Opportunities, Challenges, and Risks Proposed by the Circular Economy in the Primary Resource Extraction and Mining Sectors.

The circular economy is largely understood as an economic system that challenges and moves away from the linear, take-make-use-waste model of consumption in which most of the world still operates.

The Ellen MacArthur Foundation defines a circular economy as one that eliminates waste and pollution, keeps products and materials in circulation at their highest value and regenerates nature (EMF, 2022b). Crucially and idealistically, incorporating these principles should be by design or by developing innovative upstream solutions that provide these results. But what are the risks, challenges and opportunities for the primary resource extraction and mining sector? What does a circular economy mean for critical metals, particularly those crucial for the transition to a green economy? How can circular economy principles be integrated into operations and what are the benefits? And what for the people? – the just transition to a circular, green economy.

Risks and Opportunities

As the circular economy and sustainability are mainstreamed and garner their required attention, demand for greener, more sustainable material alternatives will increase. Additionally, green technologies, such as renewable energy and storage technologies, are increasing the demand for specific crucial minerals. From a circular economy perspective, these two factors pose risks but also opportunities for the primary resource extraction and mining sectors. An example of a risk posed by the circular economy is decreased demand for iron ore. Ferrous scrap is one of the most widely recycled materials in circulation and the amount of scrap being recycled is increasing year on year. Lower steel waste and losses in the economy will result in lower demand for iron ore. Additionally, mining companies are typically not in a position to pivot their operations to benefit financially from these recycling flows (Bartels, Drewell & Morrison, 2019). On the other hand, the increased demand for minerals including lithium, cobalt, nickel and copper, among others, used in renewable energy and storage technologies, present an enormous opportunity for the sector (IEA, 2021). However, it is important that the minerals required for the green economy transition are extracted in a way that is sustainable and reduces environmental and social consequences. This can be achieved by integrating circular principles into extraction and mining operations.

Integrating Circular Principles into Mining Operations

There are several circular interventions able to be integrated into mining operations that result in improved efficiency, cost-savings and reduced environmental impact. From a reuse perspective, utilising mine waste as a secondary resource can reduce waste management costs, increase margins and result in lower overall impact on the environment. This might include extracting residual minerals from waste rock, sludge, or tailings in contextually appropriate, innovative ways. Similarly, integrating circular water management strategies such as recycling and reuse will result in lower dependence on municipal water supply and associated costs as well as contribute positively to water conservation efforts (Khan *et al.*, 2022).

Regeneration is a fundamental principle for a circular economy. The investment in and use of renewable energy is a regenerative practice due to the decreased reliance on fossil fuel-based energy. Adopting renewable energy technologies will reduce energy consumption, costs and, in most instances, the carbon footprint of extraction and mining operations. Early planning for sustainable mine closure and rehabilitation is another regeneration strategy which could include repurposing of mines or dumps into educational facilities or ecological assets through afforestation and grassland rehabilitation.

Technological and Business Model Innovation

The adoption of innovative technologies and business models is key to enabling the success of the circular economy. Rethinking metallurgical processes that are more efficient in terms of energy and water consumption and harness modern developments in science will be key to enabling the circular economy. From a business model perspective, instead of only selling mineral resources, countries reliant on mineral reserves for economic growth can move to leasing models. Mineral leasing can result in countries that own these resources to take control of the mineral value chain and have more control over the sustainable use of these minerals (Khan *et al.*, 2022)

What of the People? – The just transition to a Circular and Green Economy

In the context of mining and the transition to a green economy, it is crucial that the people directly and indirectly affected by this transition are placed front and centre too. On a continent riddled with historical social injustices, it is unethical at the very least not to place equal, if not greater, emphasis on the social dimension of sustainability in Africa. The circular economy does present social risks. An example being job loss because of decreased demand for primary resources. However, if considered early and strategically, opportunities for job creation in waste processing and in the development and integration of modern technologies can be identified. Of course, the element of worker safety and well-being will be a crucial consideration. Enabling a just transition to a green and circular mining sector needs to be strategic, and employers and mine owners should aim to avoid making labour obsolete through technological advancement and efficiency gains.

Circular Economy and ESG

From an ESG perspective, as investor demands become increasingly focused on the sustainability performance of their investments, the effective reporting against ESG frameworks and standards is crucial. However, to be able to reap the full spectrum of benefits from effective reporting, adoption and integration of strategies that result in improved sustainability performance is required. Integrating principles of the circular into primary resource extraction and mining companies' operations and activities has a strong potential to deliver on ESG requirements (EMF, 2022a). Mining companies that do not adapt to our changing world, taking on board principles of sustainability and the circular economy are at risk of being left behind and missing opportunities to create new forms of value and access new forms of capital (Averda, 2022).

This article merely scratches the surface of the opportunities that exist for the primary resource extraction and mining sector. It also demonstrates that there are risks and challenges. However, those that act first, fast and smart can convert those risks and challenges into opportunities. It is time for opportunities offered by the circular economy to be realised and innovative circular interventions integrated into the sector to convert risks and challenges into differentiating factors that keep mining companies relevant, sustainable, and able to leverage capital in a rapidly changing world.

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