



**BENEFICIATION – National and African Mining Vision
discourse**

PRESENTATION BY

THE SECRETARY FOR MINES AND MINING DEVELOPMENT

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**7th ZIMBABWE MINING & INFRASTRUCTURE INDABA
2015**

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IMPORTANCE OF MATERIALS IN SOCIETY

- Linked to all industries across the economy
- Minerals underpin downstream sectors
- Improve quality of life
- Future technological progress
- Improved environmental performance
 - Green energy

54 IMPORTANT MINERALS/MATERIALS

Aluminum, Antimony, Barytes, Bauxite, Bentonite, Beryllium, Borates, coking Coal, Chromium, Clays (and kaolin), Cobalt, Copper, Diatomite, Feldspar, Fluorspar, Gallium, Germanium, Gold, Gypsum, Hafnium, Indium, Iron ore, Limestone (high grade), Lithium, Magnesite, Magnesium, Manganese, Molybdenum, Natural Graphite, Natural Rubber, Nickel, Niobium, Perlite, Phosphate Rock , Platinum Group Metals, Potash, Pulpwood, Rare Earth Elements – Heavy, Rare Earth Elements – Light, Rhenium, Sawn Softwood, Scandium, Selenium, Silica Sand, Silicon Metal, Silver, Talc, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zinc.

Country	Materials produced	Total % of supply
China	48	30%
USA	36	10%
Russia	42	4.9%
Brazil	36	4.6%
Australia	34	4.0%
South Africa	26	3.9%
Chile	18	3.4%
Canada	30	3.2%
India	30	2.5%
Turkey	25	2.1%

CRITICALITY OF SOME MINERALS

- Importance of mineral to the economy
- Risk associated with supply

21 CRITICAL MINERALS/MATERIALS

*Antimony, Beryllium, Borates, Chromium, Cobalt,
Coking coal, Fluorspar, Gallium, Germanium,
Indium, Magnesite, Magnesium, Natural Graphite,
Niobium, PGMs, Phosphate Rock, Rare Earth
Elements (REEs), Silicon Metal, Tantalum, Tungsten.*

	Mineral/Metal	Uses or value added products
1	Antimony (Kwekwe)	Flame retardants, alloys for batteries, plain bearings, solders, fiberglass composites
2	Beryllium (Kamativi)	Military applications, consumer electronics and telecommunications products, Alloys (CuBe), ceramics, aerospace, landing gears, medical devices
3	Chromium (Great Dyke)	Stainless steel (cutlery, sink etc.), chrome plating, white cast iron, foundry grade chromite.
4	Coking Coal (Hwange)	Steel production, alumina refineries, paper manufacturing, and the chemical and pharmaceutical industries (e.g. ammonia salts, nitric acid and agriculture fertilisers).
5	Fluorspar (Kamativi, Dande)	flux for smelting; in the production of glass and enamels; source of hydrogen fluoride; production of AlF_3 and cryolite (Na_3AlF_6), which are the main fluorine compounds used in aluminium smelting.
6	Magnesite (Kadoma, Zvishavane)	refractory material production for lining in blast furnaces , kilns and incinerators , binder in flooring material, catalyst and filler in the production of synthetic rubber and in the preparation of magnesium chemicals and fertilizers: In fire assay, magnesite

7	Natural Graphite (Karoi)	Refractories, crucibles, mould washes, break & clutch linings, fuel cell and battery applications, foundry operations and steelmaking, automotive parts, lubricants.
8	Niobium (Kamativi)	Structural steel, Automotive steel, Pipeline steel, Superalloys steels, Chemical industry; Niobium is also used in special alloys for the nuclear and the aircraft industries, magnets, superconductors, jewelry, thermometers, capacitors or catalysts.
9	PGMs (Great Dyke)	Catalytic converters, jewelry, catalysts for the chemical industry and fuel cells.
10	Phosphate Rock (Dorowa)	Fertilisers, detergents, animal feedstocks.
11	Rare Earth Elements (Bikita, Kamativi, Mhangura, Mberengwa, Hwange, Mana Pools)	Phosphors, plasma screen usage, fluorescent lamps, permanent magnets, NiMH Batteries, Catalysts, Polishing Powders, Glass Additives Ceramics.
12	Silicon Metal (Rivers)	Electronic devices such as transistors, printed circuit boards, integrated circuits and solar panels; production of aluminum, and in the chemical industry, photovoltaics.

13	Tantalite (Kamativi, Bikita)	Electronics, metal alloys, tanks and explosives, electrical parts. Tantalum forms an oxidized layer around capacitors and high-power resistors, insulating them from damage due to high operating temperatures; metal alloys, radio transmitters and surgical equipment.
14	Tungsten (Hwange)	Cemented carbides, alloy steels, super alloys and tungsten alloys (for lighting technology, electrical and electronic technology, high-temperature technology, welding, spark erosion, space travel and aircraft devices, armaments and laser technology), incandescent light bulb filaments, X-ray tubes , electrodes in TIG welding , superalloys , and radiation shielding ; tungsten carbide , military applications in penetrating projectiles , industrial catalysts ; electrical conductor , wear-resistant abrasives , and "carbide" cutting tools such as knives, drills, circular saws , milling and turning tools used by the metalworking, woodworking, mining , petroleum and construction industries. The jewelry industry makes rings of sintered tungsten carbide, tungsten carbide/metal composites.

Nation	Goal	Key Materials identified for action	R&D Activities
Japan	Secure a stable supply of raw materials for Japanese industries	Cobalt, Nickel , Manganese, Molybdenum, REE , Tungsten , Vanadium	<ul style="list-style-type: none"> • Substitution research • Exploration, excavation, refining and safety research

Nation	Goal	Key Materials identified for action	R&D Activities
China	Maintain a stable supply of raw materials for domestic use through industry consolidation, mitigating overproduction & reducing illegal trade	Antimony, Tin, Tungsten, Iron, Mercury, Aluminum, Zinc, Vanadium, Molybdenum, REEs	<ul style="list-style-type: none"> • Rare earth separation techniques & exploration of new functional materials • Rare earths: metallurgy; optical, electrical, magnetic properties; basic chemical sciences

Nation	Goal	Key Materials identified for action	R&D Activities
South Korea	Ensure a reliable supply of materials critical to Korean mainstay industries	Arsenic, Titanium, Cobalt, Indium, Molybdenum, Manganese, Tantalum, Gallium, Vanadium, Tungsten, Lithium, REEs	<ul style="list-style-type: none"> • Recycling end-use products • Designing for recyclability • Substitute materials • Production efficiency

Nation	Goal	Key Materials identified for action	R&D Activities
Australia	Maintain investment in the mining industry & fairly taxing the depletion of national resources	Tantalum, Molybdenum, Vanadium, Lithium, REEs	<ul style="list-style-type: none"> • Promote sustainable development practices in mining

to promote sustainable management, exploration, mining, processing and marketing of mineral resources for the benefit of all Zimbabweans

Nation	Goal	Key Materials identified for action	R&D Activities
Canada	Promote sustainable development & use of resources, protect the environment & public health, ensure attractive investment climate	Aluminum, Silver, Gold, Iron, Nickel, Copper, Lead, Molybdenum.	<ul style="list-style-type: none"> • Provide comprehensive geosciences information and infrastructure • Promote technological innovation in mining processes • Value-added mineral & metal products

Country	Stages of supply chain focussed
Japan	Substitution research and exploration
China	Processing and metallurgy and export restrictions
South Korea	Recycling
Australia	Sustainable mining (depletion taxes)
Canada	Exploration
Russia	Material Stockpiling and export restriction
USA	Stockpile for strategic defence materials

AFRICAN MINERALS

- Exported as ores, concentrates or metals
- No downstream processing of value addition.
- Factored into economic planning of industrialised countries

SUB-SAHARA AFRICA SITUATION

- Free from conventional colonialism
- Poverty, hunger, diseases, civil wars
- Enormous resources of nature
- Unable to harness its resources of nature

S&T IN SUB-SAHARA AFRICA

- Lack of critical mass of human capital with appropriate knowledge and skills
- Lack of technology, infrastructure for innovation, entrepreneurship and incentives to innovate
- A skills gap prevails in Africa

SCIENCE AND TECHNOLOGY

- Main drivers of economic growth
- Distinguishes NORTH from the SOUTH
- Wide gap in economics is a science gap
- S&T defines the standard of a nation
- Country's economic well-being corelated to its ranking in S&T

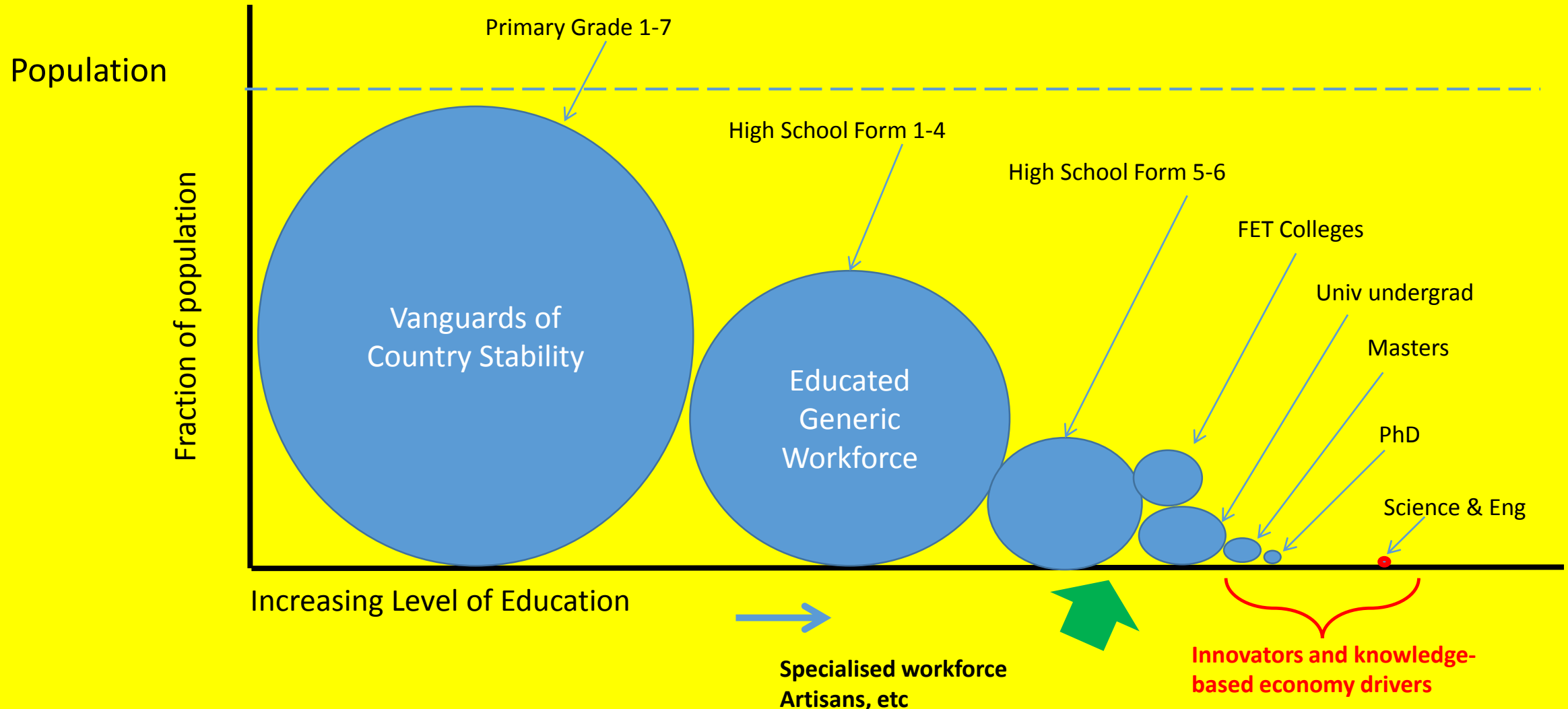
S&T TRAINING IN SUB-SAHARA AFRICA

Brain drain weakens position of S&T

Scientist/engineers per 1million

- 100 in Sub-Sahara Africa
- 800 scientists/engineers in Asia
(excluding Japan)
- 1,100 in industrialised countries

Africa is weak where it matters most – Innovation and Scientific capability for value addition



The Origins of The AISTs

At a meeting in February 2001 the African leaders lamented the knowledge deficit in Africa. They went on to suggest that world class African Institutes of Science & Technology (AISTs) in sub-Saharan Africa were perhaps Africa's greatest need. The concept was further pursued by some Africans both on the continent and in the diaspora.

OBJECTIVES OF AISTS (1)

- To catalyze the development of world class science and technology in Africa in ways that can stimulate economic growth and generate employment, and turn brain drain into brain gain;**
- To provide the best facilities for post-graduate and post-doctoral studies and research;**

OBJECTIVES OF AISTS (2)

- To bridge between research and industrial development through strong link with industry for technology transfer**

AGREEMENT BY HEADS OF AFRICAN STATES IN JANUARY 2005 AT ABUJA

4 AISTs:

1. West Africa: Abuja (Nigeria) 2007

Energy and Petroleum Engineering

2. East Africa: Arusha (Tanzania) 2008

Life Sciences (Bio-engineering and Agriculture)

3. North Africa: Berkina Faso (2009)

Water and Environmental Engineering

4 Southern Africa: ????

Minerals beneficiation and value addition

BASIS FOR ZIMBABWE'S BID TO HOST PAMUST

- **the country's strength in mineral endowments,**
- **well-developed mining industry,**
- **strong commitment education in general by the leadership of Zimbabwe central location in Southern Africa**
- **easy accessibility and a well-developed infrastructure**

ZIMBABWE AT THE CENTRE OF A MINING REGION: CENTRAL AND SOUTHERN AFRICA



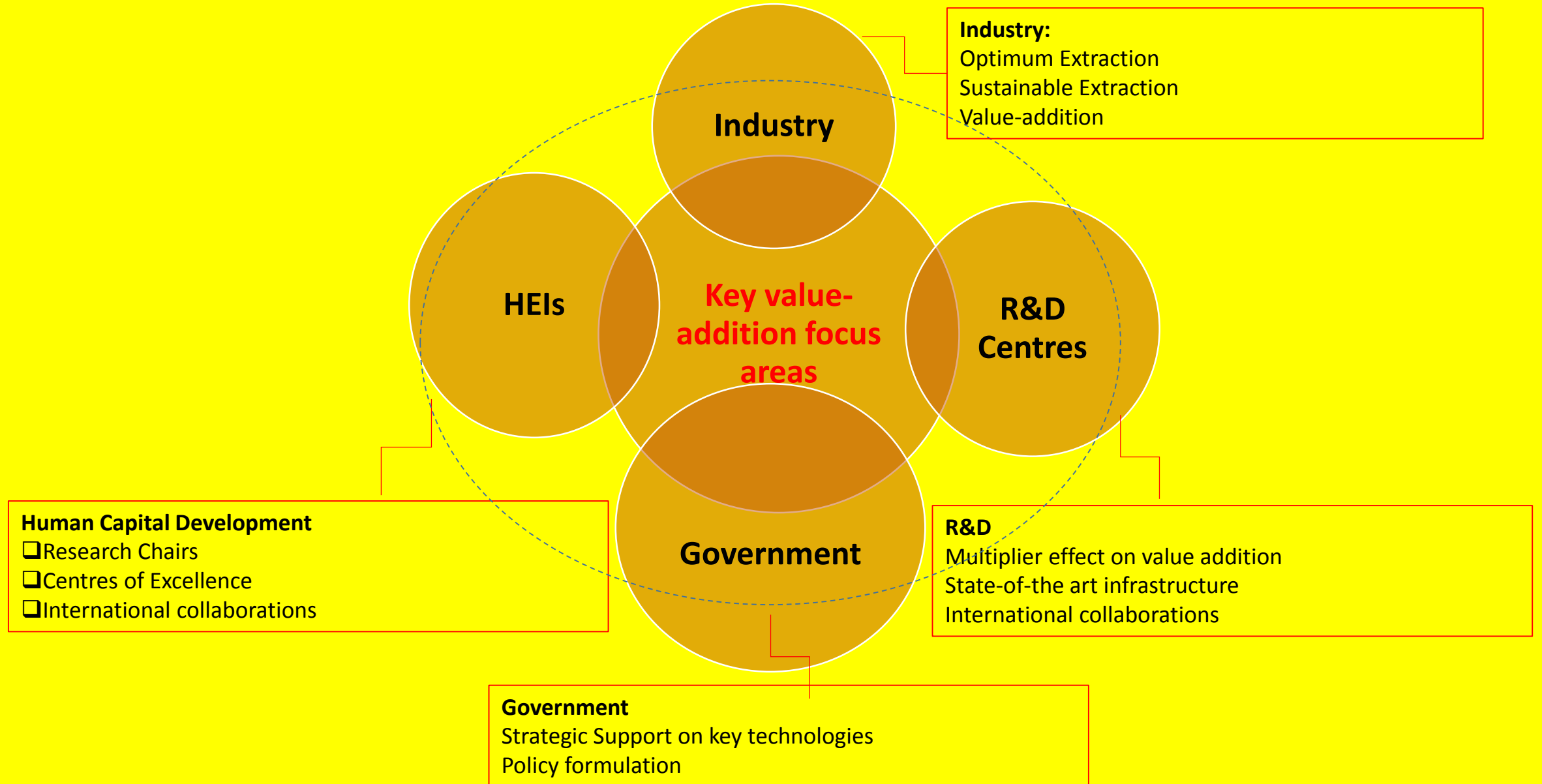
ZIMBABWE'S BID TO HOST PAMUST

- **COMESA support**
- **Zimbabwe then won the bid to host the Pan African Minerals University of Science and Technology. The Government of Zimbabwe is going to house PAMUST at the Scientific and Industrial Research and Development Centre (SIRDC), located in Harare, which already boasts a well-developed infrastructure spanning conference facilities, laboratories and communication networks.**

PAMUST: OUTPUT AND DELIVERABLES

- A critical mass of postgraduates is required to meet the mining sector needs in universities, R&D institutions, industry and government departments.
- **(1200 Masters and 300 PhD will be enrolled annually when PAMUST is fully developed); This is still inadequate to serve the needs of the whole continent!**

A Holistic National Frame Work for Value-Addition



5 AREAS OF PAMUST'S FOCUS

- Mineral Exploration**
- Mining Engineering**
- Advanced extractive processes**
- Advanced mineral-based materials value addition**
- Minerals Business Studies**

PAMUST PILLARS

ECONOMIC GROWTH

DEVELOPMENT

MINERAL BENEFICIATION
AND VALUE ADDITION

GEOSCIENCES

MINING ENGINEERING

EXTRACTIVE METALLURGY

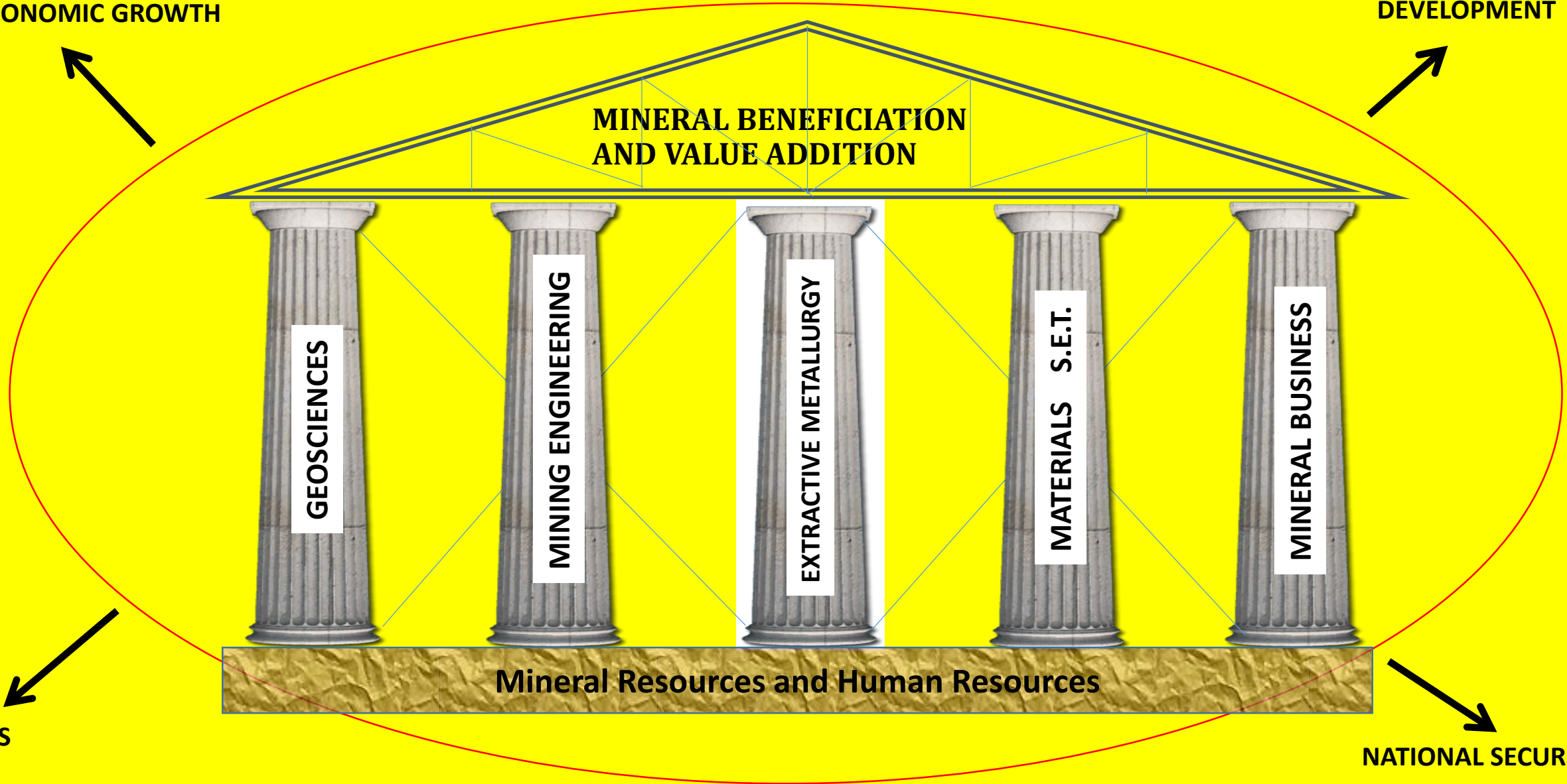
MATERIALS S.E.T.

MINERAL BUSINESS

Mineral Resources and Human Resources

JOBS

NATIONAL SECURITY



PAMUST FEATURES

- **Postgraduate research programmes (Masters, PhD and post-doctoral.)**
- **Pan-African in its student, staff, Council composition**
- **World Class institution with the most advanced facilities**
- **Large numbers of postgraduate output**

STEPS BY GOVERNMENT

- **The Government approved the provision of adequate land for PAMUST at SIRDC, in Harare.**
- **The Cabinet approved the Principles for the PAMUST Bill which will evolve into the PAMUST ACT.**
- **The Attorney General's Office is drafting the PAMUST Bill which will be debated and passed by Parliament eventually.**

FOUNDATION COMMITTEE

- His Excellency, President R.G. Mugabe, has approved the appointment of a 13-Member Foundation Committee to steer the establishment of this University.
- The Minister of Mines and Mining Development inaugurated the Foundation Committee and announced its membership on Monday 27 July 2015 which is as follows:

Foundation Committee Membership

1. Professor Robson Mafoti

Chairman

- (CEO of SIRDC)

2. Professor Francis P. Gudyanga

Co-Vice Chairman

- (Secretary for Mines and Mining Development)

3. Ambassador Dr. M. Mapuranga

Co-Vice Chairman

- (Secretary for Higher and Tertiary Education, Science and Technology Development)

Foundation Committee Membership

4. Professor Godfrey Dzinomwa

Member

- (Consulting Metallurgist)

5. Mr. Spencer G T Kahwai

Member

- (Research Fellow, Institute of Mining Research, UZ)

6. Professor Phinias M Makhurane

Member

- (Founding and Emeritus Vice Chancellor, NUST)

7. Mr. Herbert S Mashanyare

Member

- (Formerly Executive Director, Mimosa Mining Company)

8. Ambassador Dr. Mary M Muchada

Member

- (Deputy Chairman, Public Service Commission)

Foundation Committee Membership

9. Professor Levi M Nyagura

Member

- (Vice Chancellor, University of Zimbabwe)

10. Professor Samson Sibanda

Member

- (Pro-Vice Chancellor, NUST)

11. Professor David J Simbi

Member

- (Vice Chancellor, Chinhoyi University of Technology)

12. Dr. Eng. Michael J Tumbare

Member

- (Chairman, Research Council of Zimbabwe and Chairman of the Department of Civil Engineering, University of Zimbabwe)

13. Air Vice Marshal T.M. Moyo

(Commandand, National Defence College)

- Materials/ minerals play an irreplaceable role in society
- Some minerals are more critical than others
- Africa has enormous minerals resources
- Exported as raw material
- Zimbabwe hosts 14 of the 21 minerals considered critical to global economies
- Africa's inability to harness its natural resources
- African Institutes of Science and Technology
- Zimbabwe is to host PAMUST
- The establishment of PAMUST this year coincides with the Chairmanship of His Excellency, President R.G. Mugabe, of the SADC and African Union.

**It is morally unacceptable, geo-politically dangerous,
environmentally unsustainable and economically
unjustifiable for developing countries, like Zimbabwe,
to continue to fuel the development of richer
countries at the cost of their own present and future.**

I THANK YOU!