Sustainability, Future Proofing of Businesses and Value Addition in Mining: Structural Vulnerabilities in the Global South

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ABSTRACT

Mining continues to play a pivotal role in the economies of many Global South countries, yet its contribution to sustainable development and long-term economic resilience remains contested. This paper examines sustainability as a core strategy for future proofing mining-related businesses, with particular emphasis on value addition as a persistent structural vulnerability for mining-dependent economies in the Global South. Despite their critical position in global mineral supply chains, many resource-rich developing countries remain locked into extractive models characterized by raw mineral exports, environmental degradation, and limited socio-economic transformation. Using a mixed-methods approach that integrates comparative case studies and secondary quantitative indicators, the study contrasts sustainability integration and value addition practices in selected Global South and Global North contexts. The findings reveal that firms and governments in the Global North leverage strong institutions, advanced technologies, and coherent industrial policies to embed sustainability and downstream beneficiation within mining value chains. In contrast, Global South economies face institutional weaknesses, capital constraints, skills shortages, and policy inconsistencies that limit effective sustainability integration and business future proofing. The paper argues that weak local beneficiation represents an "Achilles' heel" that undermines both corporate resilience and national development outcomes in the Global South. Drawing lessons from resource-poor but economically successful countries, the study emphasizes the need for context-specific sustainability frameworks, strategic industrial policy, and inclusive governance mechanisms. The paper contributes to debates on sustainable mining, development economics, and business resilience by positioning sustainability-driven value addition as a strategic imperative rather than a regulatory burden.

Keywords: Sustainability, future proofing, value addition, mining, Global South, beneficiation, ESG

INTRODUCTION

The global transition to Net Zero has created a "Green Premium" for cobalt, lithium, copper among other minerals to achieve the green revolution.

Mining has long occupied a central position in the development trajectories of many Global South economies. Countries across Africa, Latin America, and parts of Asia possess abundant reserves of minerals essential to global industrialization, technological innovation, and energy transitions. Copper from Zambia and Chile, cobalt from the Democratic Republic of Congo (DRC), gold from Ghana and South Africa, lithium from Zimbabwe and Bolivia, and bauxite from Guinea are integral to global supply chains (UNCTAD, 2023). However, despite this mineral wealth, many of these economies continue to experience slow industrialization, high poverty levels, and environmental degradation.

The persistence of this paradox—resource abundance alongside underdevelopment—has been widely discussed in development literature under concepts such as the "resource curse" and "Dutch disease" (Auty, 2001; Sachs & Warner, 2001). More recently, attention has shifted toward sustainability and business resilience as pathways for addressing these structural challenges. Sustainability, in this context, extends beyond environmental protection to include social equity, governance quality, and long-term economic viability.

At the firm level, future proofing refers to the capacity of businesses to anticipate, adapt to, and withstand evolving economic, environmental, regulatory, and social pressures (Benn, Dunphy, & Griffiths, 2014). For mining companies, future proofing increasingly depends on their ability to integrate sustainability principles, respond to environmental, social, and governance (ESG) expectations, and contribute meaningfully to local economic transformation. Futureproofing of business goes beyond surviving market dips; in the 21st century it's about ensuring that the "Decarbonization Super-cycle" does not mirror the "Commodity Super-cycle" of the early 2000s, which left many Global South nations with holes in the ground and debt on the books.

A critical weakness undermining future proofing in the Global South is the limited extent of value addition and downstream beneficiation. While minerals are extracted locally, processing, refining, and manufacturing are often conducted elsewhere, primarily in the Global North or emerging industrial economies. This extractive-export model constrains job creation, technology transfer, and domestic industrial capacity, leaving mining economies vulnerable to commodity price volatility and external shocks (UNIDO, 2022).

This paper investigates sustainability and future proofing in mining with a focus on value addition as a structural vulnerability in the Global South. By comparing experiences from mineral-rich developing countries and resource-poor but economically successful nations, the study seeks to illuminate pathways toward more resilient, sustainable, and inclusive mining-based development.

LITERATURE REVIEW

Sustainability and the Mining Sector

Sustainability in mining has evolved from a narrow focus on environmental compliance to a broader framework encompassing social responsibility, governance, and long-term economic value creation. The triple bottom line framework introduced by Elkington (1997) emphasizes the interdependence of economic performance, environmental stewardship, and social well-being. In the mining context, sustainability involves responsible resource extraction, environmental rehabilitation, community engagement, transparency, and ethical labor practices (Hilson, 2020).

Global pressures have intensified sustainability expectations in mining. Climate change mitigation, biodiversity protection, indigenous rights, and supply chain transparency have become central concerns for investors, regulators, and consumers (OECD, 2021). As a result, sustainability performance increasingly affects firms' access to capital, market legitimacy, and operational continuity. EU's Carbon Border Adjustment Mechanism (CBAM) states that If Global South countries do not add value using green energy (e.g., smelting copper with solar vs. coal), their products will face higher taxes in Western markets. Thus, value addition is no longer just an economic goal; it is a regulatory necessity for market access.

Future Proofing and Business Resilience

Future proofing is closely linked to the concept of business resilience—the ability of firms to survive and thrive amid uncertainty. Porter and Kramer (2011) argue that companies that align social and environmental goals with core strategies create shared value that strengthens competitiveness. In mining, future-proofed firms invest in cleaner technologies, digitalization, stakeholder partnerships, and circular economy practices that reduce risk exposure and enhance adaptability.

In the Global North, sustainability-driven innovation has enabled mining firms to respond proactively to regulatory tightening and social expectations. However, in the Global South, structural constraints often limit firms' capacity to adopt such strategies, reinforcing vulnerability.

Value Addition and Development

Value addition refers to the transformation of raw materials into higher-value products through processing, refining, and manufacturing. Development economists have long emphasized industrialization and value chain upgrading as critical drivers of economic transformation (Chang, 2002). In mining, local beneficiation is essential for maximizing employment, skills development, and fiscal returns.

Despite this, many Global South countries remain exporters of unprocessed minerals. Weak infrastructure, limited access to capital, skills deficits, and policy incoherence have constrained beneficiation efforts (UNCTAD, 2023). As a result, mineral wealth often fails to translate into broad-based development. Selling raw lithium ore yields roughly $500–$1,000/tonne, whereas producing lithium hydroxides (value addition) jumps to $20,000+, and battery precursors even higher. This gap represents the "lost capital" that could fund the very sustainability initiatives these countries lack.

METHODOLOGY

This study adopts a mixed-methods research design, combining qualitative comparative case analysis with secondary quantitative data. The qualitative component draws on documented case studies from selected mineral-rich Global South countries (DRC, Zambia, Zimbabwe, Ghana, and South Africa) and resource-poor but economically successful countries (Japan, Singapore, and South Korea). These cases were selected to illustrate contrasting development pathways.

Quantitative indicators, including export composition, value-added manufacturing shares, and ESG performance metrics, were drawn from reports published by the World Bank, UNCTAD, OECD, and national statistical agencies. Data triangulation was used to enhance validity and reliability.

MINERAL-RICH GLOBAL SOUTH COUNTRIES: SUSTAINABILITY AND VALUE ADDITION CHALLENGES

The DRC is a central supplier of cobalt and copper, minerals critical to renewable energy technologies and electric vehicles. However, most mineral exports are in raw or semi-processed form. Sustainability challenges include environmental degradation, weak regulatory enforcement, artisanal mining-related human rights abuses, and limited local processing capacity (World Bank, 2020). DRC & The Artisanal-Industrial Paradox , In the DRC, future-proofing is hindered because 20% of cobalt comes from artisanal mining (ASM). Global buyers (Apple, Tesla) demand "clean" cobalt. If the DRC cannot integrate ASM into a sustainable value-added chain, it faces de-risking—where firms simply stop buying from them, destroying the local economy.

These challenges undermine business future proofing by increasing reputational risks and supply chain instability. Although recent policy initiatives seek to promote local processing, progress remains constrained by infrastructure deficits and governance weaknesses.

Zambia’s copper sector has historically dominated its economy, yet value addition remains limited to smelting and refining. Manufacturing linkages are weak, and fluctuations in copper prices have repeatedly exposed the economy to external shocks. Environmental pollution and community displacement have further complicated sustainability outcomes (Fraser & Larmer, 2010).

Zimbabwe possesses significant deposits of gold, platinum, lithium, and chrome. Despite policy rhetoric promoting beneficiation, most minerals continue to be exported in raw form. Sanctions, capital shortages, and policy uncertainty have limited investment in downstream industries. Lithium exports, in particular, highlight missed opportunities in battery manufacturing and green industrialization (Moyo & Sithole, 2022). 4.3 Zimbabwe & The Lithium Ban 2022/23 on raw lithium exports. While a bold move for value addition, the country is faced with Infrastructure Deficit. Without a stable power grid often relying on aging coal or hydro affected by climate change, high-energy processing plants cannot run, leading to stockpiles of raw ore that cannot be sold or processed.

Ghana and South Africa have made notable efforts to reform mining governance and increase local participation. However, environmental degradation, mine closure liabilities, and unequal benefit distribution persist. While South Africa has relatively advanced processing capacity, broader industrial linkages remain limited.

RESOURCE-POOR COUNTRIES AND ALTERNATIVE DEVELOPMENT PATHWAYS

Japan's lack of mineral resources forced a strategic focus on technology, efficiency, and value addition. Through industrial policy, innovation, and skills development, Japan built globally competitive manufacturing sectors while embracing resource efficiency and circular economy principles (Yoshida, 2016).

Singapore's success is rooted in governance quality, strategic planning, and integration into global value chains. Sustainability planning, education, and institutional coherence enabled economic transformation despite resource scarcity (Porter, 2009).

South Korea's state-led industrialization strategy emphasized export-oriented manufacturing, innovation, and human capital investment. Its experience underscores the primacy of institutions and value creation over natural resource endowment (Chang, 2002).

DISCUSSION: STRUCTURAL VULNERABILITIES AND SUSTAINABILITY GAPS

4. Expanding Section 6: Discussion (The "Why" and "How") Use a table to contrast the Structural Vulnerabilities vs. Future-Proofing Enablers. Structural Vulnerability Impact on Global South Future-Proofing Strategy Capital Flight Profits are externalized to HQ in Global North. Implement "Local Content" laws with teeth. Energy Poverty Smelting requires massive, stable power. Invest in "Mine-Gate" renewable micro-grids. Technological Dependency Relying on foreign IP for refining. R&D partnerships with local universities. Dutch Disease Currency spikes kill other sectors (Agri/Manuf). Sovereign Wealth Funds (e.g., Norway model).

The comparison reveals that mineral wealth alone does not guarantee sustainable development. In the Global South, weak institutions, limited capital, skills shortages, and fragmented value chains undermine sustainability integration and future proofing. By contrast, resource-poor countries demonstrate that strategic planning, governance, and value addition are decisive.

Structural Vulnerability	**Impact on Global South**	**Future-Proofing Strategy**
Capital Flight	Profits are externalized to HQ in Global North.	Implement "Local Content" laws with teeth.
Energy Poverty	Smelting requires massive, stable power.	Invest in "Mine-Gate" renewable micro-grids.
Technological Dependency	Relying on foreign IP for refining.	R&D partnerships with local universities.
Dutch Disease	Currency spikes kill other sectors (Agri/Manuf).	Sovereign Wealth Funds (e.g., Norway model).

Sustainability in mining must therefore move beyond environmental compliance to encompass industrial policy, skills development, and inclusive governance. Without these reforms, mining-dependent economies risk remaining trapped in extractive models vulnerable to global shocks.

Circular Economy plays a vital role in future-proofed mining businesses and one way to achive this is by harnessing "Urban Mining" (recycling). If Global South countries only focus on extraction and do not build

recycling infrastructure for the minerals they mine, they will lose out as the Global North begins to recycle its own mineral stock in 20–30 years.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Regional Integration (AfCFTA): Individual countries like Zambia or Zimbabwe are too small to build full battery plants. They must create Regional Value Chains (e.g., DRC provides cobalt, Zambia copper, Zimbabwe lithium) to achieve economies of scale.

Sustainability Bonds: Linking mining royalties to "Green Bonds" to fund the transition from extraction to processing.

Data Sovereignty: Developing national geological databases so governments—not just foreign firms—know the true value of what is underground.

CONCLUSION

This paper has demonstrated that sustainability and value addition are central to future proofing mining businesses in the Global South. Limited beneficiation represents a structural vulnerability that undermines resilience and inclusive development. Learning from resource-poor but successful economies, Global South countries must reposition sustainability-driven value addition as a strategic development priority.

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