robust verification and validation processes (Sterk *et al.*, 2011).

De-Risking Investments

To make Africa a globally competitive investment destination for domestic and foreign direct investors (FDI), significant efforts must be made to de-risk the investment landscape on the continent. For example, eighty percent (80%) of infrastructure projects initiated across Africa fail at the feasibility and planning stage, and FDI inflows have remained stagnant at around \$40-50 billion annually, a trend that began well before the COVID-19 pandemic. Other risks that can deter investors include political instability (MIGA, 2020), environmental and social risks, macroeconomic risks, legal and regulatory uncertainties, as well as infrastructure deficits (Foster and Briceño-Garmendia 2010; Collier 2010).

De-risking investments involves actions aimed at creating a conducive policy and regulatory environment to foster productive investments. This involves streamlining regulations, improving governance, and ensuring transparency in investment processes. It also requires investments to expand transport, energy, and communication infrastructure to support economic activities and reduce costs. Additionally, it includes exploring new and innovative financing mechanisms, such as blended finance and public-private partnerships, strengthening the capacity of local institutions and stakeholders to manage and implement investment projects effectively, and promoting regional integration and cooperation to create larger markets and enhance economic resilience.

Social Compacts

Overcoming the obstacles enumerated above require multifaceted actions necessitating policy coherence and integration (Gupta & Van der Grijp, 2010), and good governance (Kolstad & Søreide, 2009). Moreover, efforts are needed to strengthen institutional capacity with a focus on technical expertise, administrative structures, and financial management (Bessada & Martin, 2015).

Securing social licenses to operate, particularly in the context of large-scale natural resources projects requires environmental stewardship, transparency, and cultural sensitivity (Boutilier & Thomson, 2011; Harvey & Bice, 2014; Jenkins, 2004; Hilson, 2012) and effective community engagement in line with the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters. It also calls for the establishment of platforms for multi-stakeholder engagement aimed at bridging the gap on the understanding of costs and benefits of mining and what constitutes value for different stakeholders (WEF, 2016).

Overall, effective natural resources governance geared towards shared value creation and the path to net zero requires actions at all levels, and is a joint responsibility of host and home countries, policymakers, corporations, investors, consumer groups, civil society organisations, local communities, labour, and other stakeholders. This also requires a much broader in scope and reach multidimensional sustainable development licence to operate (SDLO) (Pedro *et al.*, 2017).

Conclusion

Africa's natural resource wealth offers huge opportunities for the continent to play a leading role in the global energy transition. To fully capitalize on its comparative advantages to build sustainable competitive advantages and avoid the ills of resource extractivism, a new dispensation is required. This calls for integrated implementation of mineral, trade, climate, energy and industrial policy, underpinned by the AfCTA, the Africa Mining Vision, and beyond GDP metrics. It also requires targeted action to de-risk investments and strengthen social compacts.

References

Acosta, A. (2013). Extractivism and Neoextractivism: Two Sides of the Same Curse. In *Beyond Development: Alternative Visions from Latin*

- America, edited by Miriam Lang, and Dunia Mokrani, 61–86. Amsterdam: Rosa-Luxemburg Foundation, Quito and Transnational Institute.
- African Development Bank (AfDB). (2023). The African Leaders Nairobi Declaration on Climate Change. African Union. (2009). *Africa Mining Vision*.
- African Union. (2023). The African Green Minerals Strategy.
- AMCEN. (2015). African Ministerial Conference on the Environment: Decision and Resolutions. African Ministerial Conference on the Environment.
- Arabella Advisors. (2018). The Global Fossil Fuel Divestment and Clean Energy Investment Movement Report.
- Auty, R. M. (1993). Sustaining development in mineral economies: The resource curse thesis. Routledge.
- Bauer, Andrew (2014), Managing the Public Trust: How to Make Natural Resource Funds Work for Citizens.
- Bertheau, P., A.S. Oyewo and C. Cader (2021). Electrification pathways for Sub-Saharan Africa and the impact of decentralized technologies. *Energy Strategy Reviews*, 34, 100617.
- Bebbington, A., L. Hinojosa, B.D. Humphreys, M.L. Burneo and X. Warnaars (2008). Contention and ambiguity: Mining and the possibilities of development. *Development and Change*, 39(6), 887-914.
- Besada, H., and P. Martin (2015). Mining and the Politics of Knowledge Production. Routledge.
- Bleaney, M., and D. Greenaway (2001). The Impact of Terms of Trade and Real Exchange Rate Volatility on Investment and Growth in Sub-Saharan Africa. *Journal of Development Economics*, 65(2), 491-500.
- Bloomberg NEF. (2021). *The Cost of Producing Battery Precursors in the DRC*. United Nations Economic Commission for Africa.
- Bloomberg (June 2024). The List of Money Managers Axing Oil Stocks Just Got Longer. The List of Money Managers Axing Oil Stocks Just Got Longer (yahoo.com).
- Bos, K., and J. Gupta (2019). Stranded assets and stranded resources: Implications for climate change mitigation and global sustainable development. *Energy Research & Social Science*, 56, 101215.
- Boutilier, R. G., and I. Thomson (2011). Modelling and Measuring the Social License to Operate: Fruits of a Dialogue Between Theory and Practice. Social Licence to Operate Seminar, Brisbane, QLD.
- Bradshaw, C. J. A., N.S. Sodhi and B.W. Brook (2010). Tropical turmoil: A biodiversity tragedy in progress. *Frontiers in Ecology and the Environment*, 8(2), 99-107.

- Brookings Institution. (2021). The Nigerian Petroleum Industry Act: Addressing old problems in a new framework. Brookings Institution.
- Burton, J., T. Lott and B. Rennkamp (2018). Sustaining carbon lock-in: Fossil fuel subsidies in South Africa. *Energy Research & Social Science*, 42, 44-56.
- Bush, J. (2018). The Nigerian Petroleum Industry Act: Reform and Challenges. *Journal of Energy Law and Policy*, 36(2), 145-162.
- Carbon Tracker Initiative. (2017). Expect the unexpected: The disruptive power of low-carbon technology.
- Castel-Branco, C. N. (2014). Growth, capital accumulation and economic porosity in Mozambique: social losses, private gains. *Review of African Political Economy*, 41(sup1), S26-S48. doi:10.1080/03056244.2014.976363.
- Chagnon, C. W., F. Durante, B.K. Gills, S.E. Hagolani-Albov, S. Hokkanen, S.M.J. Kangasluoma and M.P.S. Vuola (2022). From extractivism to global extractivism: the evolution of an organizing concept. *The Journal of Peasant Studies*, 49(4), 760-792.
- Chang, H.-J. (2002). *Kicking Away the Ladder: Development Strategy in Historical Perspective*. Anthem Press.
- Cherif, R. and F. Hasanov (2019). The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy. *IMF Working Paper No. 19/74*. International Monetary Fund. doi:10.5089/9781484393172.001.
- Collier, P., and A. Hoeffler (2005). Resource rents, governance, and conflict. *Journal of Conflict Resolution*, 49(4), 625-633.
- Collier, P. (2010). *The Plundered Planet: Why We Must - and How We Can Manage Nature for Global Prosperity*. Oxford University Press.
- Corden, W. M. (1984). Booming Sector and Dutch Disease Economics: Survey and Consolidation. *Oxford Economic Papers*, 36(3), 359-380.
- Cust, J., and A.G. Zeufack (Eds.). (2023). *Africa's Resource Future: Harnessing Natural Resources for Economic Transformation during the Low-Carbon Transition*. Washington DC: World Bank.
- Elisa, G. (2020). Africa, extractivism and the crisis this time, *Review of African Political Economy*, 47(166), 511-521.
- Fessehaie, J., Z. Rustomjee and L. Kaziboni (2016). Can mining promote industrialization? A comparative analysis of policy frameworks in three Southern African countries. *World Development*, 89, 15-30.
- Foster, V. and C. Briceño-Garmendia (2010). *Africa's Infrastructure: A Time for Transformation*. World Bank.

- Gudynas, E. (2010). The New Extractivism of the 21st Century: Ten Urgent Theses about Extractivism in Relation to Current South American Progressivism. Americas Program Report, January 21. Washington, DC: Center for International Policy.
- Gupta, J., and N. Van der Grijp (2010). Mainstreaming Climate Change in Development Cooperation: Theory, Practice, and Implications for the European Union. Cambridge University Press.
- Gylfason, T. (2001). Natural Resources, Education, and Economic Development. *European Economic Review*, 45(4-6), 847-859.
- Harvey, B. and S. Bice (2014). Social Impact Assessment, Social Development Programmes and Social License to Operate: Tensions and Contradictions in Intent and Practice in the Extractive Sector. *Impact Assessment and Project Appraisal*, 32(4), 327-335.
- Hausmann, R., D. Rodrik and A. Velasco (2005). *Growth Diagnostics*. John F. Kennedy School of Government, Harvard University.
- Hausmann, R., B. Klinger and R. Wagner (2008). *Doing Growth Diagnostics in Practice: A 'Mindbook'*. Center for International Development, Harvard University.
- Hidalgo, C. A., B. Klinger, A.L. Barabási and R. Hausmann (2007). The Product Space Conditions the Development of Nations. *Science*, 317(5837), 482-487.
- Hilson, G. (2012). Corporate Social Responsibility in the Extractive Industries: Experiences from Developing Countries. *Resources Policy*, 37(2), 131-137.
- ICMM. (2022). Role of Mining in National Economies: Mining Contribution Index (6th Edition). ICMM's Mining Contribution Index (MCI).
- IEA (2021). The Role of Critical Minerals in Clean Energy Transitions. IEA, Paris. Available at: www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions.
- IEA. (2023) World Energy Outlook 2023 IEA, Paris <https://www.iea.org/reports/world-energy-outlook-2023>.
- IMF (2024). Regional Economic Outlook. Sub-Saharan Africa; A Tepid and Pricey Recovery.
- IPCC (2023). Sections. In: Climate Change (2023). Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 35-115.
- International Renewable Energy Agency (IRENA). (2015). Renewable Energy Target Setting. Abu Dhabi: IRENA.

- IRENA. (2018). Renewable Energy Market Analysis: Africa and its Regions. International Renewable Energy Agency.
- Jenkins, H. (2004). Corporate Social Responsibility and the Mining Industry: Conflicts and Constructs. *Corporate Social Responsibility and Environmental Management*, 11(1), 23-34.
- Kargel, J. S. (1994). Metalliferous asteroids as potential sources of precious metals. *Journal of Geophysical Research: Planets*, 99(E10), 21129-21141.
- Kebede, E. (2018). Economic implications of local production of electric vehicles in developing countries. *African Journal of Economic and Sustainable Development*, 7(3), 145-160.
- Kolstad, I., and T. Søreide (2009). Corruption in Natural Resource Management: Implications for Policy Makers. *Resources Policy*, 34(4), 214-226.
- Michaelowa, A., A. Espelage and B. Müller (2018). Negotiating the Paris Rulebook: Southern Africa's Role in Shaping Article 6. *Climate Policy*, 18(3), 347-359.
- MIGA. (2020). World Investment and Political Risk. Multilateral Investment Guarantee Agency, World Bank Group.
- Morris, M., R. Kaplinsky and D. Kaplan (2012). "One Thing Leads to Another" - Commodities, Linkages, and Industrial Development. *Resources Policy*, 37(4), 408-416.
- Mudenda, C., L. Zulu and P. Gumbo (2020). Value Addition and Beneficiation in Mining: Transitioning from Extractive to Developmental Economics. *Journal of Development and Mining Economics*, 3(2), 23-37.
- Mulugetta, Y. and F. Urban (2010). Deliberating on low carbon development. *Energy Policy*, 38(12), 7546-7553.
- Neary, J.P. and S. van Wijnbergen (1986). Natural Resources and the Macroeconomy: A Theoretical Framework. In J. P. Neary & S. van Wijnbergen (Eds.), *Natural Resources and the Macroeconomy* (pp. 13-45). MIT Press.
- Nichols, E. (2018). The Resource Curse: A Look into the Implications of an Abundance of Natural Resources in the Democratic Republic of Congo. *Scholarly Horizons: University of Minnesota, Morris Undergraduate Journal*, 5(2), Article 6.
- Nhamo, G., S. Nhamo and L. Nhamo (2018). The green economy framework and the impact on sustainable development in Africa. *International Journal of African Renaissance Studies*, 13(1), 59-75.

- Nhamo, G., S. Nhamo and L. Nyahunda (2020). Greening Africa through electric vehicles: Opportunities and challenges post COVID-19. *African Journal of Science, Technology, Innovation and Development*, 12(6), 725-738.
- Ogwueleka, F. N. (2013). Analysis of the potential contributions of asteroid mining to global mineral supply. *Resources Policy*, 38(3), 233-239.
- Olsen, K. H. (2019). The Clean Development Mechanism's Contribution to Sustainable Development: A Review of the Literature. *Climate and Development*.
- Oqubay, A., J.Y. Lin and C. Lopes (Eds.). (2020). *The Oxford Handbook of Industrial Policy*. Oxford University Press.
- Pedro, A.M.A. (2004). United Nations Economic Commission for Africa. Sustainable Development Division Mainstreaming mineral wealth in growth and poverty reduction strategies. ECA policy paper; no. 1, vii, 24.
- Pedro, A. M. (2006). Mainstreaming Mineral Wealth in Growth and Poverty Reduction Strategies. *Economic Commission for Africa, African Development Bank, and African Union*.
- Pedro, A. M. (2016). The Africa Mining Vision as a Model for Natural Resource Governance in Africa. *Mineral Economics*, 29(2-3).
- Pedro, A., E.T. Ayuk, C. Bodouoglou, B. Milligan, P. Ekins and B. Oberle (2017). Towards a sustainable development licence to operate for the extractive sector. *Mineral Economics*, 30, 167.
- Pedro, A.M.A. (2022). Making extractives work for sustainable development in resource-rich countries Yakovleva, N., and E. Nickless (Eds.) in *Routledge Handbook of the Extractive Industries and Sustainable Development* (1st ed.). Routledge.
- Pegg, S. (2006). Can policy intervention beat the resource curse? Evidence from the Chad-Cameroon pipeline project. *African Affairs*, 105(418), 1-25.
- Porter, M. E. (2011). *The Competitive Advantage of Nations, States and Regions*. Harvard Business School.
- Reinsberg, B., and L. Vanhala (2020). The Politics of International Development Aid and Climate Change: Analyzing the Influence of Donor Preferences. *Global Environmental Politics*, 20(2), 34-57.
- Ross, M. L. (2012). *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations*. Princeton, NJ: Princeton University Press.
- Sachs, J. D., G. Schmidt-Traub, C. Kroll, G. Lafortune, G. Fuller and F. Woelm (2019). Sustainable development report 2019. Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

- Sala-i-Martin, X., A. Subramanian (2013). Addressing the Natural Resource Curse: An Illustration from Nigeria. *Journal of African Economies*, 22(4), 570-615.
- Saleem, A., Z. Ullah and N. Mahmood (2018). Climate Change and Its Impact on Agriculture in Pakistan: A Review. *Environmental Science and Pollution Research*, 25(5), 4478-4487.
- W. Sterk, S. Bäuerle, E. van der Goot, et al., (2011). *Ensuring the Environmental Effectiveness of Linked Carbon Markets*. Öko-Institut e.V. The Church of England. (2017). Extractive Industries: The policy of the National Investing Bodies of the Church of England and the Ethical Investment Advisory Groups Advisory and Theological Papers. United Nations. Economic Commission for Africa.; African Union Commission (2011-10). Minerals and Africa's development: the international study group report on Africa's mineral regimes. Addis Ababa: © UN. ECA,. <https://hdl.handle.net/10855/21569>.
- United Nations Economic Commission for Africa. (2013). *Economic Report on Africa 2013: Making the Most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation*. Addis Ababa: UNECA.
- United Nations Economic Commission for Africa. (2015). *Economic Report on Africa 2015: Industrializing through Trade*. Addis Ababa: UNECA.
- United Nations Economic Commission for Africa. (2016). *Transformative Industrial Policy for Africa*. Addis Ababa: UNECA.
- United Nations Economic Commission for Africa. (2018). *An empirical analysis of the African Continental Free Trade Area and the economy of Nigeria*. Addis Ababa: UNECA.
- United Nations Environment Programme. (2017). *Resource Efficiency: Potential and Economic Implications*. Nairobi: UNEP.
- United Nations Environment Programme. (2018). *Africa's Resource Efficiency: National and Sub-regional Policies and Strategies*. Nairobi: UNEP.
- UNCTAD. (2020). *Commodities at a Glance: Special Issue on Strategic Battery Raw Materials*. United Nations Conference on Trade and Development.
- United Nations Environment Programme. (2024). *Global Resources Outlook 2024*. Nairobi: UNEP.
- UNFCCC. (1992). United Nations Framework Convention on Climate Change.
- United Nations Economic Commission for Europe. (1998). *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters*.

UNFCCC. (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change.

UNFCCC. (2015). The Paris Agreement.