



Digital Transformation, Critical Minerals and Just Energy Transition

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Introduction: Navigating the Convergence of Digitalization and Energy Transition

The global pursuit of a net-zero future is driving an unprecedented intersection between digital transformation, critical minerals, and the just energy transition. As societies leverage digital technologies to accelerate sustainability and climate action, policy makers, sustainability professionals, and energy sector leaders are increasingly confronted with the material realities underpinning these innovations.

The World Summit on the Information Society (WSIS)+20 Review and recent United Nations (UN) resolutions have brought multilateral recognition to the environmental, social, and governance dimensions of this convergence, highlighting both opportunities and urgent challenges. This article explores how digitalization can enable the just energy transition, while emphasizing the importance of responsible mineral sourcing, life-cycle sustainability, and policy coherence.

Digital Technologies as Enablers of Sustainability

Digitalization is reshaping the landscape of sustainability. Advanced sensors, artificial intelligence, and data analytics are revolutionizing climate monitoring, enabling more accurate emissions tracking and early warning systems for extreme weather events. Smart grids and Internet of Things (IoT) applications are facilitating resource-efficient energy management, optimizing load balancing, and integrating renewable energy sources at scale.

Digital platforms support the circular economy by improving material traceability and enabling product life extension through predictive maintenance. These innovations are essential to achieving the Sustainable Development Goals (SDGs) and the Paris Agreement targets.

Material Foundations of Digitalization: Infrastructure and Supply Chains

While digital technologies appear intangible, their deployment relies on extensive physical infrastructure: data centers, telecommunication networks, and end-user devices. These systems are constructed from a complex array of critical minerals, such as lithium, cobalt, copper, rare earth elements, and nickel, whose extraction, processing, and transport form the backbone of the digital and energy transitions. Data centers consume significant energy and water, and the rapid proliferation of electronic devices generates mounting e-waste. The resilience and sustainability of digital transformation therefore hinge on secure, responsible, and transparent mineral supply chains.

Environmental, Social, and Governance (ESG) Implications of Digital Expansion

The acceleration of digitalization brings with it substantial ESG risks. Mining and refining critical minerals can lead to deforestation, pollution, and biodiversity loss if not managed responsibly. In many regions, local communities, particularly Indigenous Peoples, face displacement, labor rights violations, and inequitable distribution of benefits. The growing energy and water demands of digital infrastructure risk exacerbating resource competition and emissions, especially where grids remain fossil-fuel dependent. E-waste poses health and environmental hazards, often exported to countries with weaker regulatory frameworks. Addressing these risks is central to upholding the just transition principle: ensuring that the shift to a low-carbon economy is fair, inclusive, and respects human rights.

Critical Minerals in Digital and Energy Transitions: Demand, Risks, and Life-Cycle Perspective

The clean energy transition drives surging demand for critical minerals, as batteries, wind turbines, solar panels, and digital hardware require specialized materials. This demand is expected to multiply over the coming decades, raising concerns about supply bottlenecks, price volatility, and geopolitical tensions. Life-cycle assessments highlight the need to minimize environmental and social impacts at every stage, from extraction to end-of-life management. Without robust safeguards, the rush for minerals could undermine the very sustainability goals digital and energy transitions aim to achieve.

Just Transition Principles: Responsible Supply Chains and Community Participation

A just energy transition demands a holistic approach to mineral supply chains. Responsible sourcing frameworks, such as due diligence, traceability, and certification schemes, help ensure that minerals are extracted and traded in ways that respect human rights, labor standards, and environmental protection. Community participation is essential, enabling affected populations to have a say in decisions that impact their lives and livelihoods. Embracing circular economy principles, such as recycling, reuse, and design for disassembly, can reduce primary mineral demand, extend product lifespans, and create new economic opportunities.

Policy Coherence: Aligning Digital, Climate, Energy, and Development Agendas

Effective governance of the digital energy transition requires policy coherence across traditionally siloed domains. Climate policies must account for the material and energy footprints of digital infrastructure; digital strategies should incorporate sustainability and social justice considerations; and energy policies need to reflect both the enabling role of digitalization and the implications for mineral supply chains. International frameworks, such as the UN Guiding Principles on Business and Human Rights and the SDGs, provide common reference points for aligning actions and measuring progress.

Multilateral Recognition: WSIS+20 Review and UN Policy Signals

The recent WSIS+20 Review has placed the intersection of digitalization, critical minerals, and sustainability firmly on the multilateral agenda. This process recognized the need for integrated approaches that consider the life-cycle impacts of digital infrastructure, promote responsible mineral sourcing, and support developing countries in accessing technologies and benefits equitably.

The [WSIS Process+20](https://lnkd.in/ekWNhK5J) Review, and the related UN Resolution A/RES/79/277 (<https://lnkd.in/ekWNhK5J>) adopted by consensus by the United Nations General Assembly in December 2025, explicitly addresses the environmental footprint of Digital Technologies (see paras. 42–47 of the Resolution). Crucially, paragraph 44 recognizes the need for the sustainable and responsible use of critical mineral resources underpinning digital infrastructure and devices.

WSIS+20 calls for enhanced policy coherence across digital, climate, energy, and development agendas, and emphasizes the importance of international cooperation, standards, and finance in addressing shared challenges.

Conclusion

The digital transformation holds immense promise for advancing sustainability, climate action, and inclusive development. Yet, realizing this potential requires confronting the material realities and governance challenges embedded in critical mineral supply chains and digital infrastructure.

Together with partners, such as [Global Witness Resource Justice Network](#), [SIRGE Coalition](#), [NaturalResource Governance Institute](#), [Power Shift Africa](#), the [ICT4peace Foundation](#) and the Earth Council – as well as several Governments – advocated an agreement on responsible

transition minerals at [COP30 Brazil](#). However consensus was not reached in Belem.

On the other hand, and as shown above, the [WSIS Process+20](#) outcome at the [United Nations](#) in New York in December 2025 provided a strong new multilateral and diplomatic reference point and a renewed opportunity to advance progress at [COP31](#) in Turkey 2026, in this regard.

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