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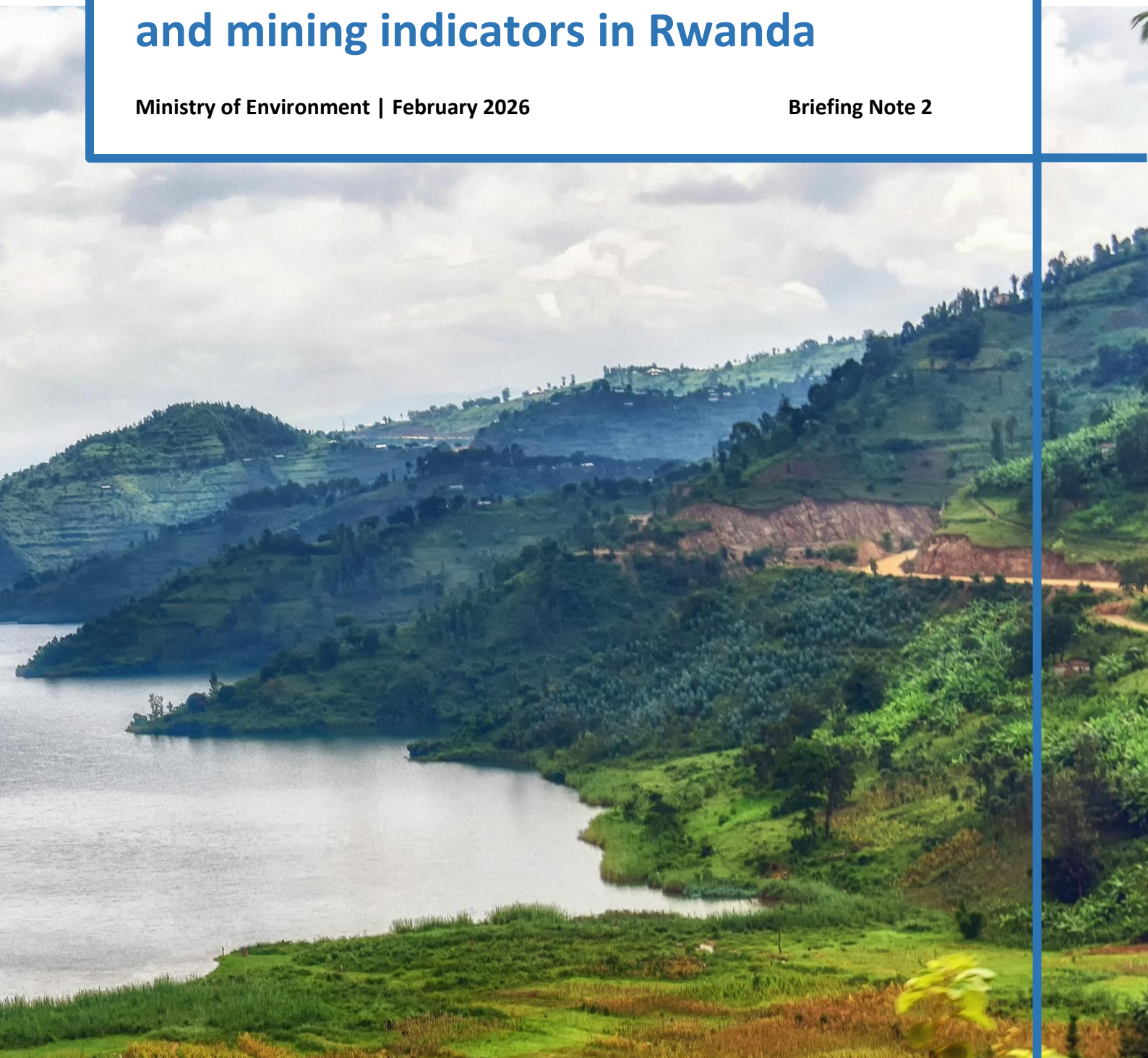
MINISTRY OF ENVIRONMENT

Inclusive Adaptation in Practice: Tracking early signals in water resources and mining indicators in Rwanda

Ministry of Environment | February 2026 **Briefing Note 2**



Briefing Note 2: Inclusive Adaptation in Practice: Tracking early signals in water resources and mining indicators in Rwanda

Ministry of Environment, Department of Environment and Climate Change, Kigali, Rwanda
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Executive Summary

Rwanda is entering a crucial phase in its climate and development journey, guided by the *Second National Strategy for Transformation* (NST2), the *Climate, Environment and Natural Resources (CENR) Sector Strategic Plan* (2024–2028), and the *Nationally Determined Contribution (NDC 3.0) for 2025–2035*. A significant innovation in this agenda is the use of monitoring, evaluation, and learning (MEL), not only for reporting but as a management tool to detect early signals of progress, guide timely action, and ensure inclusivity.

This briefing note evaluates two priority subsectors—water resources and mining—that are both highly vulnerable to climate change and central to Rwanda's socio-economic transformation. It tracks two indicators established under the aforementioned frameworks: (i) hectares of land restored through terracing, agroforestry, and rainwater harvesting; and (ii) the proportion of licensed mining operators implementing safeguards such as runoff control, slope stabilization, waste containment, and site rehabilitation. Evidence is drawn from national policy frameworks, interviews with key stakeholders, and field visits to eight restoration sites and three mining concessions.

The findings indicate clear progress. For water resources, nurseries in Rubavu and Musanze are supplying seedlings for restoration, terraces in Nyabihu are reducing erosion and improving land productivity, and rainwater harvesting systems are alleviating household water burdens while controlling runoff. In mining, operators in Muhanga, Rulindo, and Rwamagana have begun adopting climate-compatible practices, with some companies implementing gender policies that have increased women's workforce participation to between 18% and 25%.

However, these early signals also highlight risks. Restoration sites face procurement delays, weak maintenance systems, and limited occupational safety. Mining safeguards often remain voluntary, artisanal and small-scale miners are largely excluded, and women continue to be underrepresented in leadership positions. Unless these gaps are addressed, current gains may not be sustainable.

The evidence underscores the need for stronger enforcement of safeguards, timely contract and payment systems, and the routine use of equity-sensitive MEL with sex-, age-, and disability-disaggregated data. Expanding leadership pathways for women and integrating artisanal miners into reforms will also be critical. By taking these steps, Rwanda can consolidate its early progress and demonstrate how climate adaptation can yield results that are both resilient and inclusive while strengthening its position as a frontrunner in equity-driven adaptation under the Paris Agreement.

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List of Abbreviations

ASM	artisanal and small-scale mining
CENR	climate, environment, and natural resources
GESI	gender equality and social inclusion
GGCRS	Green Growth and Climate Resilience Strategy
GGA	global goal on adaptation
IISD	International Institute for Sustainable Development
KII	key informant interview
MEL	monitoring, evaluation, and learning
NDC	nationally determined contribution
NAP	national adaptation plan
O&M	operation and maintenance
RMB	Rwanda Mines, Petroleum and Gas Board
TWIMA	Trinity Women in Mining Association
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

Rwanda's climate and development agenda is entering a decisive phase, guided by the *Second National Strategy for Transformation* (NST2) (Ministry of Finance and Economic Planning, 2024), the *Climate, Environment and Natural Resources (CENR) Sector Strategic Plan* (2024–2028) (Ministry of Environment, 2024), and the *Nationally Determined Contribution (NDC 3.0) for 2025–2035* (Republic of Rwanda, 2025). Together, these frameworks outline an ambitious pathway toward achieving Vision 2050 and the Green Growth and Climate Resilience Strategy. A key innovation in this new approach is the treatment of monitoring, evaluation, and learning (MEL) not as a retrospective reporting exercise but as a forward-looking management tool. MEL is increasingly positioned to identify early signals of readiness, operational deployment, and inclusive participation, ensuring that interventions remain adaptive, timely, and accountable.

Early monitoring and tracking of implementation are central to effective climate adaptation, as they enable governments to understand whether actions are progressing as intended, identify implementation challenges, and inform timely adjustments. Monitoring is defined as the systematic tracking of implementation and performance to assess progress and detect problems that require corrective action, while learning ensures that insights from monitoring and evaluation are fed back into planning and decision-making processes (Njuguna et al., 2024). When embedded from the outset, MEL systems strengthen adaptive management by clarifying what works, for whom, and under what conditions, thereby improving effectiveness, equity, and accountability in adaptation efforts (Organisation for Economic Co-operation and Development, 2024; UN Framework Convention on Climate Change [UNFCCC] Adaptation Committee, 2023).

Rwanda's experience also holds global significance. The challenges of embedding inclusivity, leadership, and justice into adaptation are commonly faced by countries striving to operationalize the Paris Agreement's global goal on adaptation (GGA). By documenting how early signal tracking can reveal both progress and bottlenecks, Rwanda contributes to an emerging body of evidence on how adaptation can be governed in ways that are not only technically effective but also socially inclusive and accountable.

This briefing note thus examines two critical subsectors—water resources and mining—that are both highly climate-sensitive and central to Rwanda's socio-economic transformation. The water resources subsector is directly linked to catchment restoration through nurseries, terracing, and rainwater harvesting systems, while the mining subsector is advancing climate-compatible practices such as runoff control, slope stabilization, waste containment, and rehabilitation. Evidence is drawn from policy reviews, key informant interviews, and site-level observations, with a focus on identifying early operational signals and assessing inclusivity through a gender equality and social inclusion (GESI) lens.

2. Policy Framework for MEL Adaptation

Rwanda's adaptation agenda is anchored by an integrated policy framework that prioritizes climate resilience and inclusivity as fundamental drivers of development, rather than as secondary concerns. At the highest level, Vision 2050 identifies environmental sustainability and social equity as key engines for long-term transformation (Ministry of Finance and Economic Planning, 2020). Building on this vision, the Green Growth and Climate Resilience Strategy (GGCRS), revised in 2023 (Ministry of Environment, 2023), outlines programmatic priorities such as watershed restoration, ecosystem rehabilitation, and the transition to climate-compatible mining practices. These ambitions are further operationalized through the *CENR Sector Strategic Plan (2024–2028)* (Ministry of Environment, 2024), which establishes measurable targets, clarifies institutional responsibilities, and outlines pathways for resource allocation. The *Revised National Gender Policy* of 2021 (Ministry of Gender and Family Promotion, 2021) reinforces equity and inclusion by mandating the systematic integration of women, youth, and other vulnerable groups into all adaptation programs, including those in the water resources and mining sub-sectors.

What distinguishes the current framework is the intentional positioning of MEL as a tool for adaptive management. Rather than being limited to ex post reporting, MEL is designed to generate real-time evidence that supports timely decision making, corrective actions, and accountability. This approach aligns with international guidance from the UNFCCC Adaptation Committee and the GGA under the Paris Agreement, which emphasize iterative learning, participatory engagement, and equity-sensitive tracking. As noted in the National Adaptation Plan (NAP) Global Network toolkit on MEL, effective monitoring goes beyond tracking outputs alone to generate information that supports adaptive planning and decision making throughout the adaptation process (NAP Global Network, 2024).

Two key insights emerge from this policy architecture. First, Rwanda is embedding MEL within a broader governance shift toward adaptive management, reflecting international best practices while tailoring it to national priorities. Second, by integrating GESI principles into feedback loops, Rwanda's evolving MEL system positions the country as a leader in demonstrating how inclusivity can be incorporated into the operationalization of the GGA.

This layered framework lays the groundwork for examining whether policy intent is translating into practice. The following sections focus on the water and mining subsectors, chosen for their ecological significance, economic contribution, and vulnerability to climate risks. By analyzing early signals of readiness, operational deployment, and participation, this assessment explores Rwanda's institutional and community progress toward achieving inclusive, climate-resilient outcomes under the dual guidance of the CENR Strategic Plan and NDC 3.0.

3. Priority Adaptation Indicators for Early Signal Tracking

A central feature of Rwanda's NDC 3.0 framework is the establishment of clear, measurable indicators that can act as early signals of adaptation readiness and implementation. Among the proposed indicators, two are particularly significant due to their ecological, economic, and social relevance: catchment restoration and climate-compatible mining practices.

The first indicator, catchment restoration, measures the number of hectares rehabilitated through hillside terracing, agroforestry, and vegetative stabilization. Beyond the ecological benefits of reducing runoff, preventing erosion, and stabilizing slopes, this indicator reflects Rwanda's broader commitment to ecosystem-based adaptation as a foundation for food and water security. It also directly aligns with the GGCRS (2023) priorities on watershed rehabilitation and the UNFCCC's recognition of nature-based solutions as vital to global resilience pathways.

The second indicator, climate-compatible mining practices, tracks the proportion of licensed operators implementing at least three safeguards, including runoff control, slope stabilization, waste containment, and site rehabilitation. This indicator addresses the dual challenge of growth and sustainability: while mining is central to Rwanda's economic development strategy, it can exacerbate climate risks and undermine surrounding ecosystems without appropriate safeguards. Therefore, embedding resilience standards into mining operations is not only an environmental necessity but also an economic imperative.

Table 1. Indicators for catchment restoration and climate-compatible mining

Indicator	Baseline (2023/2024)	Target 2030	Target 2035	Policy linkage	GESI integration
Catchment restoration (ha)	332,861	550,000	640,000	GGCRS (2023), CENR Sector Strategic Plan (2024–2029), Vision 2050	Disaggregate by gender, age, disability; track women/youth in nurseries, persons with disabilities in terracing
Climate-compatible mining (%)	72.9%	90%	100%	CENR Sector Strategic Plan (2024–2029), Law n° 072/2024 of 26/06/2024 on mining and quarry operations, Environmental Law (2018)	Workforce disaggregation; women 18%–25% of the workforce; women-led small and medium-sized enterprise participation (e.g., TWIMA)

Source: Adapted from Government of Rwanda (2025) with authors' analysis.

Importantly, both indicators have been deliberately designed with a GESI lens. Catchment restoration includes the disaggregation of participation by women, youth, and persons with disabilities, recognizing their contributions and ensuring equitable access to economic opportunities. In the mining sector, GESI integration is reflected in the measurement of women's workforce participation, women-led cooperative engagement, and targeted initiatives such as the Trinity Women in Mining Association (TWIMA).

Together, these indicators highlight the dual logic of Rwanda's NDC 3.0 MEL system. On one side, ecological metrics—such as hectares restored and compliance percentages—illustrate technical progress toward resilience. On the other side, social dimensions—including participation, equity, and empowerment—determine whether adaptation outcomes are inclusive and sustainable.

By incorporating both dimensions into the MEL framework, Rwanda indicates a shift away from solely output-driven monitoring toward a more integrated approach that assesses not only *what* is being delivered but also who is reached and empowered throughout the process. This perspective lays the conceptual foundation for the subsequent sectoral analyses.

4. Framework and Methods for Early Signal Tracking

This analysis employs a multi-layered methodology designed to capture not only technical progress but also institutional readiness and inclusivity—dimensions that are critical for Rwanda's MEL architecture under both the CENR Sector Strategic Plan (2024–2028) and NDC 3.0 (2025–2035). In accordance with international guidance, particularly the International Institute for Sustainable Development's toolkit for early tracking in NAP processes, the approach integrates a desk-based policy review, key stakeholder perspectives, and site-level verification. This ensures a robust assessment of emerging adaptation signals and their implications for equity-sensitive climate governance.

4.1 Document and Policy Review

A structured review of Rwanda's national strategies and sectoral plans established the analytical foundation of this exercise. Core documents included the GGCRS (revised in 2023), which sets overarching adaptation priorities; the CENR Sector Strategic Plan (2024–2028), which translates those priorities into operational targets; and subsectoral instruments such as catchment management plans, mining policy frameworks, and the National Gender Policy (Ministry of Gender and Family Promotion, 2021). Each document was assessed not only for its stated goals but also for the extent to which it embeds MEL functions, equity-sensitive metrics, and accountability mechanisms.

4.2 Key Informant Interviews

Semi-structured key informant interviews (KIIs) were conducted with actors at national, district, community, and private sector levels to surface insights not captured in policy documents. Respondents included

- **government institutions**: the Ministry of Environment; Rwanda Water Board; Rwanda Mines, Petroleum and Gas Board (RMB); Rwanda Forestry Authority; and district environment officers.
- **community actors**: women's cooperatives managing nurseries and terracing, youth groups engaged in anti-erosion works, and small-scale mining associations.
- **private sector operators**: licensed mining companies piloting climate-compatible practices.

The KIIs explored three dimensions: institutional readiness (budget allocations, coordination platforms, and MEL templates), operational progress (procurement and project execution), and inclusivity (opportunities for women, youth, and persons with disabilities).

4.3 Field Observations

Direct observation anchored the analysis in verifiable practice. Field missions were conducted across eight catchment restoration sites (nurseries, terraces, rainwater harvesting systems, and erosion-control structures) in Rubavu, Nyabihu, and Musanze, as well as three mining concessions in Muhanga,

Rulindo, and Rwamagana. These sites were selected to represent geographic diversity and varying ecological and economic contexts.

The catchment sites included seedling nurseries supplying hillside restoration, radical terraces stabilizing farmland, rainwater harvesting tanks alleviating household water stress, and anti-erosion trenches protecting fields. GESI dimensions were evident throughout: women constituted the majority of nursery workers, youth provided heavy labour for terracing and trenching, and persons with disabilities participated in tree planting and terrace marking.

Table 2. Sites for catchment restoration activities visited

Site	Location (district–sector–cell–village)	Intervention type	Indicator linkage	GESI highlights
1	Musanze–Kinigi–Kaguhu–Impano	Tree nursery	Agroforestry seedling supply enabling hectares of restoration	Women are the majority of nursery labour; youth assist
2	Musanze–Nyange–Ninda–Nyarubande	Agroforestry nursery	Agroforestry seedling supply	Women/men/youth engaged across tasks
3	Nyabihu–Jenda–Gasizi–Kanzenze	Rainwater harvesting tanks	Catchment management/erosion control supporting vegetative stabilization	Men and women both engaged; youth helpers
4	Nyabihu–Jenda–Gasizi (Mikingo); Kareba–Rubare & Kamatenga	Rainwater harvesting tanks	Catchment management/erosion control	Women maintain tanks; men construct; youth transport materials
5	Musanze–Nyange–Ninda–Nyarubande	Rainwater harvesting tanks	Catchment management/erosion control	Women and youth are central to daily upkeep
6	Nyabihu–Mukamira–Kanyove–Kabeza	Radical terraces	Terracing – hectares rehabilitated	~250 workers, including 150 women, 42 men, 50 youth, and eight persons with disabilities; youth among supervisors
7	Rubavu–Nyakiriba–Gikombe–Nyakibande	Anti-erosion trenches (forest)	Vegetative/soil stabilization	Youth ≈62.5%, women ≈30%, persons with disabilities <1%
8	Rubavu–Nyakiriba–Gikombe–Nyakibande	Agroforestry nursery (38 beds)	Agroforestry seedling supply	Women and youth each ≈30% of the workforce

Source: Authors' field data from KIIs (2025).

The mining sites included Rugendabari Mining Company Ltd in Muhanga, Trinity Nyakabingo Mine in Rulindo, and Trinity Musha Mine in Rwamagana. Each demonstrated varying levels of compliance with climate-compatible safeguards: terracing, contouring, and sedimentation ponds at Rugendabari; slope benching, wastewater ponds, and tailings containment at Nyakabingo; and re-profiling, revegetation, and land rehabilitation at Musha. Beyond environmental safeguards, these companies also engaged in community development activities, including the provision of medical insurance, construction materials, road rehabilitation, and institutional support for vulnerable households. Women's participation, while still below target levels, is increasing, with associations such as the TWIMA fostering economic empowerment and social cohesion.

Table 3. Sites of climate-compatible mining practices visited

Site	Location (district–sector–cell–village)	Intervention type	Indicator linkage	GESI highlights
1	Muhanga–Rugendabari Sector	Tin and coltan concession	Runoff control (terraces, trenches), waste containment (sedimentation ponds, tailings sites), site rehabilitation (tree planting)	Women and the community engaged through *Umuganda*[1]; local social projects supported
2	Rulindo–Shyorongi (Nyakabingo)	Tungsten concession	Slope stabilization (benching, re-contouring), runoff control (ponds, dams), waste containment (tailings)	Community benefits include housing support, women being part of the workforce, and benefits
3	Rwamagana–Musha–Ntunga	Mixed minerals (Trinity Metals Group)	Site rehabilitation (re-profiling tailings, revegetation), slope stabilization, runoff control	Women's participation through TWIMA; medical insurance and social support to vulnerable families

Source: Authors' field data from KIIs (2025).

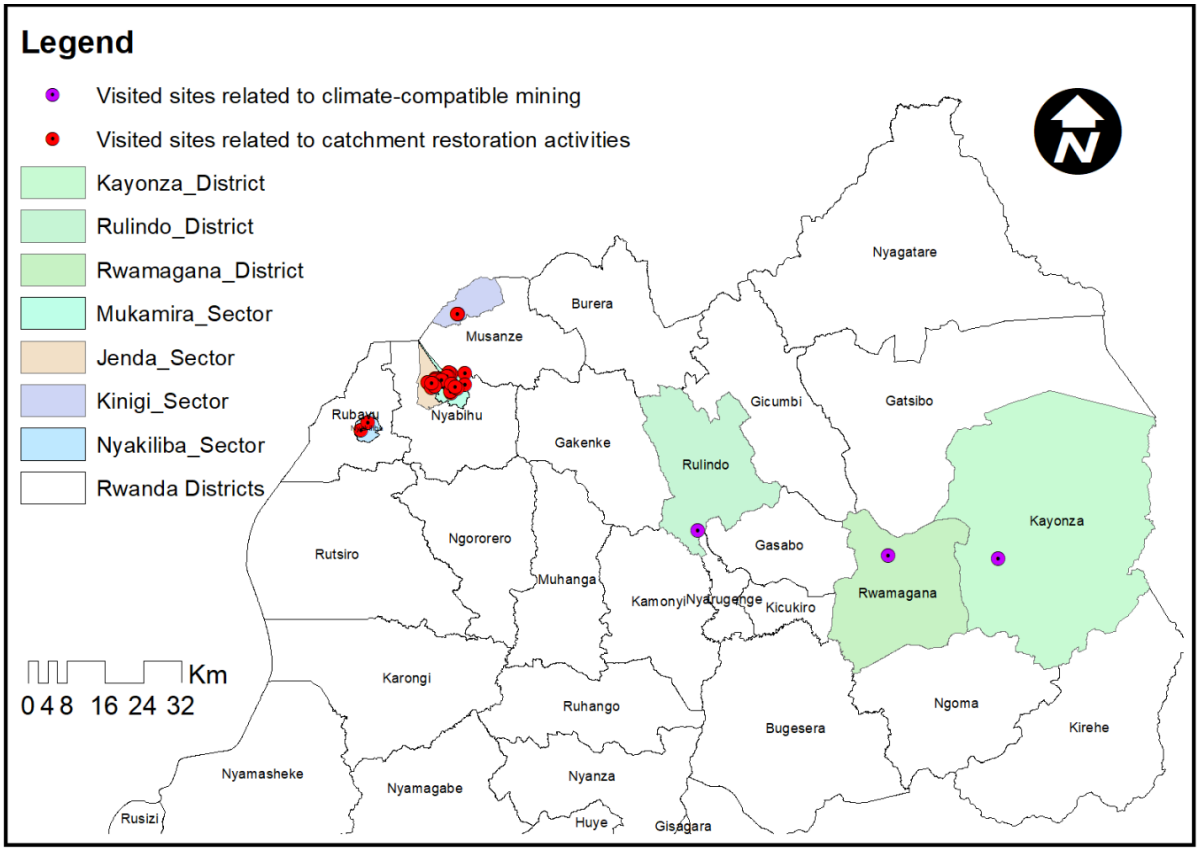
Together, the two sets of sites highlight complementary pathways for enhancing climate resilience in Rwanda's landscapes. Catchment restoration interventions help reduce soil erosion, secure water resources, and support rural livelihoods through methods such as terracing, agroforestry, and rainwater harvesting. At the same time, mining operators implementing climate-compatible safeguards—including runoff control, slope stabilization, waste containment, and site rehabilitation—are directly addressing the environmental risks linked to extraction in fragile, rainfall-intensive areas.

The integration of these approaches illustrates how ecosystem restoration and responsible mining can work together to improve landscape stability, protect community well-being, and contribute to Rwanda's broader climate and development goals. Figure 1 provides a spatial overview of the assessment areas by showing the locations of all visited sites for both catchment restoration and mining.

At each site, a mixed-methods approach was employed, integrating spatial mapping, geo-referenced photographs, and structured interviews with workers and community representatives. This method ensured the systematic capture of both quantitative indicators (e.g., hectares rehabilitated, proportion of safeguards adopted) and qualitative insights (e.g., participation, implementation processes).

[1] Umuganda is Rwanda's monthly community work program, held on the last Saturday of each month from 8:00 to 11:00 a.m., during which citizens carry out collective activities for public benefit under the coordination of local authorities, including environmental protection, public space cleaning, tree planting, minor infrastructure maintenance, and disaster risk reduction, followed by a community dialogue on local development and service delivery matters.

Figure 1. Locations of sites visited for catchment restoration and climate-compatible mining assessment



Source: Authors' own mapping, 2025.

4.4 Triangulation and Signal Detection

Data from the policy review, KIIs, and site visits were triangulated to identify three categories of early signals:

- readiness signals – institutional markers, such as budget allocations, tenders issued, staffing, and reporting templates.
- operational signals – tangible evidence, such as functioning nurseries, terraces, rainwater harvesting tanks, and mining safeguards.
- participation signals – equity-sensitive dimensions, including engagement by women, youth, and persons with disabilities and the role of cooperatives and community organizations.

This layered analysis moves beyond output-based monitoring to assess whether institutional systems, operational practices, and participation patterns are converging toward inclusive adaptation outcomes.

4.5 Alignment With Global MEL Standards

The framework was designed in accordance with UNFCCC Adaptation Committee (2023) guidance and the MEL Toolkit for NAP processes developed by Beauchamp et al. (2024). Both sources emphasize that MEL should not only track progress but also drive adaptive management, equity, and accountability. These sources emphasize that MEL systems should extend beyond the tracking of implementation progress to actively support adaptive management, equity, and accountability by generating evidence that informs decision making, improves the targeting of adaptation actions, and strengthens learning across different scales (UNFCCC Adaptation Committee, 2023; Beauchamp et al., 2024).

By intentionally integrating top-down institutional perspectives with bottom-up community evidence, the approach aligns with global best practices while being tailored to Rwanda's national context. This strategy ensures that Rwanda's early signal tracking supports domestic decision making under the CENR Sector Strategic Plan and NDC 3.0, while simultaneously contributing to the global evidence base on participatory, inclusive, and justice-oriented methods for monitoring adaptation.

5. Evidence of Early Adaptation Outcome Signals in Water Resources and Mining

This section presents the results from the two subsectors chosen for early signal tracking: water resources and mining. The analysis is organized around two adaptation indicators defined in Rwanda's NDC 3.0:

- **catchment restoration** – this measures the number of hectares rehabilitated through hillside terracing, agroforestry, and vegetative stabilization.
- **climate-compatible mining practices** – this measures the proportion of licensed operators implementing at least three safeguards, including runoff control, slope stabilization, waste containment, and site rehabilitation.

The sites visited demonstrate how these indicators are applied in practice. Catchment restoration activities aim to reduce soil erosion, protect water resources, and enhance rural livelihoods, while climate-compatible mining interventions illustrate how the sector is beginning to incorporate safeguards into extraction processes in vulnerable landscapes.

5.1 The Water Resources Subsector

The assessment of the water resources subsector focused on four types of interventions, each contributing directly to the catchment restoration indicator:

- tree nurseries in Nyakibande (Rubavu) and Kaguhu/Nyange (Musanze), which provide seedlings for hillside stabilization and watershed rehabilitation;
- radical terraces in Mukamira/Kanyove (Nyabihu), which reduce soil erosion and improve land productivity; and
- rainwater harvesting systems installed in Musanze and Nyabihu, which help control runoff, limit uncontrolled erosion, and improve household water security.

Taken together, these interventions demonstrate how nursery establishment, terracing, and water harvesting function in a complementary manner to restore degraded catchments, conserve water resources, and strengthen community resilience.

5.1.1 Nyakibande Agroforestry Nursery (Rubavu)

The Nyakibande agroforestry nursery illustrates how early investment in restoration infrastructure can generate both ecological and socio-economic benefits. The facility, established under district oversight, has become a key supplier of seedlings for hillside terracing and watershed rehabilitation. Workers described not only the technical progress of the nursery but also its contribution to household livelihoods. As one worker explained: "Seedlings are in good health, showing strong growth, uniformity, and resilience, and employees report increased financial stability due to wages earned."

Another participant emphasized the broader sense of purpose that the nursery provides: "My daily work is not just about tending seedlings—it is helping to build a greener and healthier environment for future generations."

These testimonies highlight how ecological restoration, when coupled with inclusive employment, creates a multiplier effect that extends beyond immediate technical outcomes. However, challenges remain. Limited irrigation facilities and tool shortages threaten to undermine seedling quality, especially during dry spells.

Table 4. Early signal assessment: Nyakibande nursery in Rubabu District

Dimension	Observations	Early signal
Institutional readiness	Nursery established; district oversight functional	Positive
Operational signals	38 active seedbeds; healthy seedlings	Strong
Participation signals	Women and youth ~30% of the workforce	Inclusive
Bottlenecks	Irrigation shortages; limited tools	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

5.1.2 Terraces in Mukamira/Kanyove (Nyabihu)

The Mukamira/Kanyove terraces demonstrate early operational progress in erosion control and land productivity, while also showcasing inclusive participation. Field reports confirmed that more than 50 ha had already been terraced, with notable engagement of vulnerable groups: "Over 50 hectares have been terraced… 250 workers involved, including 150 women and 15 persons with disabilities." Yet, even within this positive trajectory, structural issues emerged that risk undermining momentum. As one worker observed: "Payment delays reduce motivation.… First aid kits and rain gear were absent."

These gaps in procurement and occupational health and safety are not minor technicalities; they represent systemic risks to the sustainability of restoration efforts. If left unaddressed, they may erode trust between communities and implementing agencies, reducing willingness to participate in future initiatives.

Table 5. Early signal assessment: Mukamira/Kanyove terraces in Nyabihu District

Dimension	Observations	Early signal
Institutional readiness	Contracts issued; district-level oversight	Positive
Operational signals	50 ha completed; erosion reduction visible	Strong
Participation signals	Women and youth represented in large numbers	Inclusive
Bottlenecks	Late payments; lack of health and safety equipment	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

5.1.3 Rainwater Harvesting Systems (Musanze and Nyabihu)

Rainwater harvesting (RWH) systems in Musanze and Nyabihu illustrate how adaptation investments can directly transform household routines and resilience. Community members consistently reported significant time savings in water collection, especially for women who are typically responsible for the household water supply. One household head explained: "Households reported saving more than three hours daily that would otherwise have been spent fetching water." While tanks were functional and contributed to erosion control, several maintenance-related challenges were observed, including rusted doors, minor leakages, and limited training on operation and maintenance (O&M). As one user candidly put it: "Rusted doors and minor leakages were observed, alongside gaps in O&M training." This underscores a common theme in adaptation interventions: technical infrastructure delivers immediate benefits, but without sustained investment in maintenance skills and resources, long-term functionality is at risk.

Table 6. Early signal assessment of rainwater harvesting in Musanze and Nyabihu Districts

Dimension	Observations	Early signal
Institutional readiness	Tanks procured and installed	Positive
Operational signals	Functional tanks, reducing erosion and collection time	Strong
Participation signals	Women central to tank maintenance	Inclusive
Bottlenecks	O&M knowledge gaps; minor structural defects	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

The water resource sites collectively demonstrate that Rwanda's catchment restoration efforts are beginning to gain visible traction under the NDC 3.0 framework. Nurseries in Rubavu and Musanze are supplying the planting stock needed for large-scale rehabilitation, terraces in Nyabihu are stabilizing hillsides and enhancing land productivity, and rainwater harvesting systems in Musanze and Nyabihu are reducing uncontrolled runoff while alleviating household water burdens. These complementary measures reflect an integrated approach, where upstream investments in seedlings support terracing programs, and water harvesting mitigates erosion pressures within restored catchments.

Equally important, the interventions reveal that restoration is not only an ecological endeavour but also a social one. Women, youth, and vulnerable groups are actively engaged across the sites, showcasing a model of catchment management that promotes equity alongside environmental outcomes. This inclusiveness is a strength that fosters local ownership and long-term sustainability.

However, the findings also highlight recurring bottlenecks, such as procurement and payment delays, gaps in occupational safety, limited irrigation, and inadequate training for O&M. If left unaddressed, these challenges risk undermining the durability of early gains. The evidence, therefore, underscores a central lesson: catchment restoration is on the right trajectory, but sustained investment in technical systems, institutional responsiveness, and community support is essential to convert early signals into lasting resilience.

5.2 Mining Subsector

Mining is one of Rwanda's fastest-growing industries and remains a cornerstone of national economic transformation. At the same time, it is highly climate-sensitive: unregulated practices can exacerbate erosion, water contamination, and slope instability. NDC 3.0 prioritizes climate-compatible mining—with operators adopting runoff control, slope stabilization, waste containment, and rehabilitation—to align economic development with environmental stewardship. Early signal tracking in selected mining concessions demonstrates progress, but also highlights persistent governance and inclusivity gaps.

5.2.1 Rugendabari Concession- Muhanga District

At Rugendabari, operators have begun integrating slope stabilization and waste containment measures. Field teams noted sediment traps and drainage systems that mitigate runoff risks. Workers highlighted the shift in practices, with one miner explaining: "We now see sediment traps installed where water used to run unchecked. It is reducing soil loss and making the site safer for work." These visible safeguards demonstrate operational readiness and compliance with RMB standards. Yet, while men dominate technical roles, women remain concentrated in ancillary services, such as sorting or cleaning. Leadership pathways for women remain limited despite their growing workforce presence.

Table 7. Early signal assessment: Rugendabari in Muhanga District

Dimension	Observations	Early signal
Institutional readiness	RMB oversight established; compliance audits initiated	Positive
Operational signals	Sediment traps, drainage channels, waste containment	Strong
Participation signals	Women visible in the workforce but concentrated in support roles	Partial
Bottlenecks	Leadership remains male-dominated; limited training for women	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

5.2.2 Nyakabingo Concession- Rulindo District

At Nyakabingo, operators have piloted rehabilitation works alongside active mining. The company has contributed to local welfare through *Umuganda* activities, and donations to vulnerable households were taking place, pointing to an emerging, though still informal, sense of social responsibility within licensed concessions. However, these efforts remain largely voluntary and are not yet anchored in formal compliance frameworks, which raises questions about their sustainability. In addition, artisanal miners operating around the concession remain largely outside climate-compatible practices, highlighting a fragmented approach to adaptation.

Table 8. Early signal assessment: Nyakabingo in Rulindo District

Dimension	Observations	Early signal
Institutional readiness	Licensed operator compliance monitored by RMB	Positive
Operational signals	Rehabilitation of slopes; waste control measures	Strong
Participation signals	Community benefits via *Umuganda* and donations	Partial
Bottlenecks	Voluntary corporate social responsibility not embedded in regulation; artisanal and small-scale mining (ASM) excluded	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

5.2.3 Musha Concession in Rwamagana District

The Musha concession presents perhaps the clearest example of progress toward GESI integration. Female participation has risen to between 18% and 25% of the workforce, supported by the TWIMA. Management has set a gender target for 2030, with one official noting: "Our goal is to reach 30% women by 2030—not only in numbers but also in skilled positions." Women interviewed expressed cautious optimism. While they valued new opportunities, they also pointed to persistent exclusion from supervisory roles. A female miner commented: "We are here and working hard, but decisions are still taken by men. We want to lead, not only to follow." This illustrates both the progress and the limits of current reforms. While female workforce participation is improving, genuine empowerment through leadership inclusion remains elusive.

Table 9. Early signal assessment: Musha concession in Rwamagana District

Dimension	Observations	Early signal
Institutional readiness	Company gender policy adopted; RMB oversight in place	Positive
Operational signals	Drainage channels, slope stabilization, and rehabilitation works	Strong
Participation signals	Women 18%–25% of workforce; TWIMA engagement	Inclusive
Bottlenecks	Leadership positions still male-dominated; ASM remains outside reform	Risk

Source: Authors' own analysis based on field data from KIIs (2025).

The mining sites visited exhibit early adoption of safeguards, such as sediment traps, drainage systems, slope stabilization, and rehabilitation, signalling progress toward the climate-compatible mining indicator. Rugendabari showcases effective runoff control and waste management, Nyakabingo pairs slope rehabilitation with community support, and Musha promotes gender inclusion through TWIMA and company-level policies.

However, persistent gaps remain. Many safeguards are voluntary rather than mandated, ASM miners are largely excluded from reforms, and while women are increasingly present in the workforce, they remain underrepresented in leadership roles. These shortcomings hinder both the sustainability and equity of current advancements.

To achieve the goals set out in the CENR Sector Strategic Plan and Rwanda's NDC 3.0, it is essential to strengthen RMB enforcement, provide structured support for ASM, and create deliberate pathways for women to enter decision-making roles. Only with these measures will mining fully contribute to climate resilience, environmental protection, and inclusive national development.

5.3 Cross-Sector Interlinkages

Across both subsectors, early indicators confirm that Rwanda is making tangible progress toward its NDC 3.0 adaptation targets. Restoration interventions—such as nurseries, terraces, and rainwater harvesting—are reducing erosion, protecting water resources, and inclusively supporting rural livelihoods. At the same time, mining concessions are beginning to incorporate climate-compatible safeguards, including runoff control, slope stabilization, waste containment, and rehabilitation, alongside emerging efforts to enhance gender inclusion.

However, persistent challenges threaten to slow this momentum. In restoration sites, procurement delays, limited irrigation, and gaps in safety and maintenance jeopardize long-term sustainability. In the mining sector, many safeguards remain voluntary, ASM miners are excluded from reforms, and women's representation in leadership roles lags behind workforce participation.

The lesson is clear: Rwanda's early progress is real but still too early to confirm. Sustained gains will require stronger enforcement, the integration of excluded actors, and systematic equity-sensitive provisions. By consolidating efforts across restoration and mining, Rwanda can demonstrate that climate adaptation is not sector-specific but ecosystem-wide—linking soil, water, and extractive industries to build resilience, safeguard ecosystems, and advance inclusive national development.

6. Cross-Sectoral GESI Analysis and Policy Implications

Rwanda's climate adaptation initiatives in the water restoration and mining subsectors reveal a trajectory that is increasingly inclusive but still incomplete. In Section 5's findings, it becomes clear that while the catchment restoration and climate-compatible mining indicators set under the CENR Sector Strategic Plan and NDC 3.0 are being operationalized with growing gender and social inclusion, critical gaps remain—particularly in leadership, formalization, and monitoring. These insights offer both affirmation of current progress and guidance for refining adaptation strategy and monitoring systems in line with best global evidence.

6.1. Evidence of Participation and Emerging Inclusion

The catchment restoration interventions reviewed—including nurseries in Rubavu and Musanze, terracing in Nyabihu, and rainwater harvesting in Musanze and Nyabihu—show that women, youth, and persons with disabilities are participating not only as labourers but in sustaining operations. For instance, women manage nursery care and tank maintenance while youth assist with heavy tasks and erosion control works. These contributions are aligned with global findings that inclusive restoration efforts produce both ecological and socio-economic gains (Muchane et al., 2020; Nsabiyumva et al., 2025).

In the mining subsector, licensed operations, such as Musha, have increased female workforce participation to approximately 18%–25% and have introduced mechanisms, including the TWIMA[2] and Recognition of Prior Learning,[3] to reduce barriers to entry and promote workforce inclusion.

These developments mirror practices observed in various jurisdictions where formalized gender integration in extractive sectors is correlated with better environmental compliance and social outcomes (Extractive Industries Transparency Initiative, 2023; International Finance Corporation, 2018).

6.2. Gaps Between Participation and Decision Making

Despite stronger representation in operational roles, both sectors display persistent bottlenecks in leadership inclusion. Women are underrepresented in supervisory, technical, and decision-making positions. ASM miners, many of whom are women or youth, are largely excluded from formal frameworks, capacity building, and regulatory oversight. These findings echo global evidence that emphasizes the distinction between participation (numbers of people) and empowerment (authority,

[2] In this document, TWIMA refers specifically to the Trinity Women in Mining Association, a women's organization supporting participation in ASM, and not to any technology-based inclusion mechanism.

[3] This is a formal process through which skills and competencies acquired through informal or non-formal experience are assessed and certified, allowing workers to access formal employment, training opportunities, and improved working conditions without requiring standard academic qualifications.

influence) (Intergovernmental Forum on Mining Minerals, Metals, and Sustainable Development, 2017; Savic, 2024).

In addition, MEL systems in both subsectors do not consistently disaggregate indicators by sex, age, disability, or ownership status. This limits visibility into whether inclusion is substantive or merely symbolic—a concern raised in both water governance briefs (UNEP-DHI Centre on Water and Environment et al., 2022) and international adaptation monitoring toolkits (Beauchamp et al., 2024).

6.3 Going Beyond the State of the Art

Rwanda's early signal evidence adds value to the global adaptation literature in several important ways. First, by applying a clear three-signal analytical framework covering readiness, operations, and participation across two climate-sensitive domains, namely catchment restoration and mining, this work moves beyond existing practice by translating broad MEL principles into a concrete analytical approach. While international frameworks emphasize the role of monitoring, learning, and adaptive management in climate adaptation (Beauchamp et al., 2024; UNFCCC Adaptation Committee, 2023), this assessment builds on that foundation by showing how early implementation signals can be systematically identified and analyzed across sectors to inform adaptive decision making.

Second, the juxtaposition of nature-based solutions (terracing, agroforestry, rainwater harvesting) with engineered sector compliance in mining (sedimentation, slope stabilization, waste containment) allows for an assessment of multi-hazard resilience in steep, rainfall-intensive landscapes. This corroborates and supplements the Intergovernmental Panel on Climate Change's *Sixth Assessment Report* findings (2022), which advocate for integrated landscape and sectoral approaches.

Third, the specificity of the findings—the percentage of women in the workforce in mining; the hectares of terraces rehabilitated; the operational challenges in irrigation, tools, occupational health and safety—adds empirical weight to global critiques that adaptation programs often underplay logistical and institutional determinants of success (e.g., tool and resource access, safety, maintenance). This fills gaps identified in agrarian and mining literature on the sustainability of interventions (Muchane et al., 2020; World Bank, 2020).

6.4. Comparative Value and Implications for Adaptation Policy Debate

In addition, MEL systems in both subsectors do not consistently disaggregate indicators by sex, age, disability, or ownership status, which limits the ability to assess whether inclusion is substantive or merely symbolic. This shortcoming is well documented in global assessments of water governance and climate adaptation, which show that the lack of disaggregated data weakens efforts to identify inequities and address distributional impacts (Beauchamp et al., 2024; UNESCO World Water Assessment Programme, 2020). At the same time, international climate finance mechanisms such as the Green Climate Fund and the Adaptation Fund increasingly require gender responsiveness and inclusive stakeholder engagement as integral elements of project design, implementation, and reporting, reflecting a growing emphasis on equity and inclusion within adaptation monitoring and evaluation frameworks (Adaptation Fund, 2016; Green Climate Fund, 2019).

Through this work, Rwanda presents a replicable model for cross-sector early signal tracking that can be adapted in other contexts. The approach links water, agriculture, extractives, ecology, and social inclusion, and is grounded in field verification and institutional readiness. In doing so, it supports a shift in global adaptation practice toward models in which participation, leadership, and accountability are recognized as central to resilience rather than treated as secondary concerns.

7. Conclusion and the Way Forward

7.1 Conclusion

The early signal detection analysis of Rwanda's water and mining subsectors under NDC 3.0 and the CENR Sector Strategic Plan (2024–2028) reveals a picture of both progress and fragility. In water resources, restoration interventions such as nurseries, terraces, and rainwater harvesting systems not only reduce erosion and protect water resources, but they also provide meaningful employment opportunities for women, youth, and persons with disabilities. In the mining subsector, licensed operators are gradually embedding safeguards—runoff control, slope stabilization, waste containment, and rehabilitation—while women's participation has reached 18%–25% of the workforce, supported by emerging associations and corporate policies.

Despite this progress, structural gaps remain. Leadership continues to be male-dominated; payment and procurement delays erode community trust; occupational safety measures are inconsistently applied; and MEL frameworks lack systematic disaggregation of results by gender, age, disability, and firm ownership. Without reforms in implementation, inclusion risks stalling at numerical participation rather than progressing toward substantive empowerment and accountability.

These findings reflect the global experience: while participation figures in adaptation projects are rising, transformative inclusion requires embedding equity into everyday practices. Rwanda's findings thus contribute to both domestic implementation of the CENR Sector Strategic Plan and the wider global adaptation debate, demonstrating how early signals can reveal both achievements and vulnerabilities in building resilience.

7.2 Policy Recommendations

To consolidate progress and address weaknesses, implementation must prioritize enforcement, learning, and accountability.

1. Equity-sensitive MEL in practice: Disaggregated monitoring must move from templates to real-time practice. District officers and cooperative managers should routinely collect and report data on participation by gender, age, and vulnerability. Results should be reviewed quarterly, linked directly to performance contracts (called Imihigo in Rwanda), and used to trigger corrective action where gaps are observed.

2. Enforce procurement and payment: At the implementation level, timely payments and the provision of protective equipment are essential. Contract monitoring should focus less on award criteria and more on compliance with payment schedules, occupational safety, and gender-sensitive reporting. Transparency mechanisms—such as publicly available compliance dashboards—can reinforce accountability.

3. Expand leadership pathways: Beyond participation, targeted mentorship and on-site coaching should be embedded within projects to enable women and youth to take supervisory roles.

Cooperative boards and mine management should document progress in leadership representation, with outcomes integrated into sector performance reviews under the CENR Sector Strategic Plan.

4. Include ASM miners in implementation: ASM actors, many of them women and youth, should be directly included in safeguard training, simplified reporting, and small-grant schemes for equipment upgrades. Field extension services must systematically track uptake and ensure that the adoption of ASM safeguards is not treated as peripheral but as integral to sector-wide performance.

5. Strengthen local institutional learning: Participatory monitoring groups at the district level should focus on documenting and resolving operational barriers, such as irrigation shortages or safety risks. Lessons must be synthesized into quarterly "early signal briefs" that are shared across districts and with national agencies. This horizontal learning culture will enhance adaptive management and strengthen the delivery of the CENR Sector Strategic Plan.

6. Use regular early signal reviews as learning tools: Quarterly early signal reviews should be institutionalized, not as compliance exercises but as adaptive learning platforms. These reviews must highlight both technical progress and the distribution of benefits, with results feeding into Cabinet updates and donor dialogues, ensuring that inclusivity and resilience remain central to implementation.

7. Leverage finance through demonstrated practice: Operational evidence of GESI integration—such as women-led nurseries, youth-led terracing teams, or inclusive mining practices—should be systematically documented and showcased. This evidence provides a comparative advantage in mobilizing climate finance from the Green Climate Fund, Adaptation Fund, and bilateral partners, reinforcing Rwanda's role as a frontrunner in equity-sensitive adaptation delivery.

7.3 Final Reflection

Rwanda's early signals confirm an important transition, from policy commitment to operational inclusion. However, the fragility of these gains underscores the urgency of structural reform. Embedding inclusion into MEL systems, procurement frameworks, leadership pipelines, and ASM integration will determine whether the CENR Sector Strategic Plan (2024–2028) achieves its intended outcomes.

Early tracking and monitoring during implementation are widely recognized as essential for identifying emerging patterns, detecting bottlenecks, and informing timely adjustments to ensure that adaptation actions reach their intended beneficiaries. Guidance on MEL for adaptation emphasizes that early and continuous tracking supports adaptive management and strengthens accountability throughout the implementation cycle (Beauchamp et al., 2024; UNFCCC Adaptation Committee, 2023). In this context, the initial years of NDC 3.0 and the CENR Sector Strategic Plan represent a defining moment for Rwanda, as they will determine whether commitments to inclusivity within the adaptation system remain aspirational or translate into measurable and lived outcomes.

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