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PAN-AFRICAN DECARBONIZATION INSTITUTE (P-ADI)

CURRENT LANDSCAPE

MINERALS DEMAND

Worldwide decarbonization targets are driving a surge in demand for new energy minerals.

INDUSTRY DECARBONIZATION TARGETS

The minerals industry, a high consumer of energy is facing its own decarbonization aspirations

SKILLS & TALENT

Shortage of talent and skills to unlock and deliver the sciences, engineering and technology required demands.

SOCIAL LICENSE TO OPERATE

Mining companies are facing more pressure from local communities and organized groups to gain acceptance within their operational jurisdictions

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VALUE PROPOSITION

A virtual Institute that connect world class research capability with the needs of the African industry to build knowledge and develop processes and decarbonization applications using Africa's resources.

The Pan-African Decarbonization (P-ADI) Institute will provide leadership for Africa to participate meaningfully in the decarbonization value chain. It will contribute industry focused research to the development of the whole value chain, transforming energy systems and sectors globally, and ensure economic return is maximized for Africa's new energy resources.

- Mineral Discovery
- Mining & Processing
- Extracting & Refining
- Product Manufacturing
- Integration & Delivery
- Recycling

- Science, Engineering & Technology
- Research, Leadership & Capability development
- Leadership & Community
- Government Policy
- Economics & Business

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P-ADI

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PUBLIC POLICY
Connect government agencies to develop aligned policies and regulations to springboard domestic and export growth in decarbonization efforts

SKILLS & TALENT
Develop leadership skills and talent to support industry and agencies to work with communities in ensuring public trust and social license.

KNOWLEDGE TRANSFER
Connect companies with African R&D to support development of regional decarbonization knowledge, data, technologies, and capability

COLLABORATION
Connect mineral resource operators, Mining Equipment, Technology and Service providers, end users and build critical mass across Africa to address decarbonization.

R&D
Align and support development of complementary and supplementary research across Africa and connect current and emerging talent into the global research landscape.

TECHNOLOGY ENHANCEMENT
Enhance the use of cutting-edge technology in mining , renewable energy and climate change in addressing issues of decarbonization

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04

02

05

01

06

P-ADI
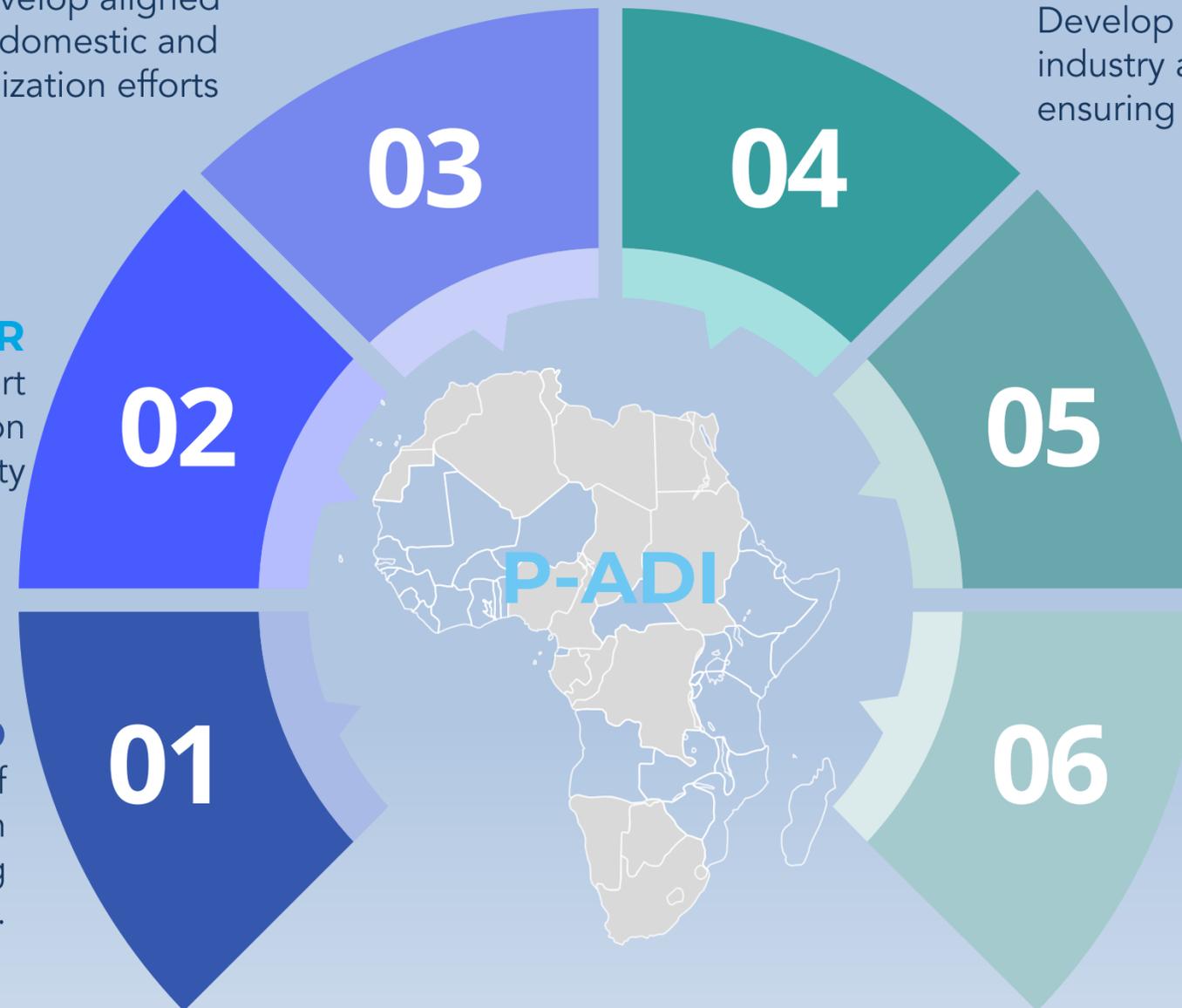
WHY AFRICA?

30%

Mineral Resources

Africa is rich with resources - around 30% of the world's resources are found in Africa across commodities, including new energy resources that underpin current and future Needs.

70%

Population

Africa is home to over 1 billion people with 70% of sub-Saharan Africa under 30 years old with a rising leadership voice across Africa.

Centuries

Mining Tradition

Africa has a long history in mining, with a once-in-a-lifetime opportunity to introduce step change in methods, equipment and improved co-creation with communities.

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Why Amira...

GOVERNANCE

Amira has delivered a trusted platform for collaborative R&D for over 60 years including financial stewardship and transparency for funders.

GLOBAL ALLIANCES

Amira has provided a platform for key stakeholder alliance across the globe including research institutions, governmental and non-governmental interest groups, and Amira member producing and supply companies.

KNOWLEDGE PLATFORM

Amira is developing a knowledge platform to provide industry decision makers with efficient access to trusted, validated, verified, and aggregated outcomes from global industry R&D outcomes.

DEFRAGMENTED R&D+I2

Amira delivers a coordinated R&D+I2 response to industry challenges, which accelerates dissemination and deployment into industry.

HIGH ROI ON R&D INVESTMENT

Amira's model provides a 15x to 20x multiplier on a company's investment in R&D+I2.

01   02   03   04   05

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POTENTIAL FOCUS AREAS OF P-ADI

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Program 1: Decarbonization Minerals Discovery & Extractive Technologies

Explore technology and processes that improve the efficiency of mining resources and the processing to refined products used in decarbonization, including environment, water optimization; Operations skills training and development; Talent and capability building

Program 2: Decarbonizing the Mine

R&D + Innovation to step change mining operations to meet operating companies' decarbonization targets Operational decarbonization efficiency drives.

Program 4: Leadership, Policy & Economics

Develop industry and agency leadership to address a coordinated Pan-African approach to minerals and decarbonization policy, economics and industry development and leadership approaches to address Environment, Society, Community and Governance (ESG)
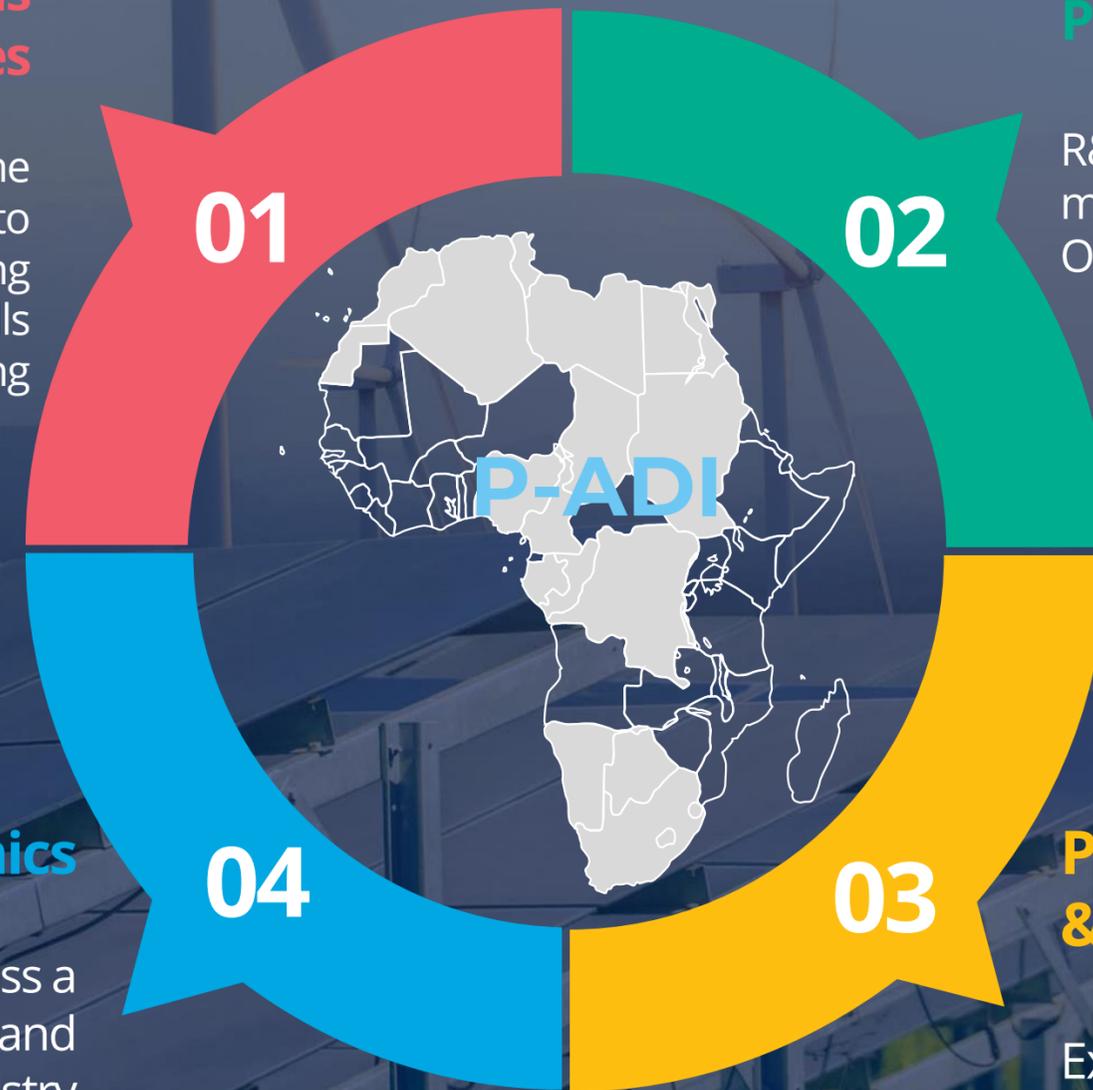
Program 3: Supply Chain Development & Integration

Explore supply chain optimization, including decarbonized transport routes, regional business development, and Pan-African infrastructure optimization, battery pre-cursor manufacturing

01 · 02 · 03 · 04

P-ADI

BUSINESS MODEL

THE FUNDING SOURCES FOR P-ADI

Amira Member Companies: 10%
(only pre-commencement support)

Amira's over 87 members annual fees and member project subscription fee.

Mninig Producers & Suppliers: 40%

Mining companies, suppliers, service providers, manufactures etc. funding specific research of interests

Grants : 40%

Seek grants from climate change, skills development, capacity building, renewable energy, decarbonisation and related funders

Governmental agencies:10%

Local and region governmental support in researches beneficial to govenments

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FINANCIAL PROJECTIONS AND KEY METRICS

COST METRICS PER RESEARCH PROJECT PER YEAR

Roles	Cost
PHD student	$ 20,000
Supervisor/Co-Supervisor	$ 10,000
Equipment, supplies & administrative expense	$ 20,000
Total	$ 50,000

TARGET YEARLY RESEARCH PROJECTS COST BREAKDOWN

	Count	Amount
Cost per Research (per year)	1	$50,000
Number of research locations (for first 5-year)	10	$500,000
Target of 10 researches per site (newly approved sites to join as collaborators)	100	$5,000,000

ANNUAL FINANCIAL PROJECTIONS (1st 5-year Tranche)

Year	Total Forecasted Funding	Amira's Funding	Grant Funding	Mining Producers/ Supplier Funding	Governmental Funding
FY23/24	$5,000,000	$500,000	$2,000,000	$2,000,000	$500,000
FY24/25	$5,000,000	-	$2,200,000	$2,300,000	$500,000
FY25/26	$5,000,000	-	$2,200,000	$2,300,000	$500,000
FY26/27	$5,000,000	-	$2,200,000	$2,300,000	$500,000
FY27/28	$5,000,000	-	$2,200,000	$2,300,000	$500,000
FY28/29	$5,000,000	-	$2,200,000	$2,100,000	$500,000

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P-ADI: GOVERNANCE, PROPOSED RESEARCH & INSTITUTIONS

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STRUCTURE

- Council
  - Executive Team (P-ADI Director, Admin, Marketing, AU)
    - Technical Committee
      - Local Committee
    - Accreditation Committee
    - Finance & Fund-raising Committee
    - Other Collaborators (Mining Producers, Suppliers, AMDC)

CURRENTLY PROPOSED INSTITUTIONS:
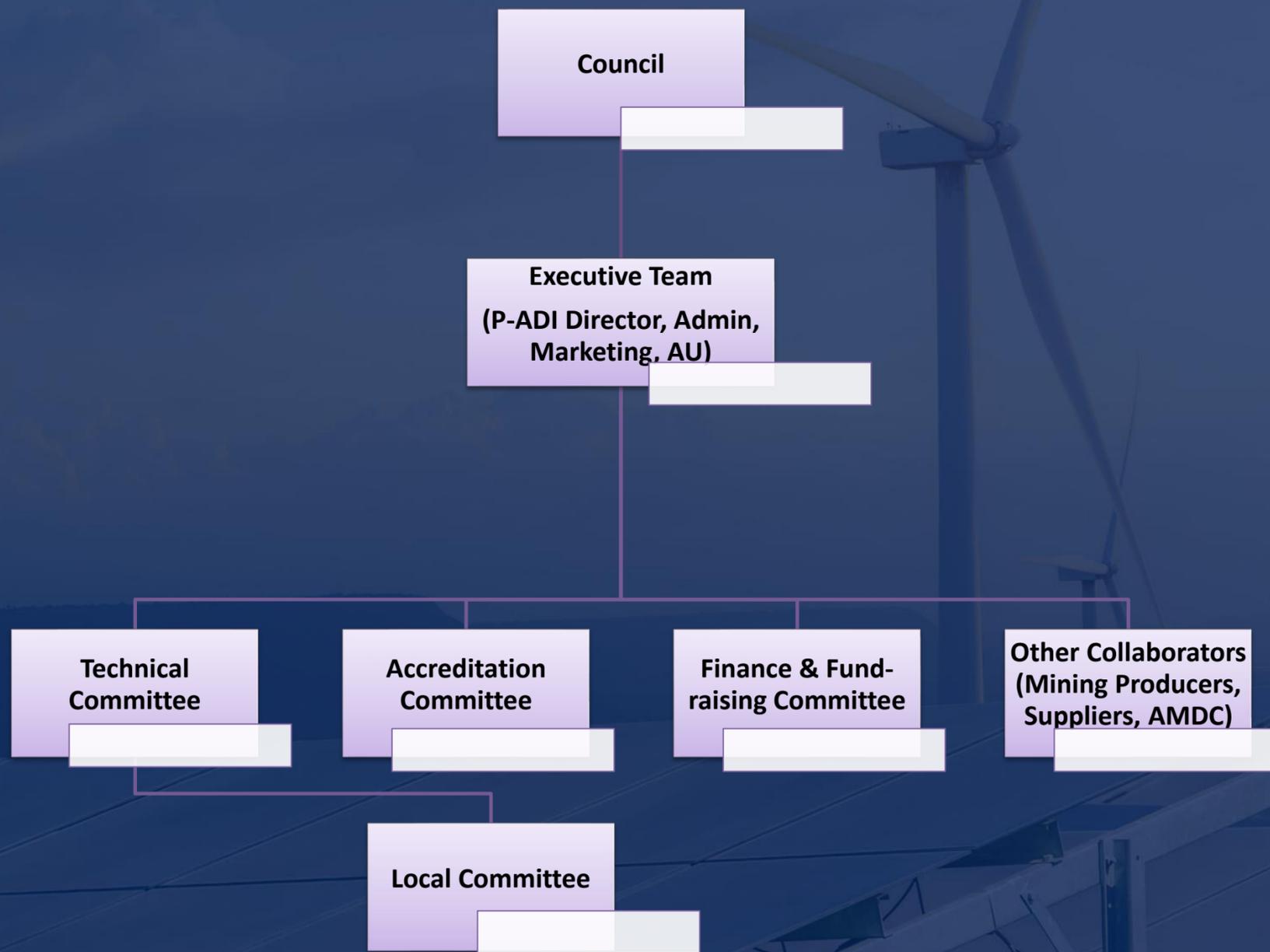
| INSTITUTION	LOCATION	PROPOSED RESEARCH
Reminex	Morrocco	Recycling scrap & end-of-life batteries
University of Cape Town	South Africa	Energy-economic and carbon footprint modelling
Kwame Nkrumah University of Science & Technology	Ghana	Green energy production and A.I system for energy mix in mining communities
University of Zambia	Zambia	Bio flotation and bioleaching
Copperbelt University	Zambia	Use of clean chemicals for mineral processing operations.
University de Lubumbashi	DRC	Waste management relevant to the lithium-ion battery
University of Mines & Technology	Ghana	Hydrometallurgical Extraction of critical minerals
Mopani Concentrator	Zambia	Cobalt Recovery from Slag
Africa Center for Excellence for Batteries (ACEB)	DRC & Zambia	New electrode and electrolyte formulations for lithium-ion batteries

African Leadership of Pan-African Decarbonisation Institute

Prof. Jennifer Broadhurst
University of Cape Town

Prof. Glen Nwaila
Wits University – S.A
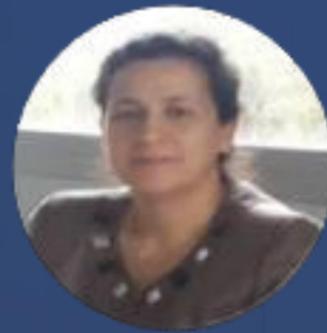
Dr. Intissar Benzakour
REMINEX, Managem

Emeritus Prof. Momade Francis
KNUST -Ghana

Mr. Cyril Muyoba
Mopani Concentrator

Prof. Jean Marie Kanda
University of Lubumbashi

Prof. Stephen Simukanga
University of Zambia

Prof. Grace Ofori-Sarpong
UMaT- Ghana

Dr. Marit Kitaw
Africa Union, AMDC

Mr. David Renner
CEO, Green Africa Minerals

Dr. Prince Amponsah
University of Ghana

Dr. Tumba Kaniki Armel
University of Lubumbashi

Prof. Jochen Petersen
University of Cape Town

Mr. Sami Sayeh
REMINEX, Managem

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University of Ghana

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UMaT - Ghana

Prof. Jean Marie Kanda
University of Lubumbashi

Dr. Intissar Benzakour
Reminex Managem

Prof. Jochen Petersen
University of Cape Town

Prof Tumba Kaniki Armel
University of Lubumbashi

Prof. Glen Nwaila
Wits University

Prof. Stephen Simukanga
University of Zambia

Mr. Sami Sayeh
REMINEX, Managem

Mr. Cyril Muyoba
Mopani Concentrator

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LAUNCHING P-ADI

Launching of P-ADI at Indaba '23, Cape Town, South Africa

Preliminary Meeting for the Pan African Decarbonization Institute (P ADI) with initial proponents including Amira, Africa union, Ghana, DRC, Zambia, Morocco, South Africa, …

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CURRENT STATUS

TIMELINE & DELIVERABLES

Q1 2023	Q2 2023	Q3 2023	Q4 2023	2024	2025	2026 - 27

9 research institutions — Researchers submitting topics after Indaba meeting ✅

A.U — Africa Union (AU) partnership in Feb. 2023 Indaba ✅

Amira Africa coordinating documentations and Sponsorship drive

Mining producer/Supplier/ Manufacturers join for research input and sponsorship

Calling non-traditional Sponsors/Governmental agencies to support

P-ADI LAUNCH

Collaborative research topic finalization & student recruitment

Confirm topic and receive short-term progressive benefits from research work

Commence Research work to delivery immediate benefits to sponsors

Continue sponsorship drive and register new members

Review Sponsor/ Government interest

Phase II - Initiation

Legend:
- 🟥 Researchers
- 🟧 Mining Producer/ Supplier/Manufactures
- 🟩 Sponsors & Governments
- 🟦 Amira

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TIMELINE TO LAUNCHING

CURRENT APPROACH

TIMELINE:

Feb '23 — P-ADI Launch at Indaba

Apr-Jul '23 — Project scoping and Charter development

Aug-Nov'23 — Sponsorship drive and further scoping

Nov '23 — 1st Council meeting

Feb '24 — Project launch at Indaba 2024

Obtain Seed Funding

Funds to initiate research work

Complete Project Development

Finish up documenation, structure, charter, resourcing for all stakeholders

Confirmation of Sponsor

Sponsors confirm level of participation and collaboration

Commenece Institute

Institute begins actual work with short and medium term deliverables

BENEFITS TO GRANTS & FUNDING AGENGIES IN CLIMATE CHANGE, SKILLS DEVELOPMENT, ...

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SKILLS DEVELOPMENT

Utilize 70% of ~1 billion youthful population in Africa

CLIMATE CHANGE MITIGATION

Address Africa's contribution to greenhouse gas globally

RENEWABLE ENRGY INTEGRATION

Innovative research to industry into critical minerals like Cu, Ge, Ni, etc. used to produce Solar Panel, Windmills etc.

CLEAN TRANSPORTATION

Enhance the development of batteries for EV and explore key metal components of EV charging infrastructure

CIRCULAR ECONOMY

Transforming environmental challenges into business opportunities through recycling

BENEFITS TO GOVERNMENT AGENCIES

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POLICY DIRECTION

Develop technical leadership capacity in driving decarbonisation policies

INTERNATIONAL PARTNERSHIP

Collaborative approach involving governments, international organization & industry

ECOMONIC GRWOTH

Enhance local economies through community participation.

CIRCULAR ECONOMY

Transforming environmental chanlleges into business oppotunities through recycling

BENEFITS TO MINING COMPANIES, MANUFACTURERS, SULPPLIERS, …

TECHNOLOGY ENHANCEMENT & TRANSFER

RESPONSIBLE SUPPLY CHANGE

PRODUCTION OF CLEANER MATERIALS (Battery,etc)

RESEARCH WITH SHORT TERM OUTCOMES

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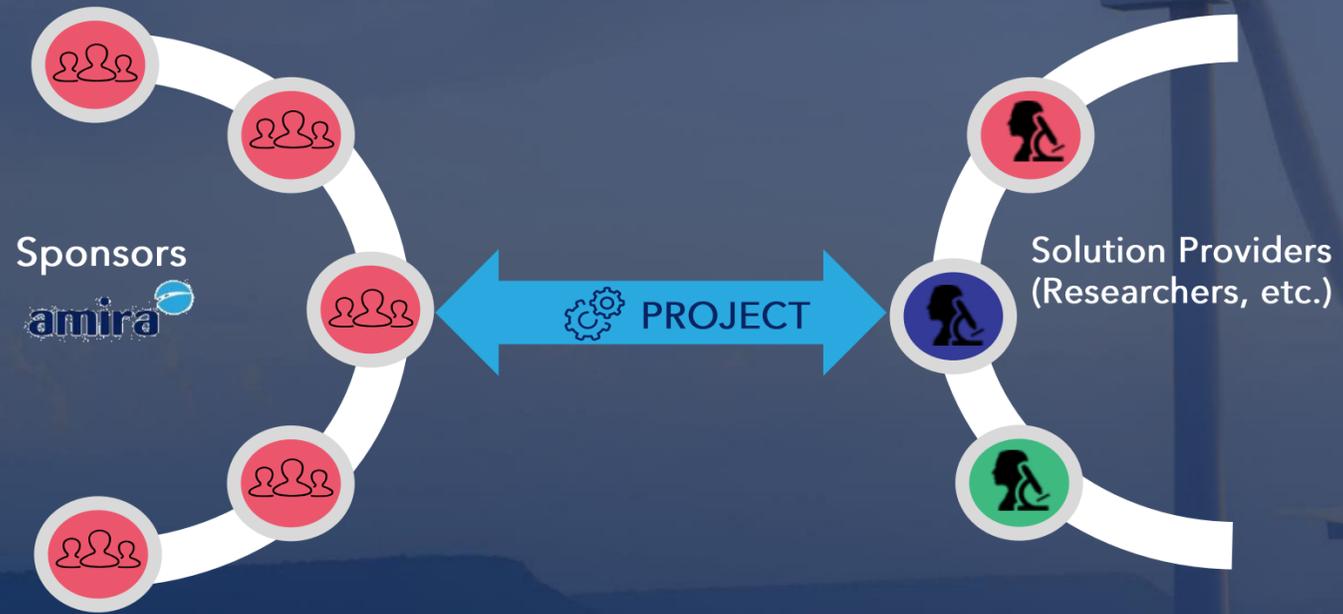
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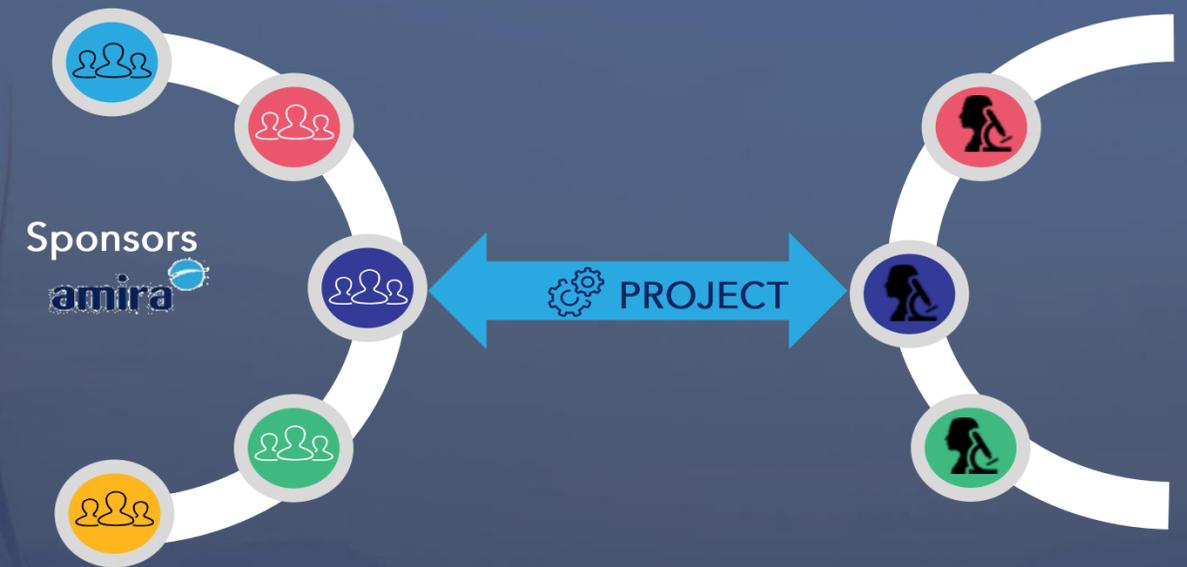
Area :

Exploration & Mining

Co-led by :

Prof. Glen Nwaila - Wits University, South Africa

Dr. Prince Ofori Amponsah – University of Ghana

Supporting institutions:

University of Mines and Technology, Ghana

University of Cape Town, South Africa

Kwame Nkrumah University of Science & Technology, Ghana

External Collaborators:

Research Theme 1: Artificial Intelligence and automation of critical mineral exploration and mining

This research theme focuses on the use of cutting-edge, world class technologies in mineral exploration and mining. It will investigate:

- AI-based mineral prospectivity modelling framework

- Ore characterization modelling using geological, mineralogical, and geochemical datasets

- Developing 3D and 4D exploration targeting and mineral assessment

- Geomodelling for targeting of potential critical minerals mineralization

- Machine learning, geo-statistics and spatial mathematics for mineral and hydrogeological predictive modelling.

- Development of machine learning and related technologies to reduce mining carbon footprint

- Developing and improving drone-based hyperspectral imaging techniques as applied to exploration geology.

Research Theme 2: Maximising the exploration potentials of artisanal, small to medium scale mining sector in Africa

This research theme addresses challenges of small to medium scale miners in mineral exploration and

mining. It will investigate:

- Comprehensive assessment of critical and technology-driven mineral resources

- Development of basic tools and techniques to maximize the exploration potential of the Artisanal and

  Small-Scale Mining (ASM) sector in Africa

- Understanding metallogenic and mineral systems

- Exploration and mine feasibility assessment/studies of critical and technology minerals prospects

  towards decarbonization

Research Theme 3: Decarbonizing deep-mining activities

Research Theme 4: Mine Safety

Area :

MINERAL PROCESSING & EXTRACTIVE METALLURGY

Led by :

Prof. Grace Ofori-Sarpong – University of Mines & Technology, Ghana

Supporting institutions:

University of Ghana

University of Cape Town, South Africa

Kwame Nkrumah University of Science & Technology, Ghana

External Collaborators:

Research Theme 1: Bio flotation and bioleaching

Research Theme 2: Sustainable water management

This research theme focuses on optimization of groundwater for mineral processing. It will investigate:

- Hydrological, hydrogeological and hydrogeochemical assessment of groundwater

Area: MANUFACTURING

Co-led by :

Prof. Jean Marie Kanda - University of Lubumbashi & ACEB

Prof. Tumba Kaniki Armel   - University of Lubumbashi & ACEB

Supporting institutions:

Reminex Managem – Morocco

Copperbelt University – Zambia

University of Zambia

University of Cape Town

External Collaborators:

This research theme focuses utilizing the rich critical mineral resources in Africa for the manufacture of

batteries and its pre-cursors. It will investigate:

- Manufacturing of cobalt and battery pre-cursors

- Development of new electrode and electrolyte formulations for lithium-ion batteries

- Developing innovative solutions for synthesis of battery electrodes materials and product (cathodes,

  graphite, etc.) from Africa resources

.

Area :

ENERGY & APPLICATION

Led by :

Emeritus Prof. Francis Momade - Kwame Nkrumah University of Science & Technology, Ghana

Supporting institutions:

University of Cape Town

External Collaborators:

This research theme focuses on the use of technology to integrate renewable energy system to the energy distribution grid, and it benefits to mining communities and beyond. It will investigate:

-   Energy, energy-economic and carbon footprint modelling, and scenario analysis

-   Novel intelligent district energy shared systems for mining communities

-   Developing AI models and algorithms to optimize the integration of renewable energy sources, Energy storage systems, and mining operations to maximize energy efficiency and minimize carbon emissions

Research Theme 2: Green Energy Production

This research theme enhances the use of production green energy as substitute for unclean energy sources, through the usage of green energy material. It will investigate:

- Green energy production from biomass

- Catalytic conversion of lignocellulosic materials into biofuels (biogas, bioethanol, biodiesel)

- Catalytic conversion of organic pollutants in wastewater

- Pilot testing of the conversion of biomass into syngas for electricity generation and its connection to the grid

- Preparation of energy materials from bio and non-bioresources (activated carbon, ores, waste materials)

Research Theme 3: Energy Production using mine wastes

This research theme addresses issues of mines waster by converting the waster into energy or energy materials to enhance a circular economy It will investigate:

- Manganese ferrite synthesis from low-grade Mn ores/tailings for energy application

- Perovskite preparation from Fire Assay Waste Materials

Area :

RECYCLING

Co-Led by :

Dr. Intissar Benzakour - Reminex Managem, Morocco

Mr. Sami Sayeh -Reminex Managem, Morocco

Supporting institutions:

University of Lubumbashi – DRC

University of Zambia

University of Cape Town

Copperbelt University

External Collaborators:

Research Theme 1: Strategic metals and critical mineral recovery from mine waste

This research theme addresses critical mineral recovery through secondary sources . It will investigate:

- Recovery of Cobalt from Copper Smelter slug

- The evaluation of cobalt, copper, germanium, zinc and tantalum reserves in slags

- Development of extraction processes of the above-mentioned metals from the slags

- Development of geopolymers and cement using the exhausted slags

- Valorisation of bulk mine wastes for other feedstocks

Research Theme 2: Reprocessing and recycling scraps in the lithium-ion battery value chain

This research theme enhance circular economy and waste reduction through recycling of electronic waste. It will investigate:

- Recycling scraps, end-of-life batteries, cathode materials and secondary materials

- Waste management relevance to the lithium-ion battery value chain

Research Theme 3: Groundwater sustainability, pollution control and remediation

Area:

ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG) RISK & IMPACT

Led by :

Dr. Prince Ofori Amponsah- University of Ghana

Supporting institutions:

University of Cape Town

External Collaborators:

Prof. Moyo Thandazile – Penn State University, USA

Research Theme 1: Environmental and Socio-economic Impact Mitigation

This research theme focuses on mitigation steps in the socio-economic and environmental impact of mining activities It will investigate:

- Carbon footprint and mitigation methods for sustainable cobalt and copper mining in the Democratic Republic of Congo

- Drone and GIS-based systems to track, monitor and evaluate the carbon footprints of mining entities (small to large scale)

- Analysis and optimisation of integrated mineral value chains for Africa

- Analysis and mitigation of mine host community socio-economics

- Develop research in the socio-economic and public health impacts across the entire spectrum of mining-related activities

Research Theme 2: Enhancing good governance

This research theme addresses adaptation and governance related issues on mining and its related activities. It will investigate:

- Developing Afro-centric frameworks for community engagement and building trust

- Identification and development of policies, regulations and mechanisms needed for a just energy transition in

  Africa

Research Theme 3: Mine closure opportunities

This research theme explores the vast opportunities mine closures present and utlilizing the benefits that can be derived mine closures It will investigate:

- Analysis of mine closure risks and post-closure opportunities through the repurposing of degraded mine

  land, infrastructure, and waste

Area :

LEADERSHIP & SKILLS TRAINING

Co-Led by :

Prof. Jennifer Broadhurst - University of Cape Town

Prof. Jochen Petersen - University of Cape Town

Supporting institutions:

University of Lubumbashi – DRC

University of Ghana

External Collaborators:

Research Theme 1: Leadership pipeline creation towards decarbonization

This research theme addresses leadership challenges Africa faces in decarbonization by empowering leaders and institution to take lead in decarbonation efforts. It will investigate:

- Reviewing institutional, policy and legislative environment to attract investment in the exploration

  and development critical minerals toward the decarbonization agenda

- Identification of skills gaps and training requirements across whole commodity value chains

Research Theme 2: Community and Industry skills development

This research theme addresses challenges in skills transfer, talent and capacity building, among communities, mining companies, suppliers and governments in Africa. It will investigate:

- Development of effective models to help continuously develop the skills of and/or train participants in the

  largely informal Artisanal Small Mining (ASM) sector on best practices in the mining industry

- Development of post-graduate and CPD courses for continuous development of advanced technical and

  leadership skills

CASE STUDY

PROBLEM STATEMENT

❑ The Nkana Concentrator used to extract both copper and cobalt through a differential flotation process. However, after the closure of their cobalt plant, this process was halted. As a result, both copper and cobalt now report to the smelter slags.

❑ With the increasing value and demand for cobalt globally, the company expressed interest in supporting research to explore alternative economic processes for recovering cobalt from the slag.

APPROACH

✓ This led to the initiation of a research project in collaboration with the Copperbelt University, the University Of Zambia (UNZA), and other P-ADI researchers.

✓ The project aims to explore and develop methods to recover cobalt from the slag, which would not only be economically beneficial to the company but also contribute to sustainable mining practices.

✓ By incorporating this research into the P-ADI program, the learnings from this project can benefit other P-ADI sponsors and contribute to a broader understanding of sustainable extraction methods for critical minerals

A showcase of P-ADI's commitment to collaborative & innovative research that addresses real-world industry challenges in a short-term whilst promoting a decarbonised future.

JOIN US

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