



Up- and Downstream Linkages in the Mineral Value Chain

Mineral Value Chain Opportunities

TIPS- Industrialisation and the Mining Economy,
Paul Jourdan, UJ, June 2016

Resource Endowment: Blessing or Curse?

Could be a curse (Dutch Disease, corruption, et al)
However, could be a blessing!

Minerals could provide wide-ranging opportunities to build inputs industries and to provide key mineral-based feedstocks into the rest of the economy

Or we could just be left with a hole in the ground and the negative enviro & socio-economic impacts of ghost towns

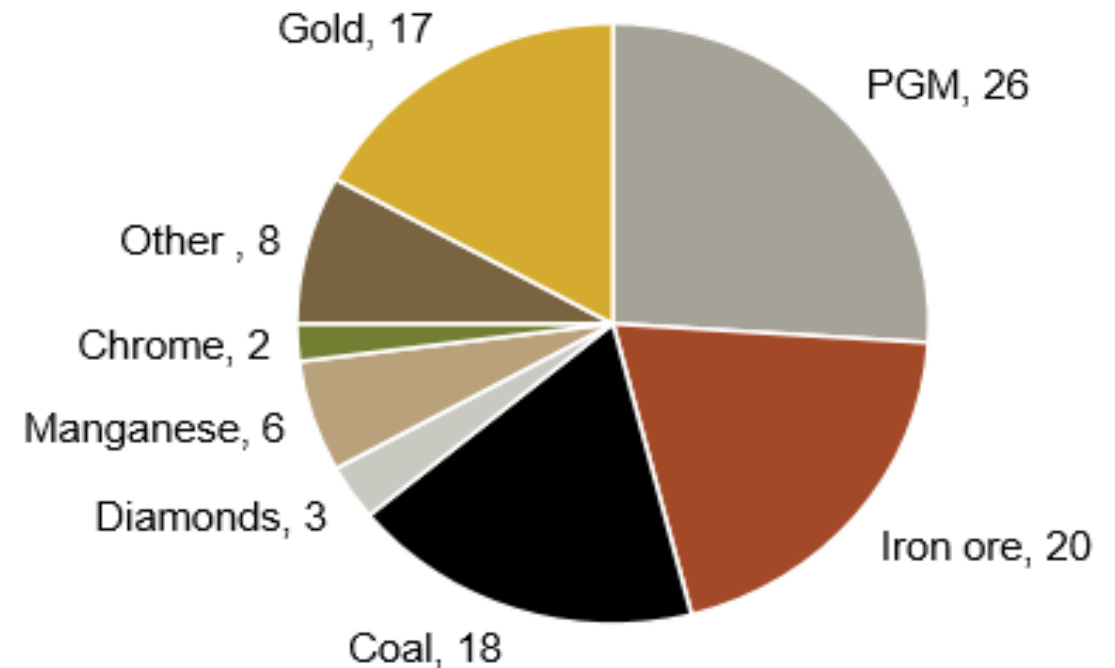


Mining in South Africa

In 2014, the South African mining industry contributed:

- 7.6% to GDP
- Around 15% to FDI
- 20% of private investment
- 1,4 million jobs
- 25% of exports

Sector contributions to mining minerals exports in SA (2014)



Source: Chamber of Mines estimates; StatsSA



Upstream Linkages

- Supplier Industries:**
- Manufacturing
 - Chemicals
 - Consumables (e.g. diesel, timber)
 - Rail
 - Port
 - Electricity

- Capital goods:**
- Equipment
 - Machinery

Downstream Linkages

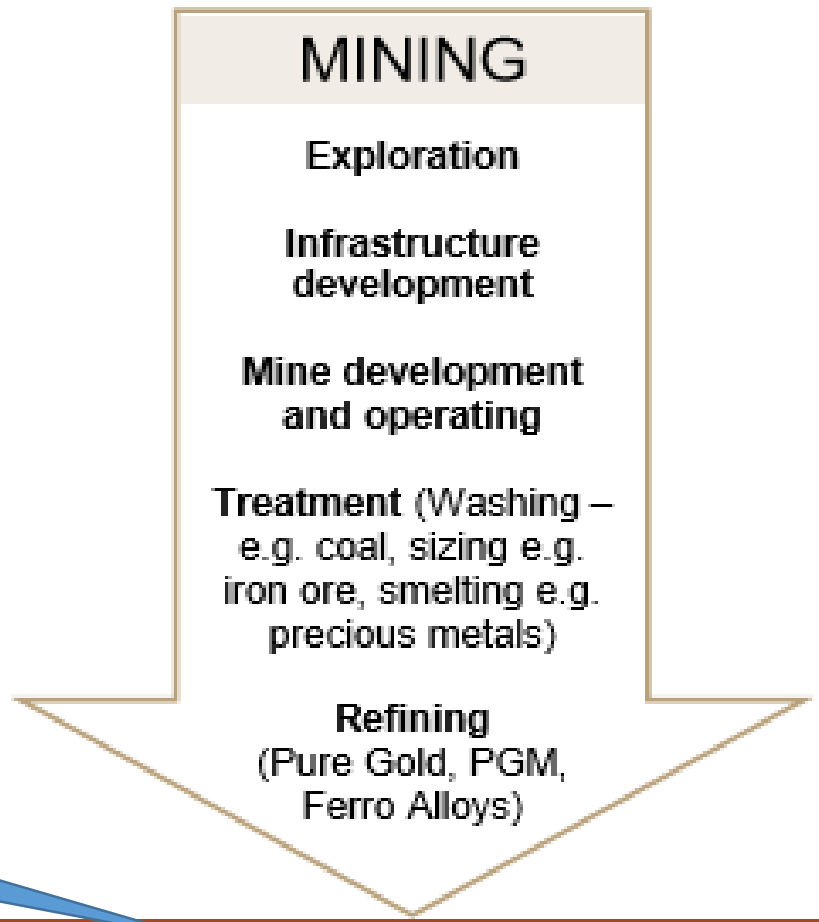
- Manufacturing**
- Autocats
 - Steel/alloys
 - Chemicals/liquids
 - Jewellery

End consumer markets

Sidestream HRD/RDI

- Direct Services:**
- Geological
 - Engineering
 - Health and safety
 - Education skills

- Related Services:**
- Financial services
 - Banking
 - Stock market (JSE)
 - Auditing and consulting services
 - Business services



MINING

Exploration

Infrastructure development

Mine development and operating

Treatment (Washing – e.g. coal, sizing e.g. iron ore, smelting e.g. precious metals)

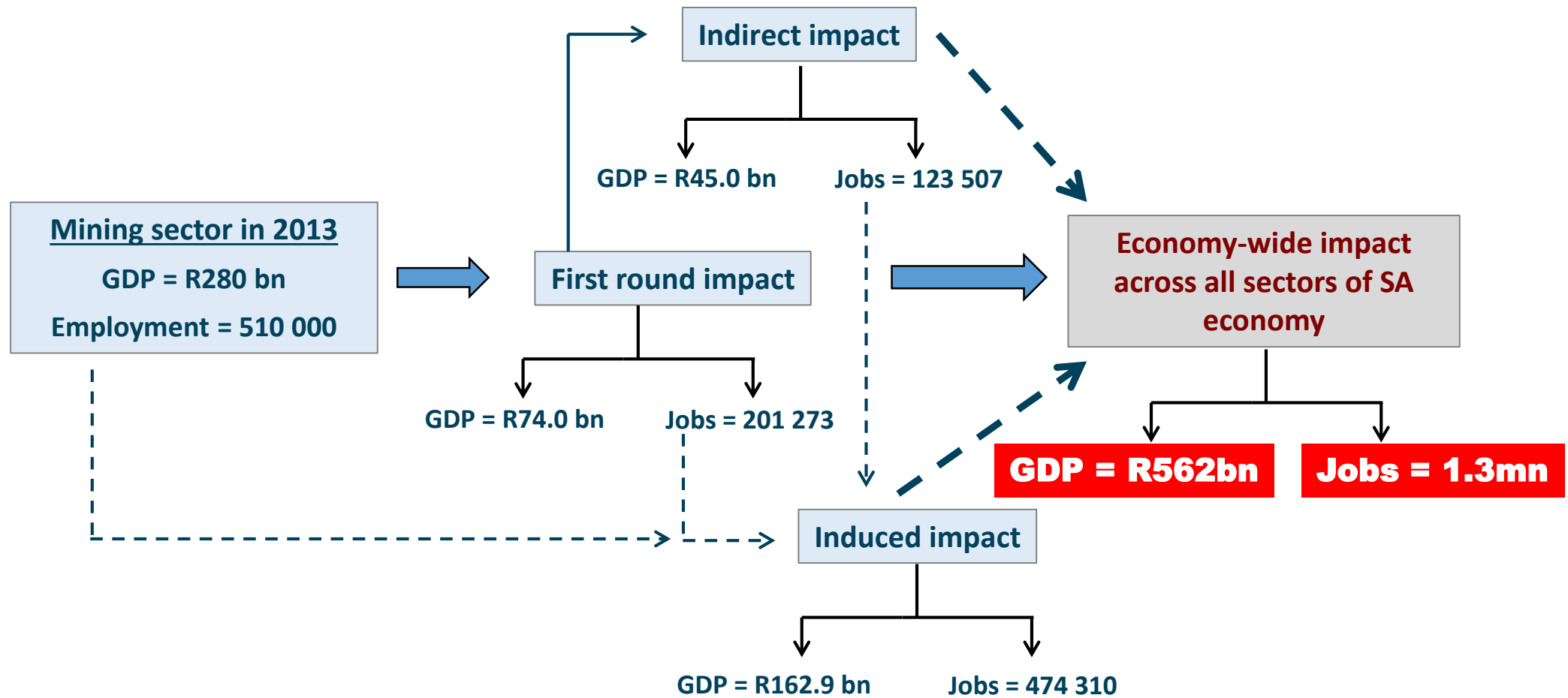
Refining (Pure Gold, PGM, Ferro Alloys)

Manufacturing

- Autocats
- Steel/alloys
- Chemicals/liquids
- Jewellery

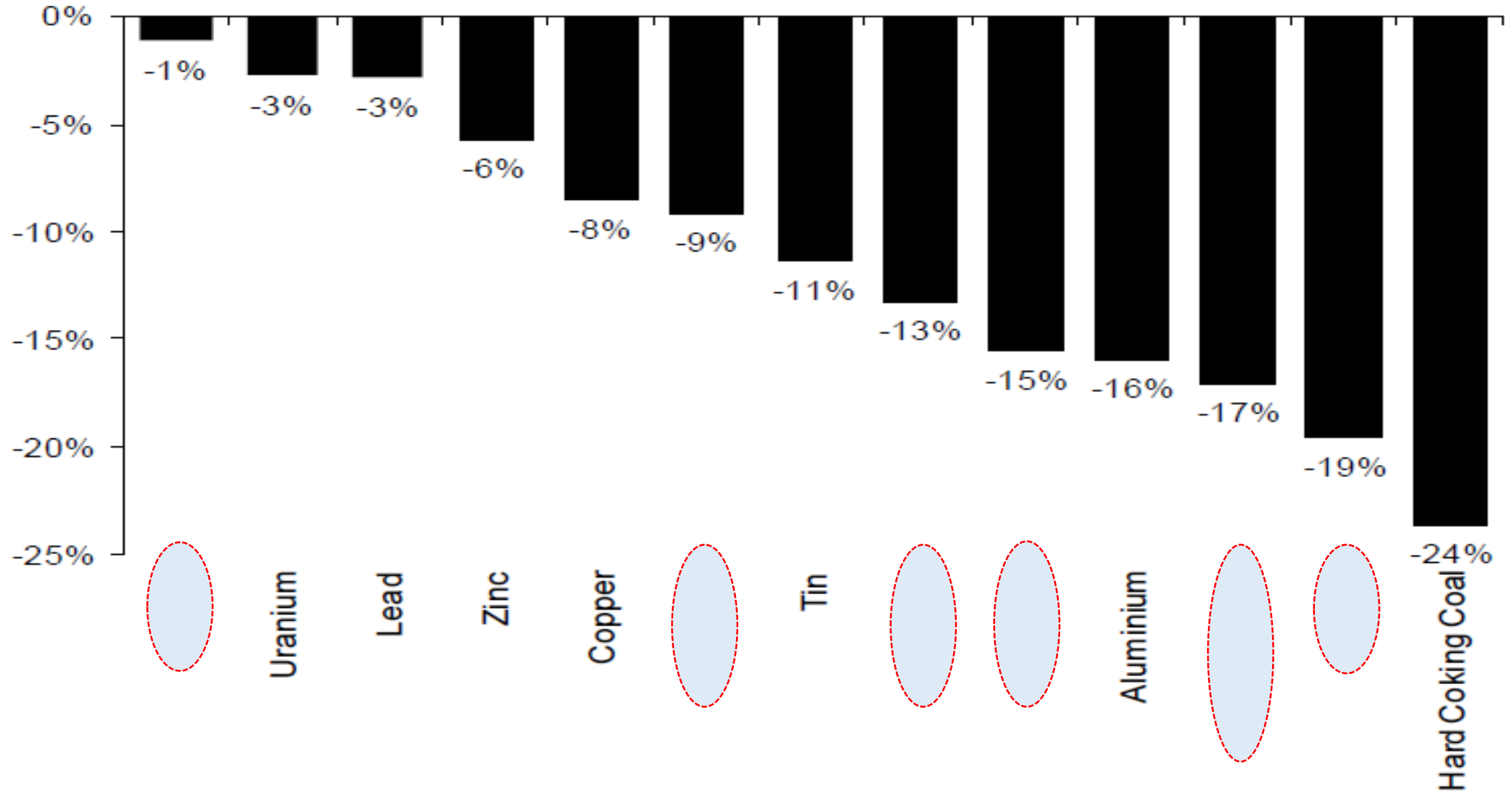
End consumer markets

Mining sector importance in 2013: Economy-wide impact



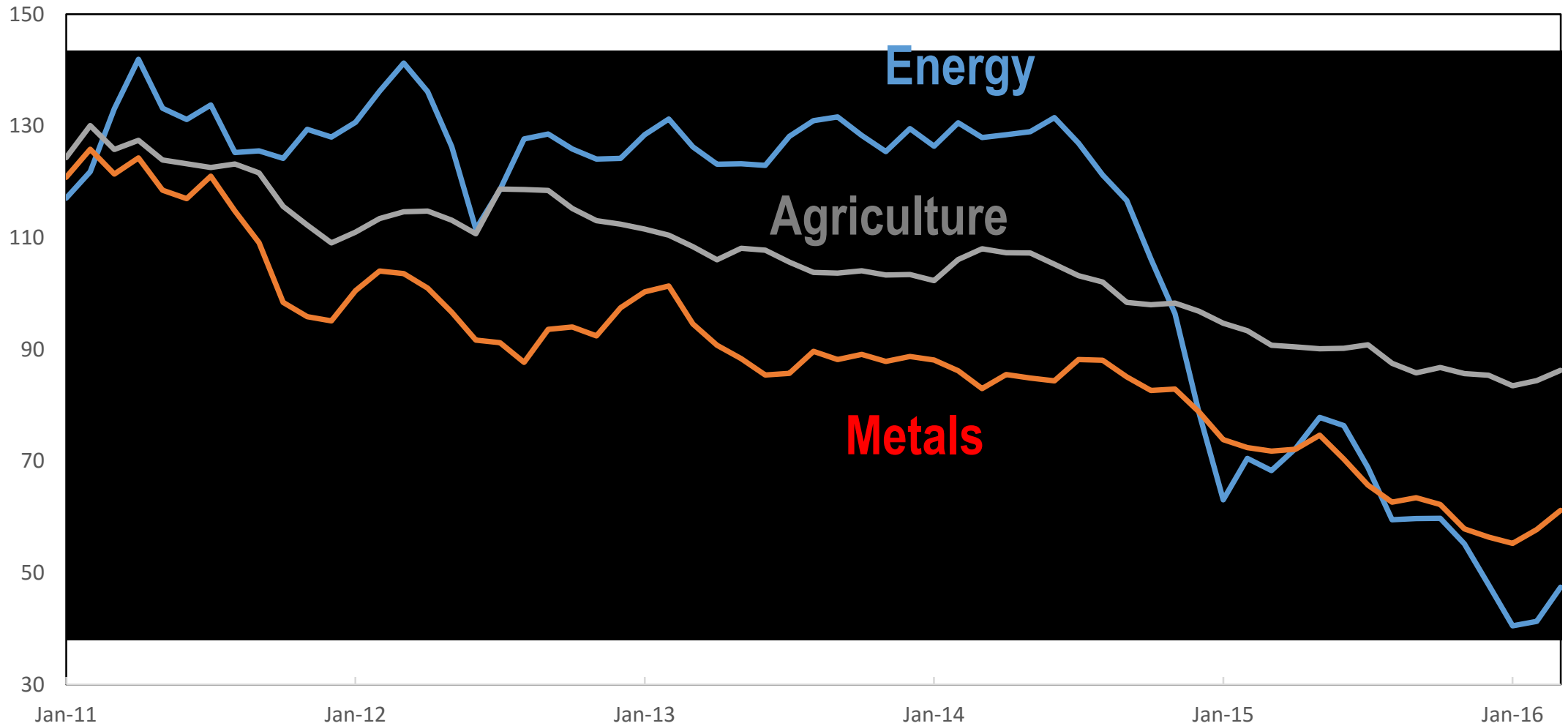
Now for the bad news.....

Price forecast for 2016 (vs. 2015)



Source Macquarie Research, January 2016

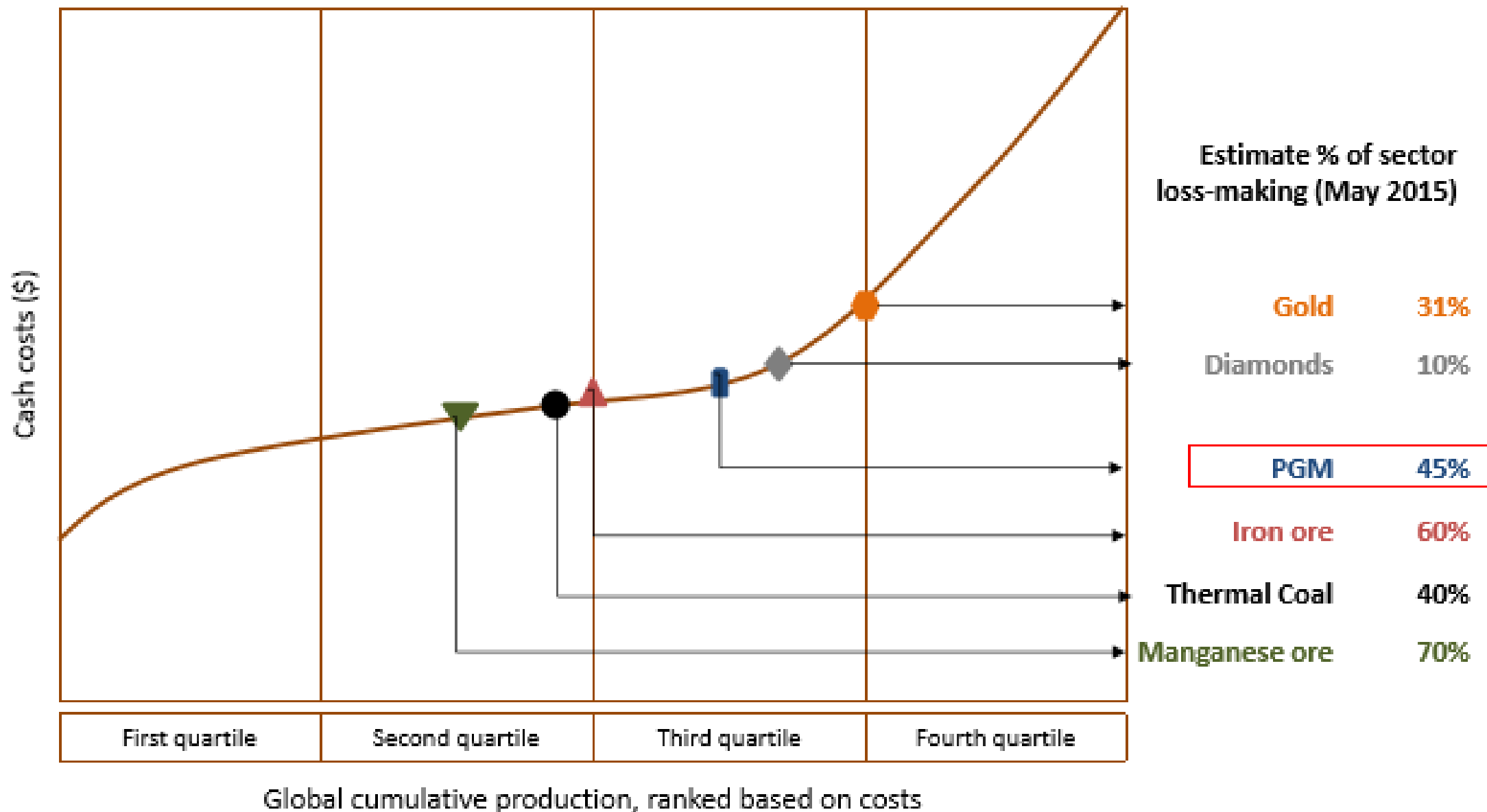
Commodity Prices Index (2010=100, IMF)



Low commodity prices - ideal time to rethink our minerals regime!



Illustrative SA commodity mining cost curve (2015)



AU: Africa Mining Vision (AMV)

“Transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth and socio-economic development”

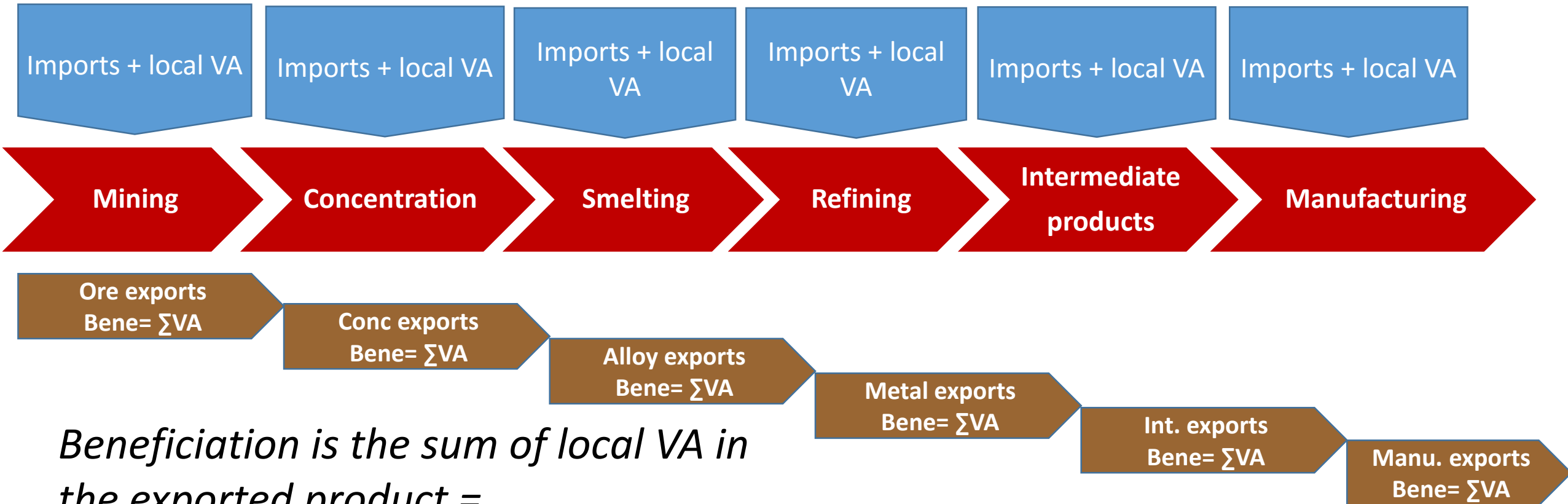
“A knowledge-driven African mining sector that catalyses & contributes to the broad-based growth & development of, and is fully integrated into, a single African market through:

- Down-stream linkages into mineral beneficiation and manufacturing;
- Up-stream linkages into mining capital goods, consumables & services industries;
- Side-stream linkages into infrastructure (power, logistics; communications, water) and skills & technology development (HRD and R&D);
- Mutually beneficial partnerships between the state, the private sector, civil society, local communities and other stakeholders; and
- A comprehensive knowledge of its mineral endowment.”

AMV recognises the critical importance of establishing the seminal mineral linkages, whilst the resource is still extant! [SA still to align to AMV]

What is Beneficiation?

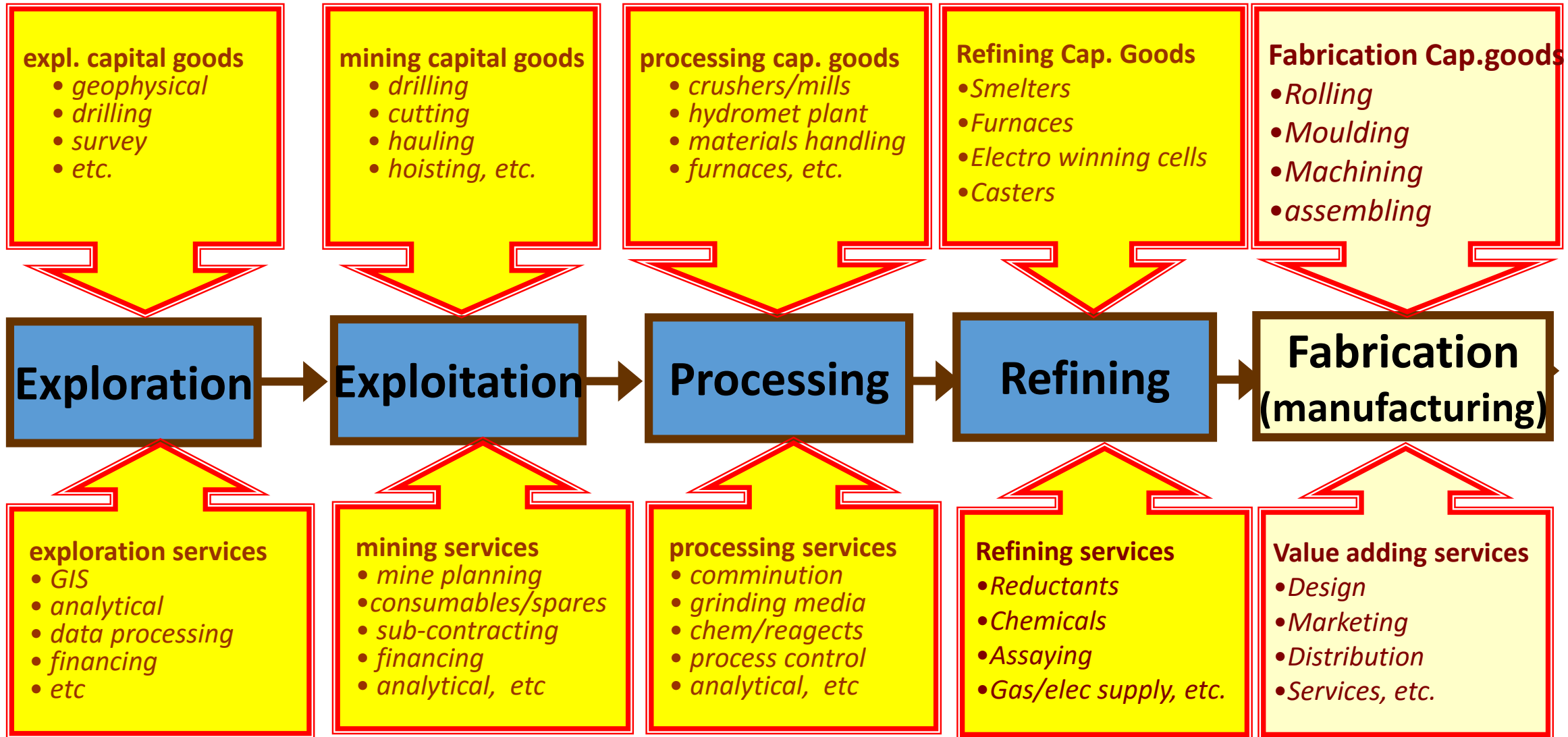
- **Narrow definition:**
 - Value-added above a “base” state (ore, concentrate, metal/alloy)
- **Broader definition:**
 - Total domestic value-addition (excluding all imported inputs)



Beneficiation is the sum of local VA in the exported product = VA in all inputs plus the VA in the process.

= both backward and forward linkages!

Resources provide opportunities for up-, down- & side-stream linkages: MVCs



Mining offers numerous opportunities along the minerals value chains (MVCs)

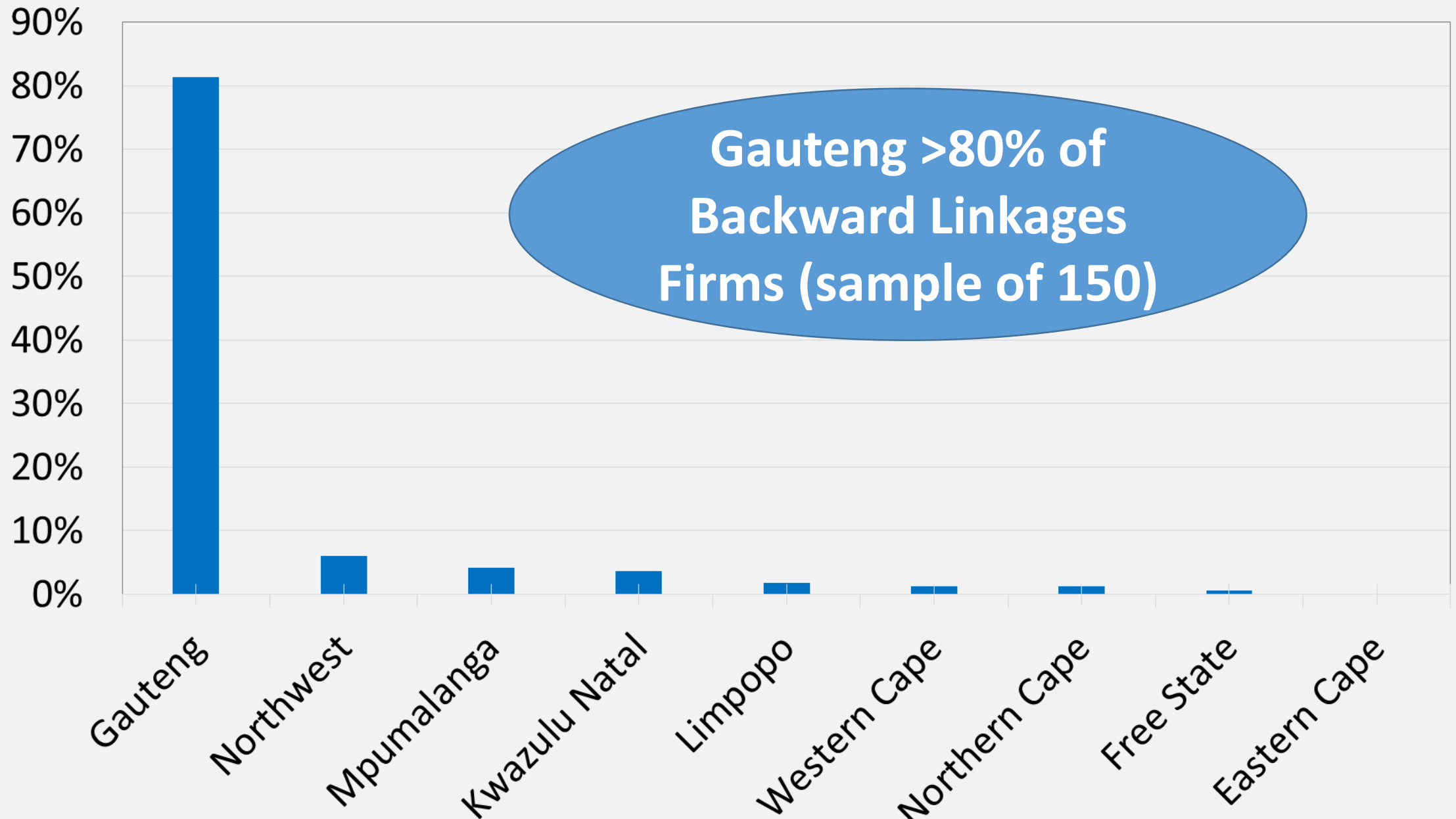


Upstream/backward Linkages

Opex impact of a large platinum mine in NW Province (R mn 2011)

Province		Wages	Procurement	Total
Eastern Cape	0.1%	1.6	5.7	7.3
Freestate	0.8%	0.5	64.2	64.7
Gauteng	73.3%	16.9	6123.0	6139.9
Kwazulu/Natal	0.5%	0.5	43.1	43.6
Limpopo	0.6%	2.3	47.9	50.2
Mpumalanga	1.1%	0.4	88.1	88.6
Northern Cape	0.0%	0.5		0.5
North-West	22.9%	196.2	1721.9	1918.0
Western Cape	0.8%	0.0	66.4	66.4
		218.9	8160.4	8379.3

Distribution of Mining Suppliers Within South Africa



SA Mining Methods

Where we are

Where we want to be

Modernisation could be roughly job neutral,
**If the capital goods and services
are locally produced**

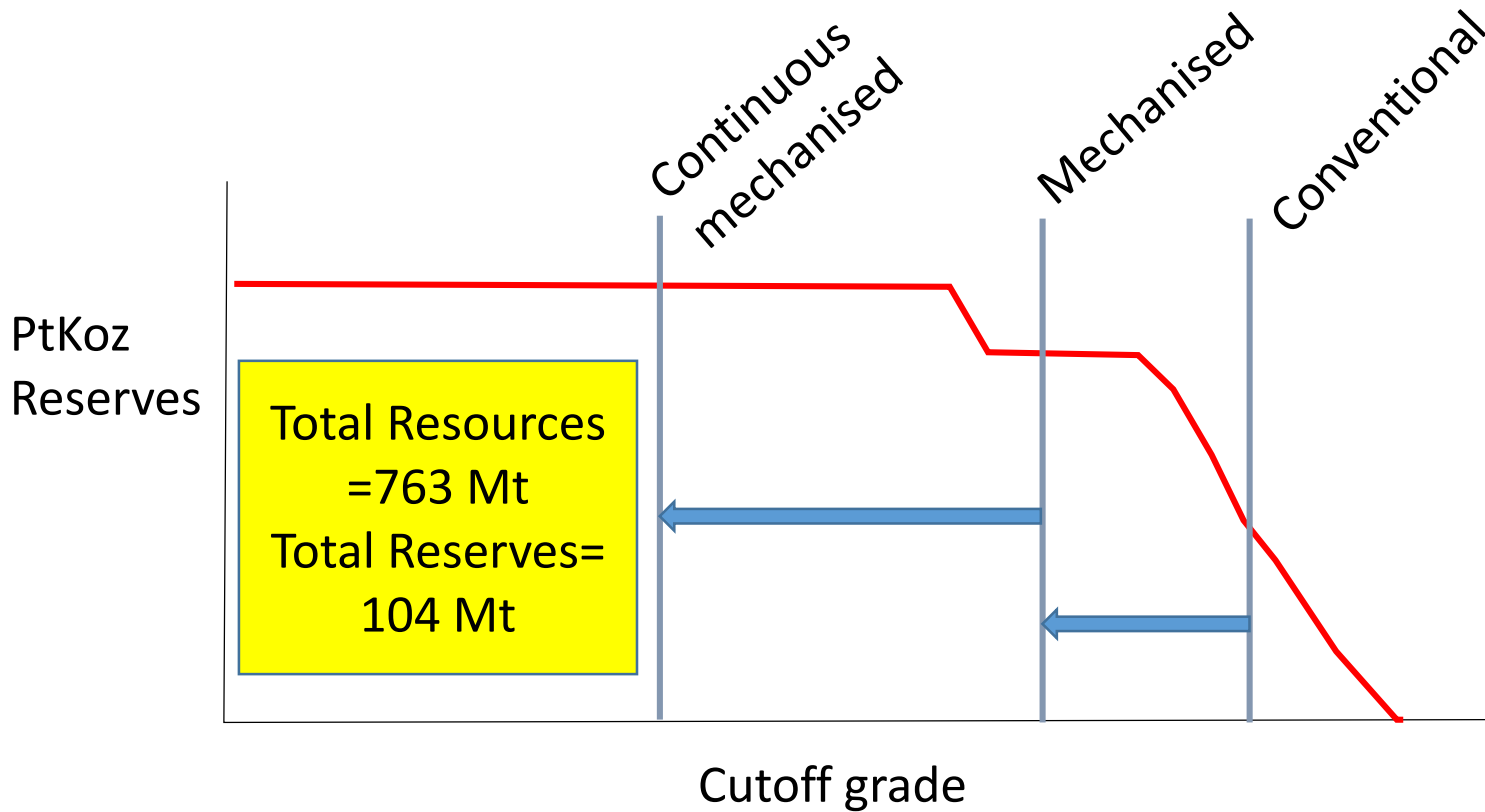
(mining jobs lost \approx supplier jobs gained)

Challenge = Upstream opportunity?

Low local content

- Enhanced imports
- Less portable skills

Mechanisation & 24/7: Effect on cutoff grades & reserves: PGMs



What it means...

- Mechanisation restores profitability to >80%
 - **Restores 11 years life**
- 24/7 mechanisation restores profitability to >95%
 - **Restores 15 years life**

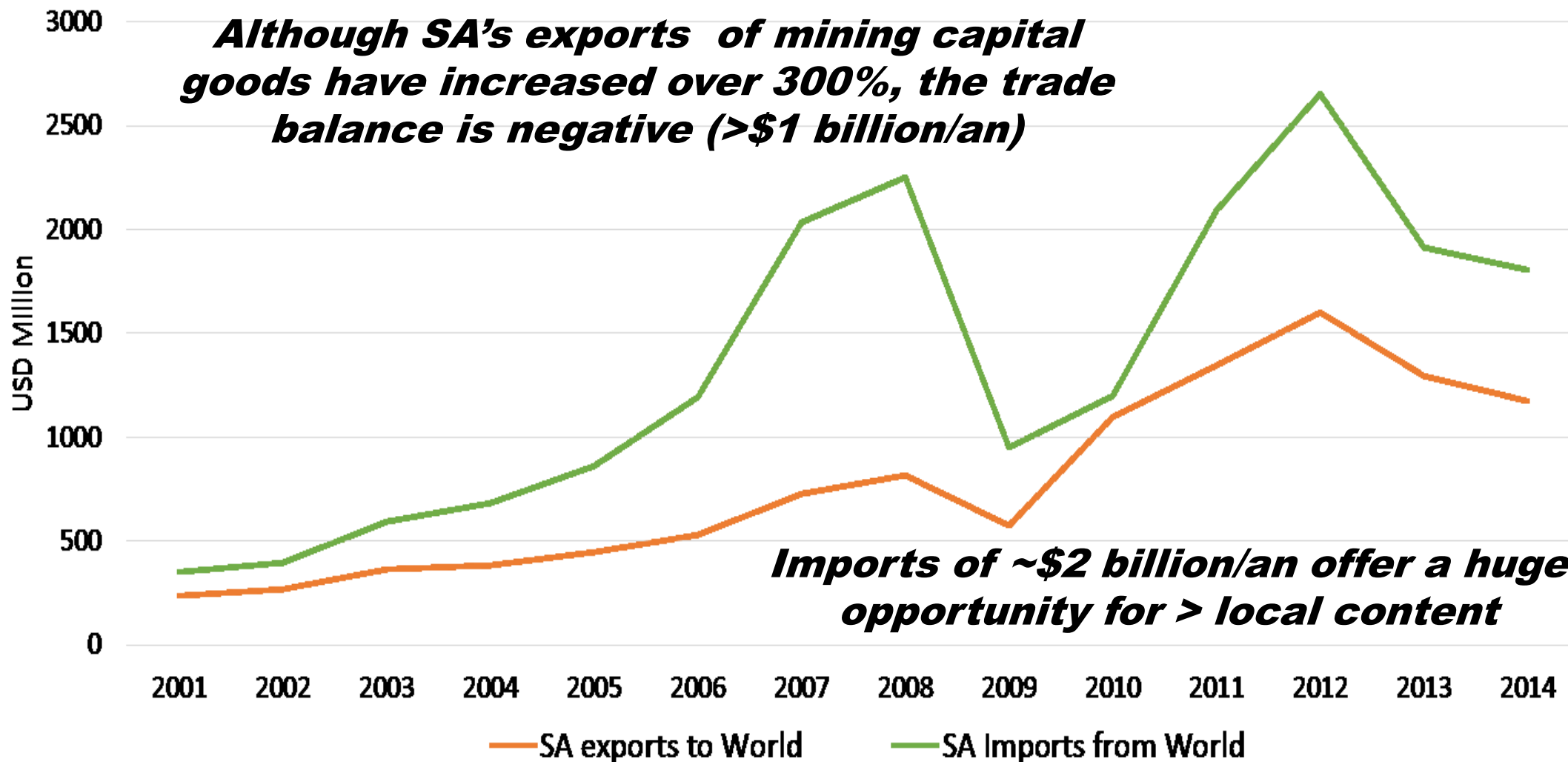
>60% of Mineral Reserves are currently uneconomic, at today's prices and costs, using conventional mining methods, resulting in sales, closures, capital curtailment & impairments.

PLUS, significant H&S improvement, multipliers, lateral migration, et al



SA Mining Capital Goods Exports to & Imports from World

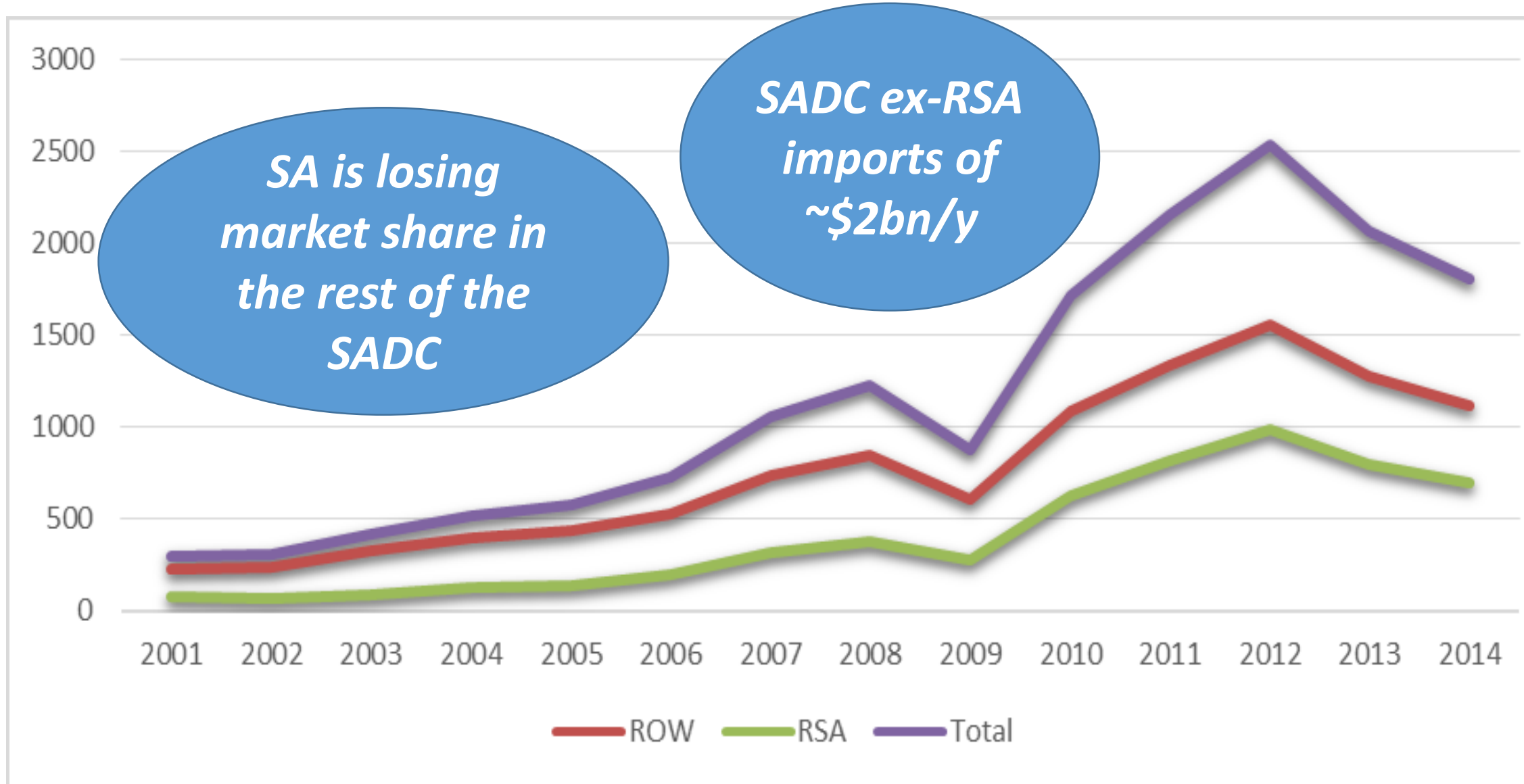
Although SA's exports of mining capital goods have increased over 300%, the trade balance is negative (>\$1 billion/an)



Imports of ~\$2 billion/an offer a huge opportunity for > local content

Data Source: ITC Trademap/Comtrade. Note: Data extracted using 6-digit HS codes and may therefore over-state values.

SADC (ex-RSA) imports of select mining inputs from RSA and ROW (US\$m)



Source: Derived from ITC Comtrade 2015

SADC Mines & Projects Pipeline... *many delayed due to slump*

• **2013 >700 SADC mines & projects:**

• **367 operating mines in:**

- South Africa (58%),
- Zimbabwe (14%),
- Zambia (7%) and
- DRC (7%).

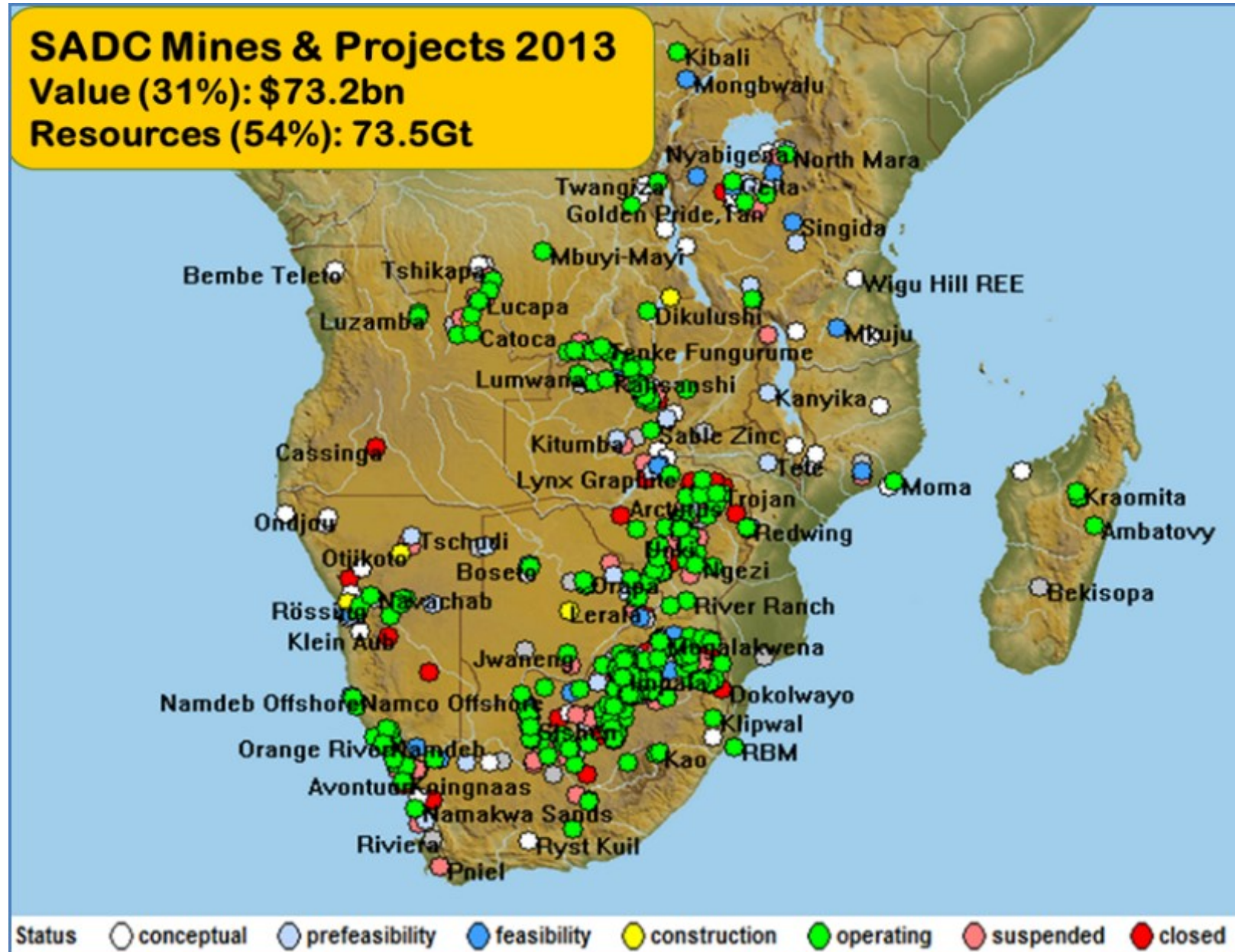
• **339 mineral development “projects”:**

- 194 conceptual projects,
- 48 at prefeasibility stage,
- 45 at feasibility stage,
- 14 under construction,
- 30 suspended projects with restart-up plans &
- 7 closed mines with plans to reopen..

SADC Mines & Projects 2013

Value (31%): \$73.2bn

Resources (54%): 73.5Gt



SADC Mining Inputs Market (backward linkages)

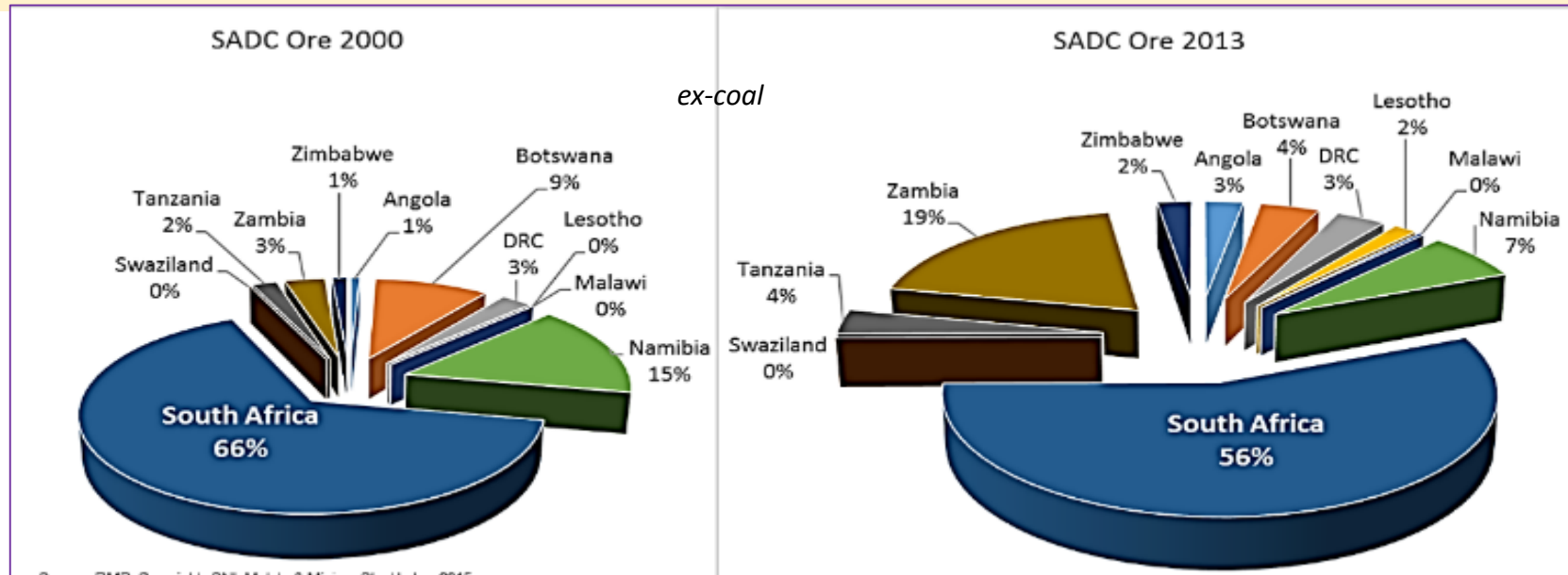
The SADC operating mines and projects provide a major opportunity (market) for the SADC mining and mineral processing inputs sector (imports of ~\$4bn/y).

Using tonnage of ore produced (ex-coal) as a proxy for inputs demand, the SADC offers double the EU mining inputs market (SADC >70% of Africa)!

Yet SADC mining capital goods are dominated by imports, particularly from the EU.

The backward mineral linkages are the most important to realise as they have numerous multipliers, lateral migration (into other sectors) and can outlive finite resources.

However, they are critically dependent on RDI capacity and high level STEM skills.



SA share in decline: Future market growth is in rest of SADC!

Key backward linkages interventions

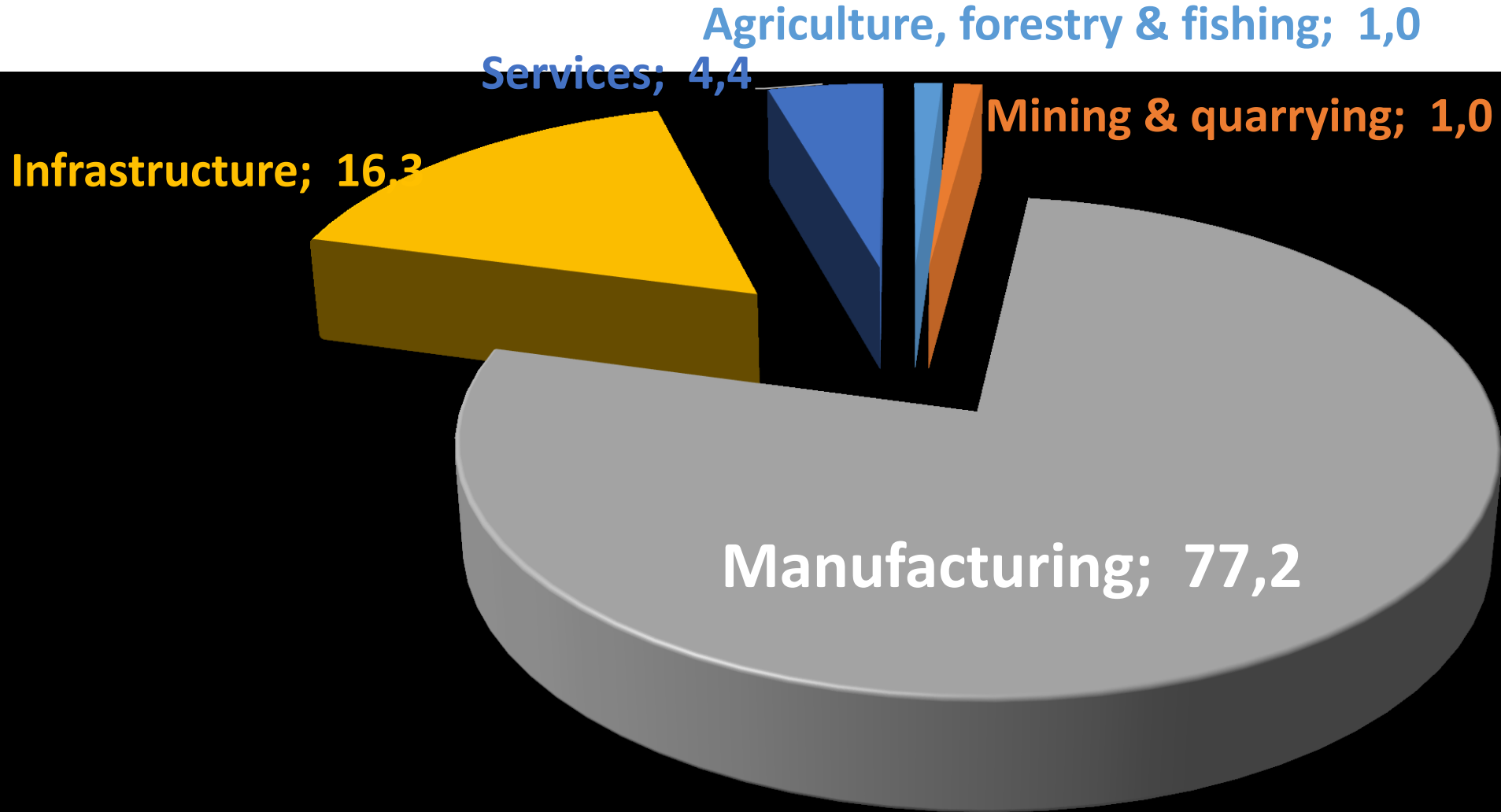
- 1) Mining Charter Procurement: Base on BEE local content & close “multinational supplier” & “BEE procurement fronting” loopholes;
- 2) Rebuild mining technology development capacity (<20% of 1994 – demise of COMRO and exit of Mining Houses). Mining Charter minimum corporate spend on HRD & RDI in SA; *Fix the STEM skills schooling pipeline*
- 3) Establish a PPP to handle the shift from mining jobs to supplier jobs (reskilling, redeployment): CoM, Unions, State;
- 4) Build strong SA mining/processing supplier industries clusters: MEMSA & SAMPEC (inputs industry, CoM & DTI);
- 6) Realise the SADC market (regional-local content and VCF);
- 7) Progress the Mining Phakisa outcomes;



Downstream/forward Linkages

Mining products as intermediate inputs

DISTRIBUTION OF MINING INTERMEDIATE OUTPUT INTO SECTORS OF THE SOUTH AFRICAN ECONOMY 2014



Key Mineral-Based Feedstocks for Domestic Development: “strategic mineral feedstocks”

Manufacturing	Steel/alloys, polymers (from coal, HCs), base metals
Energy (electricity):	Coal, natural gas (and CBM, shale gas), limestone
Infrastructure:	Steel, copper, cement (from limestone, gypsum, coal)
Agriculture:	NPK: Nitrogen (from coal, gas), phosphate, potassium, conditioners, et al.

Each of these key strategic feedstocks require national (& regional) development strategies to ensure that they are supplied to downstream industries at export parity prices

STRATEGIC REGIONAL MINERAL FEEDSTOCK VALUE CHAINS

UPSTREAM

MINING/MINERAL

STRATEGIC DOMESTIC FEEDSTOCKS

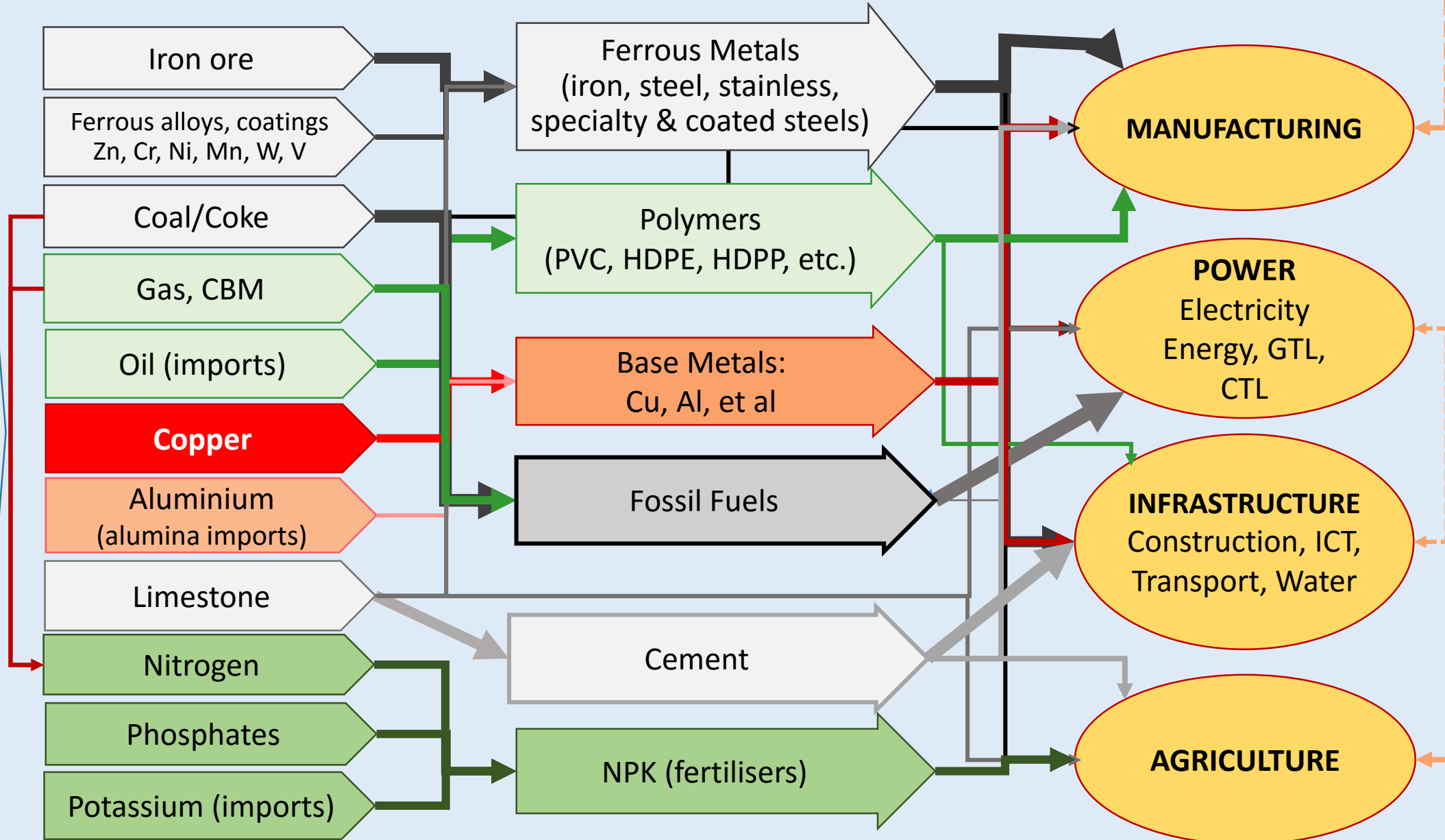
DOMESTIC CONSUMPTION

Mining & Mineral Processing Inputs

CAPITAL GOODS:
Machinery, plant, equipment, etc.

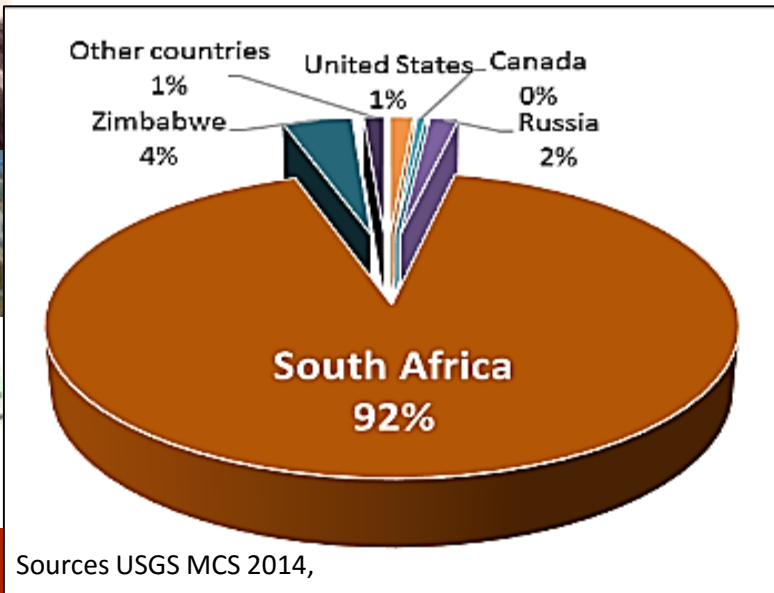
CONSUMABLES:
Explosives, drilling steel, parts, grinding media, chemicals, etc.

SERVICES:
Labour, analytical, financial, security, ICT, etc....

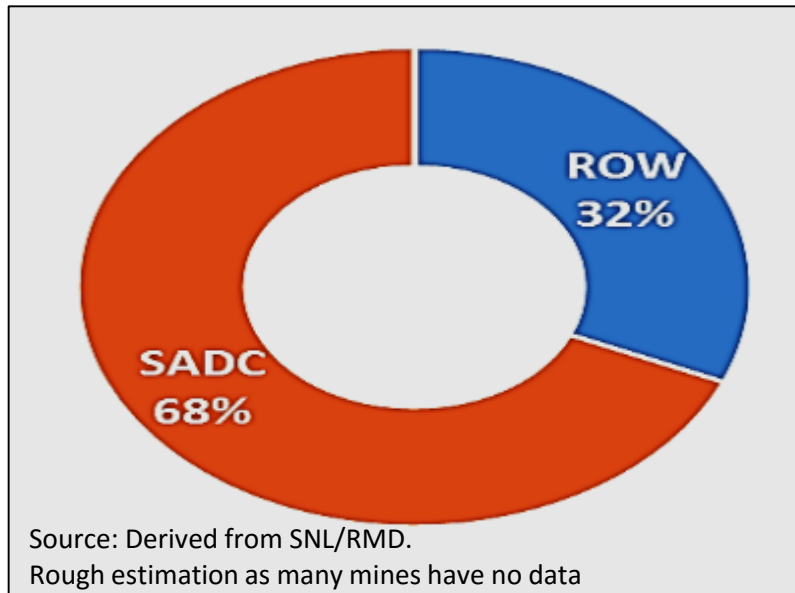


SADC Potential Producer Power (PGMs, Diamonds & Co)

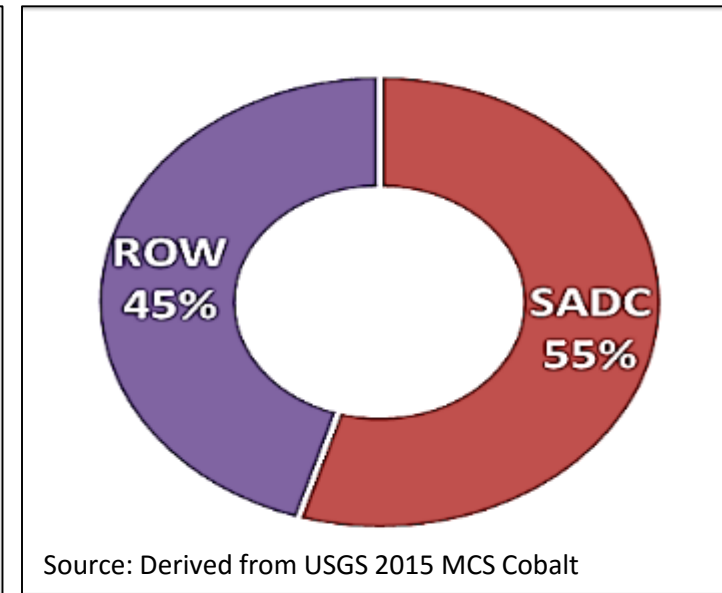
World PGM Reserves



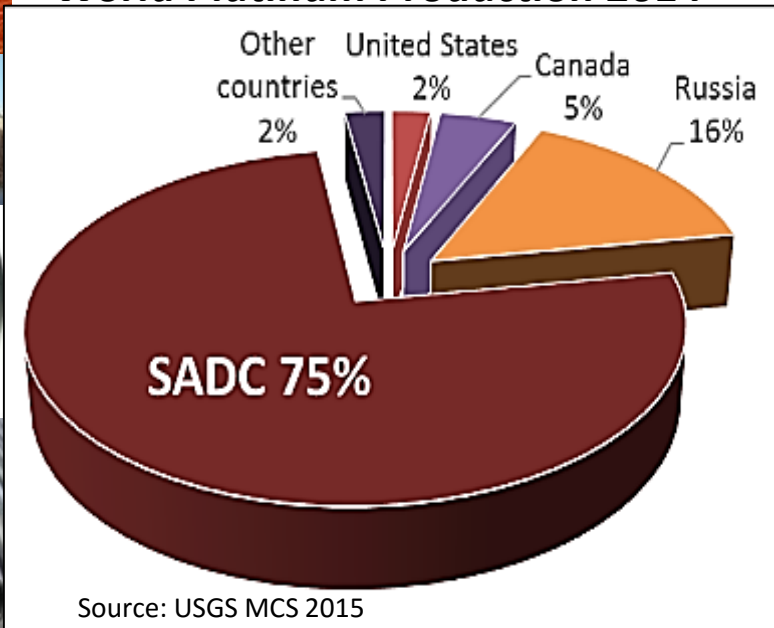
World Diamond Resources 2013



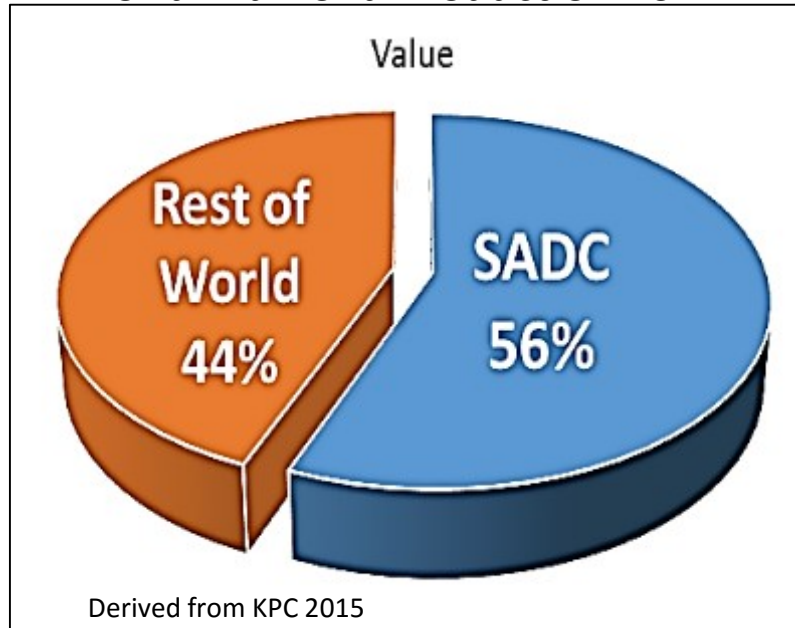
World Cobalt Reserves 2014



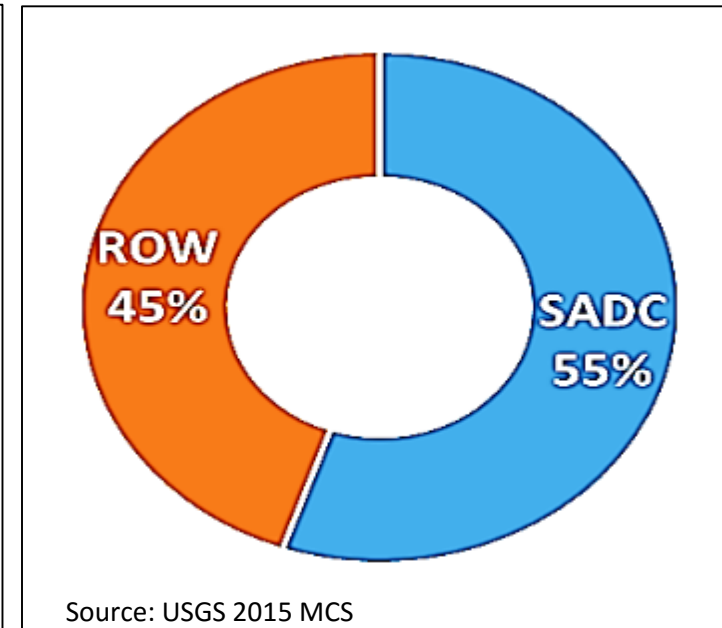
World Platinum Production 2014



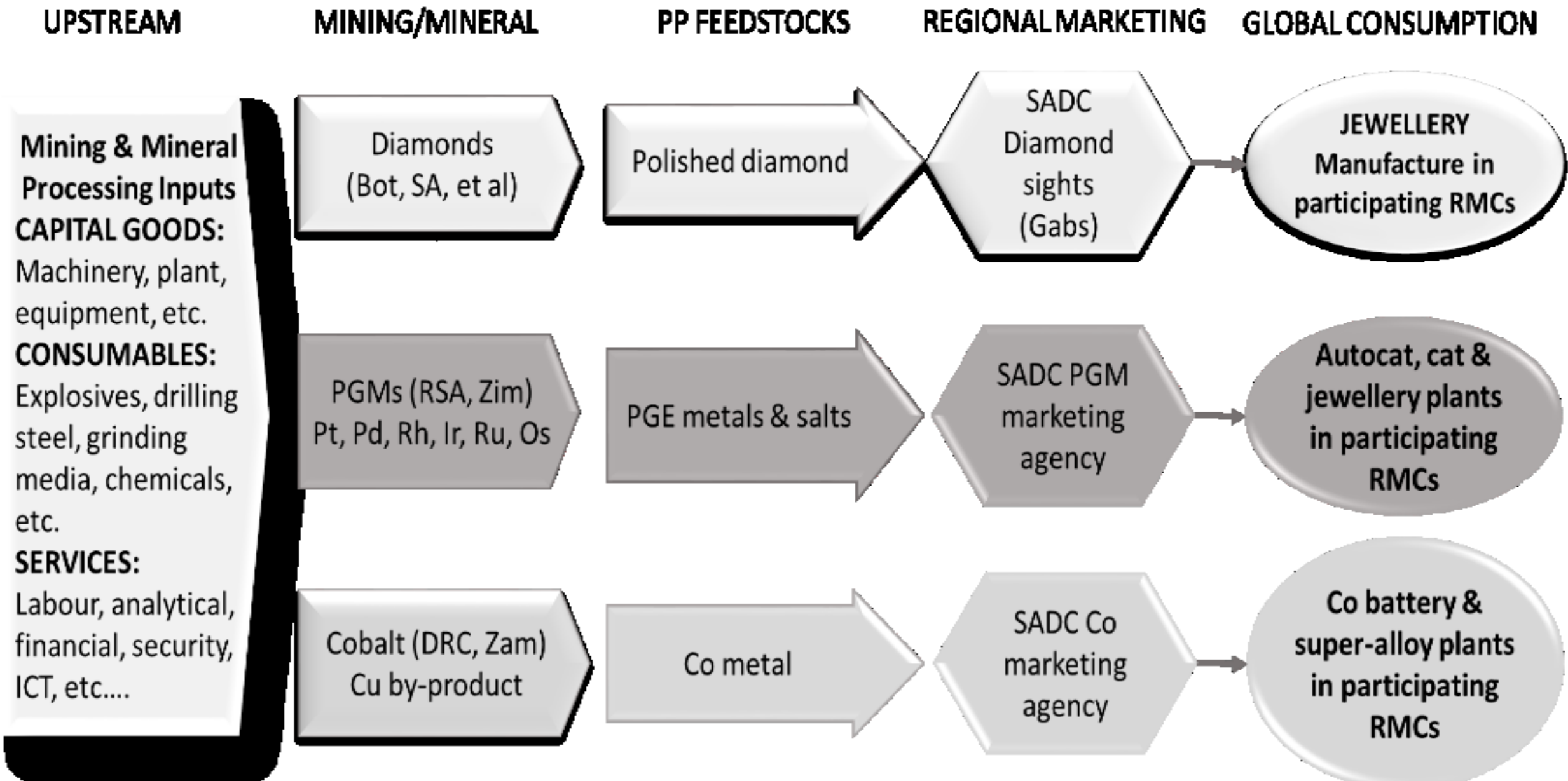
World Diamond Production 2014



World Cobalt Production 2014




SADC: Potential Producer Power MVCs (fabrication for export)



Conclusions: Downstream/forward mineral linkages

- 1) Need to identify *strategic mineral feedstocks* into domestic sectors (manufacturing, infra., agric.) & competitive domestic prices (EPP):
- 2) SA Steel Crisis (vdB Pk, Vereeniging, HS&V, et al): Need plan to make plants competitive (recap)– DTI/EDD Steel Task Team;
- 3) Establish dedicated beneficiation SEZs – ORTIA JMP, Springs PGM SEZ, Nqgura, R.Bay, S.Bay, et al;
- 4) Develop a regional (SADC) strategic feedstocks strategy, with equalisation mechanisms, to stimulate downstream manufacturing, infra. & agriculture;
- 5) Explore using (regional) potential producer power to stabilise prices and leverage downstream beneficiation;
- 6) Regional Long-term Power Strategies – SADC: low-cost & lower-carbon gas (Rovuma Basin gas, >150TCF, Congo Basin HEP >150GW);



Tackling the SADC “variable geometry” challenge,
to realise the mining linkages to kick-start
industrialisation and equitable G&D

*The “bambazonke” (industrial
polarisation) obstacle can’t be wished
away – Needs to be compensated with
“variable geometry instruments!”*

Regional Downstream Key Mineral-based Feedstocks Strategy?

The EU started with a limited agreement in 1950 (Shuman Plan) for coal (energy & petrochemicals) and steel only – European Coal and Steel Community (ECSC) – then moved to greater integration in 1959 (Rome).

The development of a similar SADC Ferrous and Fossil Fuels Feedstocks plan (4FP) could be assessed. Such a plan could support the realisation of the regional market for critical feedstocks (econ-of-scale- outer tariff) at competitive prices through planned investments facilitated by a dedicated investment vehicle (VCF – SAMVADA)



Schematic Regional MVCs "Triangle"



Scale economies intermediates/semis plants:

- Polymers/Chemicals
- Fertilisers
- Aluminium
- Steel (flats)
- (Power)



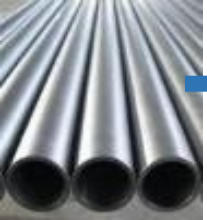
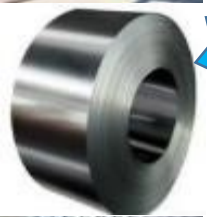
Extra-regional exports



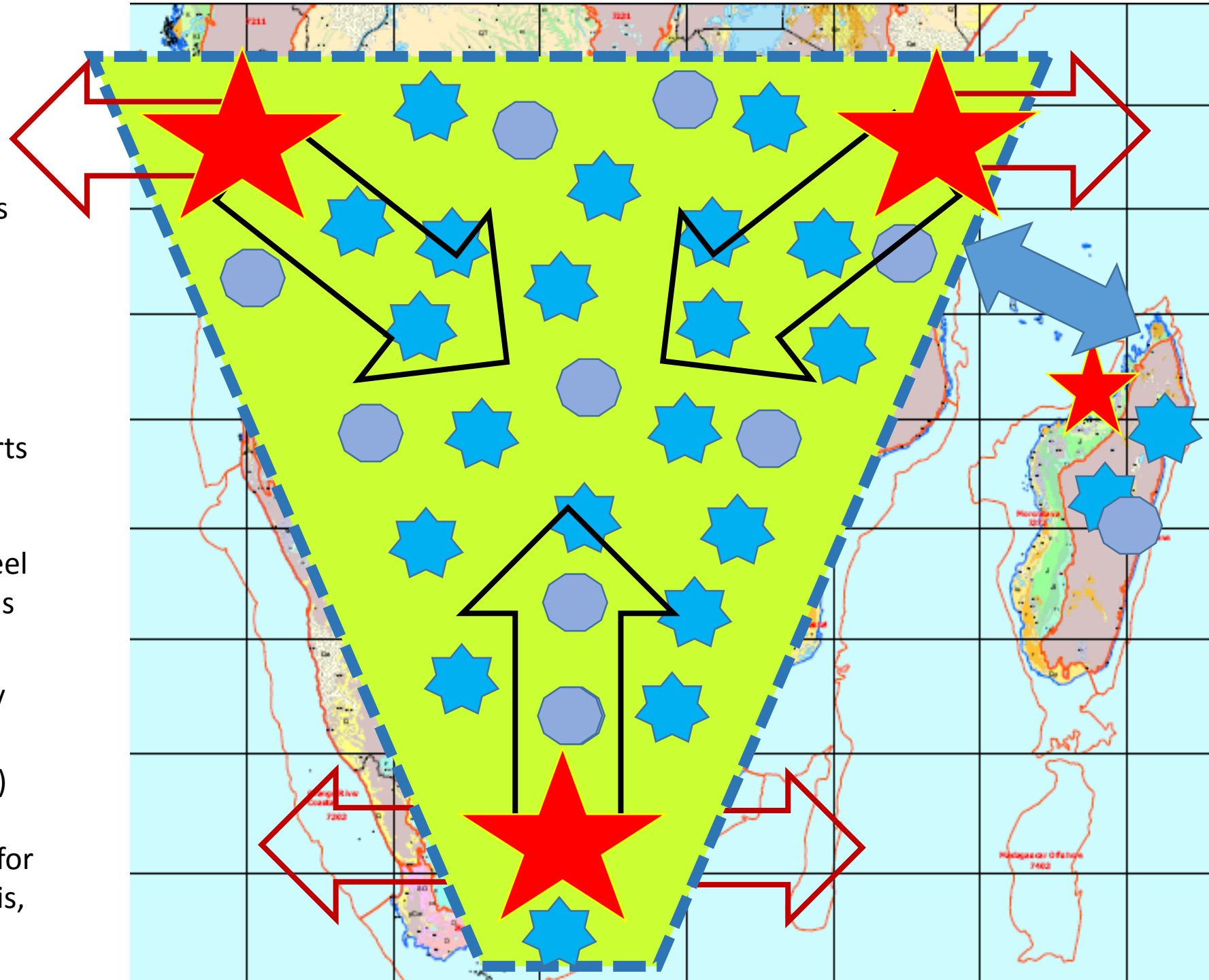
Dispersed secondary (scrap) plants (e.g. steel mini-mills, non-ferrous smelters)



Dispersed conversion/fabrication plants (plastics, profiles, etc.)



Outer tariff barrier for intermediates, semis, mining inputs



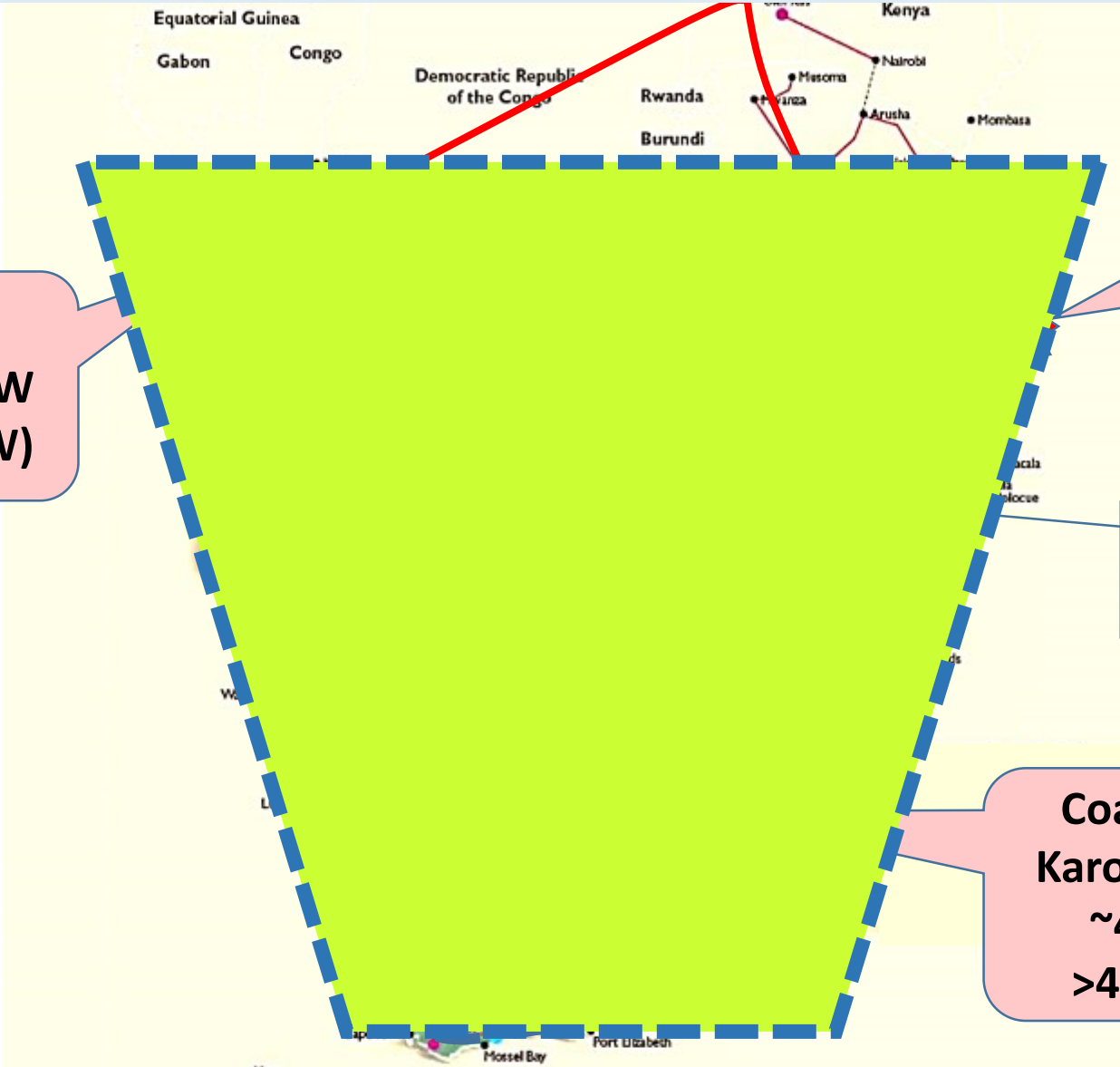
SADC Conceptual Base Power Generation Strategy (for lower tariffs & carbon emissions)



**Grand Inga 40GW
Congo Basin >150GW
(Gas ~10TCF = 10GW)**

**Rovuma Basin Gas
>150TCF (1TCF ~1GW
for 20y)**

**Coal: Kalahari and
Karoo Basins >100Gt
~40GW current
>40GW potential**



Possible East Coast
gas pipeline




- Key**
- Existing grid system
 - - - Possible future grid system
 - Future hydroelectric power station
 - Future thermal power station
 - Hydroelectric power station
 - Interconnection substation
 - Thermal power station
 - Future interconnection substation
 - Nuclear power station
 - Future gas station
 - Gas power station
 - Town

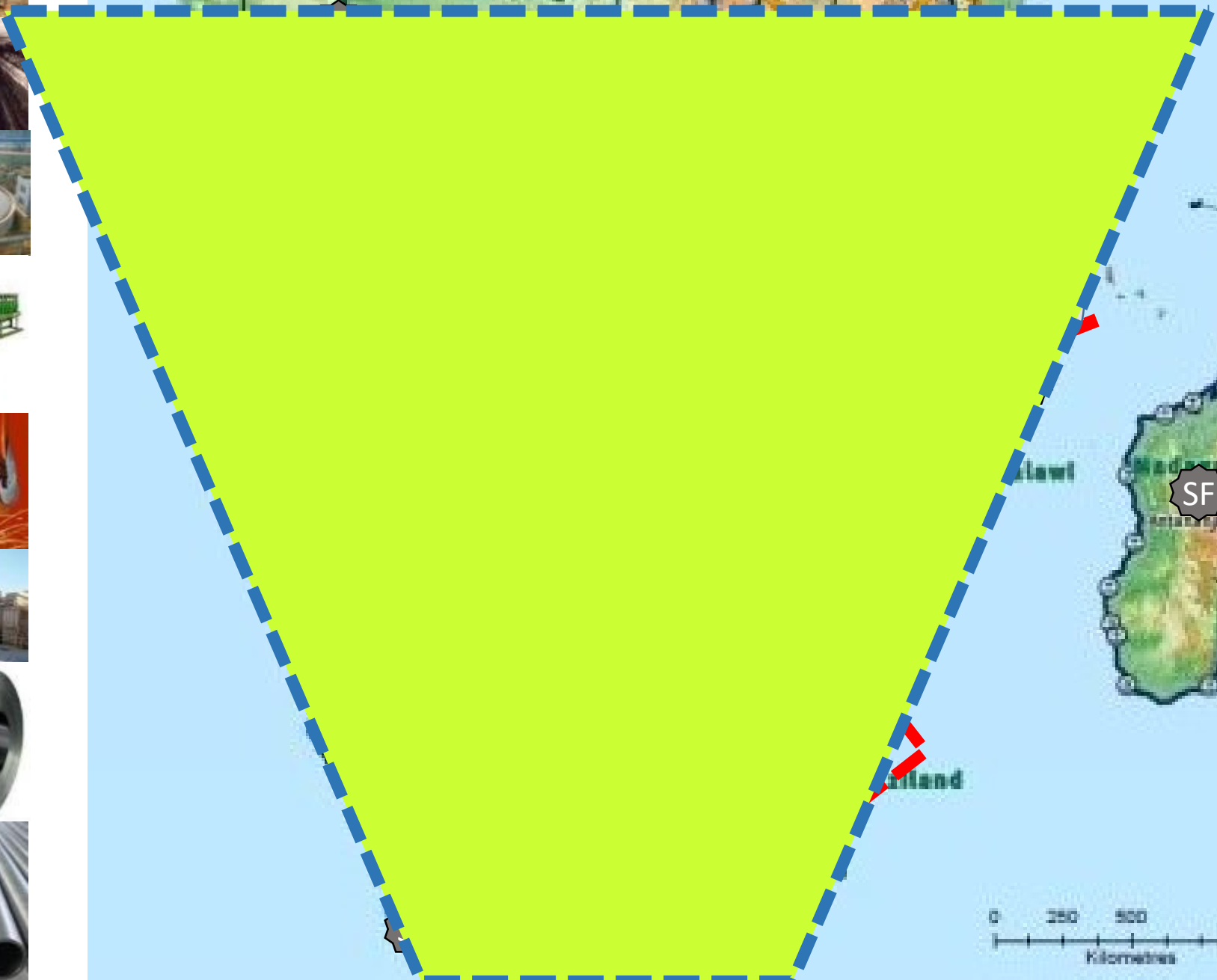
The map indicates the South African power network and interconnections with neighbouring countries.

SADC Al/Cu MVCs Strategy



SF

-  AI Smelter
-  AI Rolling Mill
-  Al/Cu Semis fabrication plants





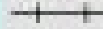

Seychelles

Malawi

Mauritius

Port Louis

Malawi






- ### SADC
-  Significant Port
 -  Other Port
 -  Railways
 -  Tripartite Transport Corridors (SADC, EAC and COMESA)

Conceptual SADC Steel Strategy



Conceptual SADC Fertiliser Strategy: Plants located on resources



-  Nitrogen
-  Phosphate
-  Potassium
-  Blending
-  Imports



K
P
N

P?

K?

K?

P?

P

P?

P?

P

P

N

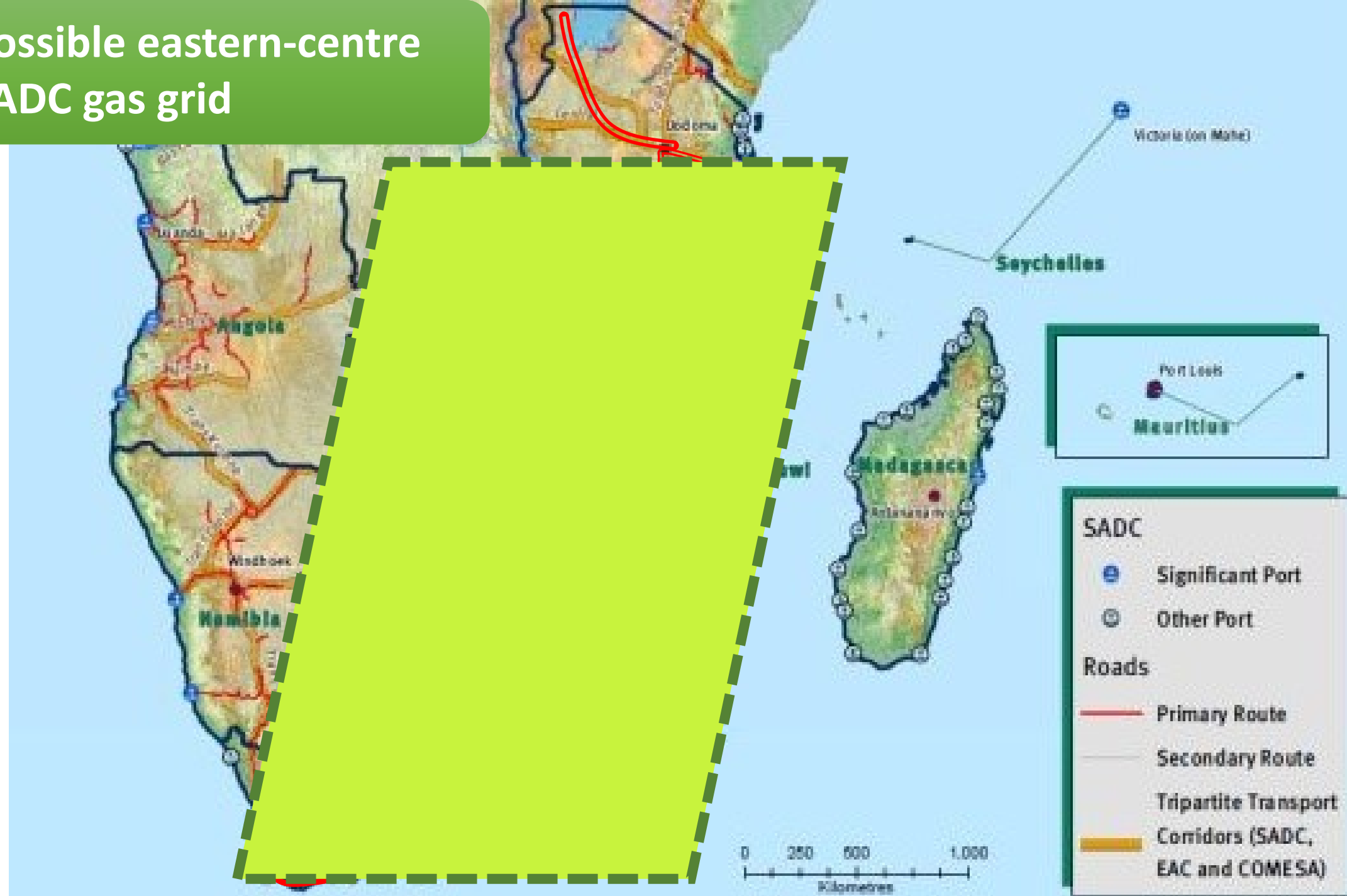
N

P

P

P?

Possible eastern-centre SADC gas grid



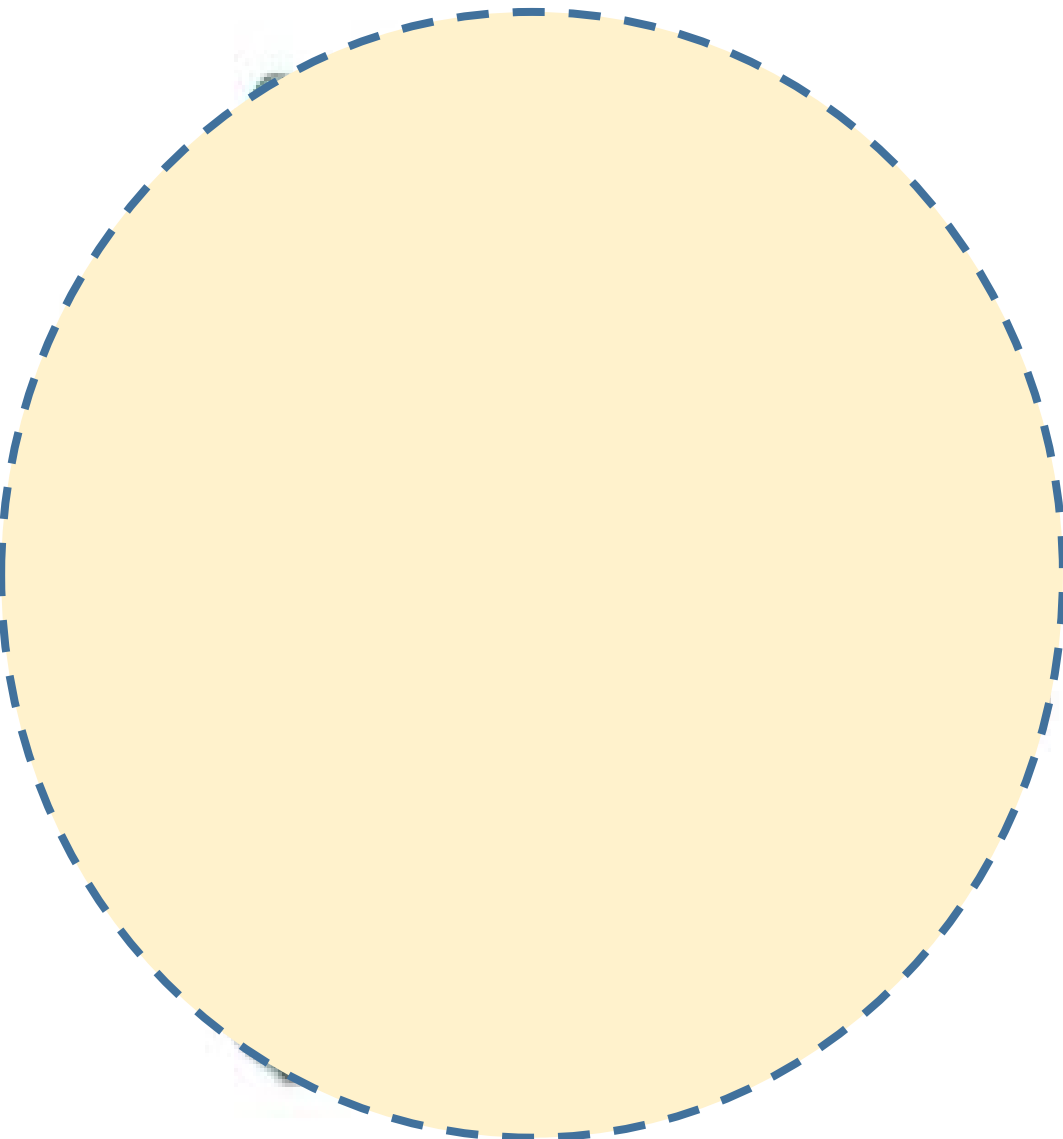


Strategies to Realise the Huge REGIONAL MVC Opportunities

*The whole is much greater than
the sum of the parts!*



1. Proposed Common Outer Tariff (mining inputs and key feedstocks)



Mining/processing Inputs (5-10%)

- Capital Goods
- Consumables
- Services

Key Regional Feedstocks (5-10%)

(intermediates & semis)

- Iron/steel & semis (& coke)
- Base metals (Cu, Al & semis)
- Fertiliser Minerals (NPK) & formulations
- Polymers
- Cement, et al

Infant Industry Protection

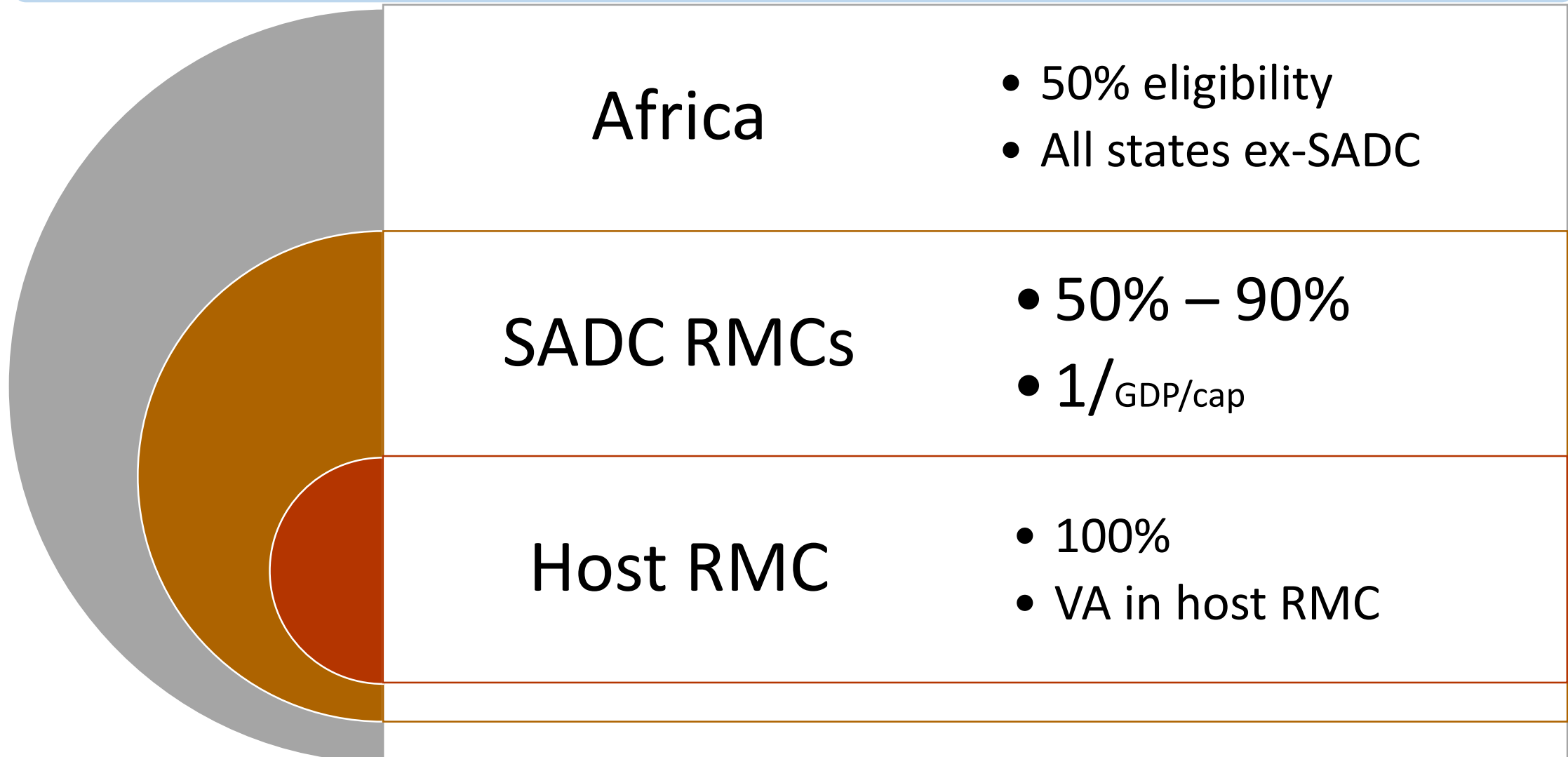
for RMCs below SADC avg GDP/capita

- Up to 10% for 7 years











Counter Bambazonke Strategies

- Regional-local content (1/GDP per capita)
- Regional Invest. VCF (1/GDP per capita)
- Regional Logistics Equalisation Scheme

2. Proposed Regional/Local Content (VA) Eligibility Weighting



Local/Regional content of 80% for services; 70% for consumables & 60% of capital goods would underpin the SADC inputs sector and dramatically reduce over-invoicing of costs

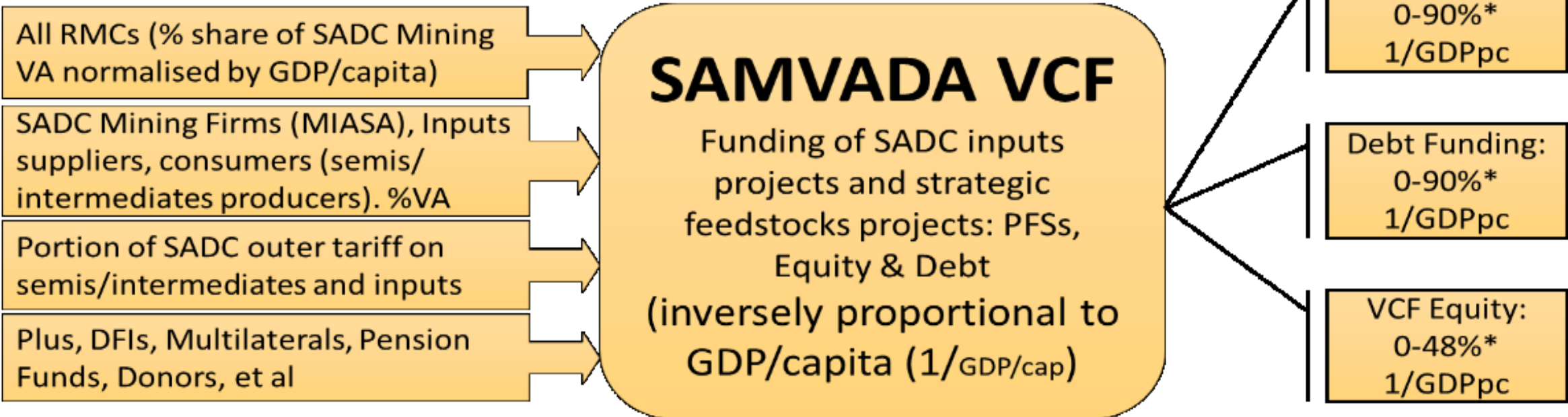
 RMC	GDP/cap	Relative Wealth 0-100%	Relative Wealth 0-75% (VCF)	Relative Wealth 0%-40%	Relative Wealth 50%-90% (inputs)
	(2013 kUS\$)				
 Angola	5783	40%	30%	16%	66%
 Botswana	7315	23%	18%	9%	59%
 DRC	484	97%	73%	39%	89%
 Lesotho	1126	90%	68%	36%	86%
 Madagascar	463	97%	73%	39%	89%
 Malawi	226	100%	75%	40%	90%
 Mauritius	9478	0%	0%	0%	50%
 Mozambique	605	96%	72%	38%	88%
 Namibia	5693	41%	31%	16%	66%
South Africa	6886	28%	21%	11%	61%
Swaziland	3034	70%	52%	28%	78%
Tanzania	913	93%	69%	37%	87%
Zambia	1845	83%	62%	33%	83%
Zimbabwe	953	92%	69%	37%	87%
Seychelles*	16186	0%	0%	0%	50%
*Note: Seychelles excluded from weighting: GDP/cap outlier and no mining or minerals VA sector					

3. Proposed Regional VCF for back- & forward linkages

Proposed Southern African Mining VA Development Agency (SAMVADA) PPP

Objective: Equitable Regional MVC Development (combat Bambazonke effect)

Capitalisation of SAMVADA

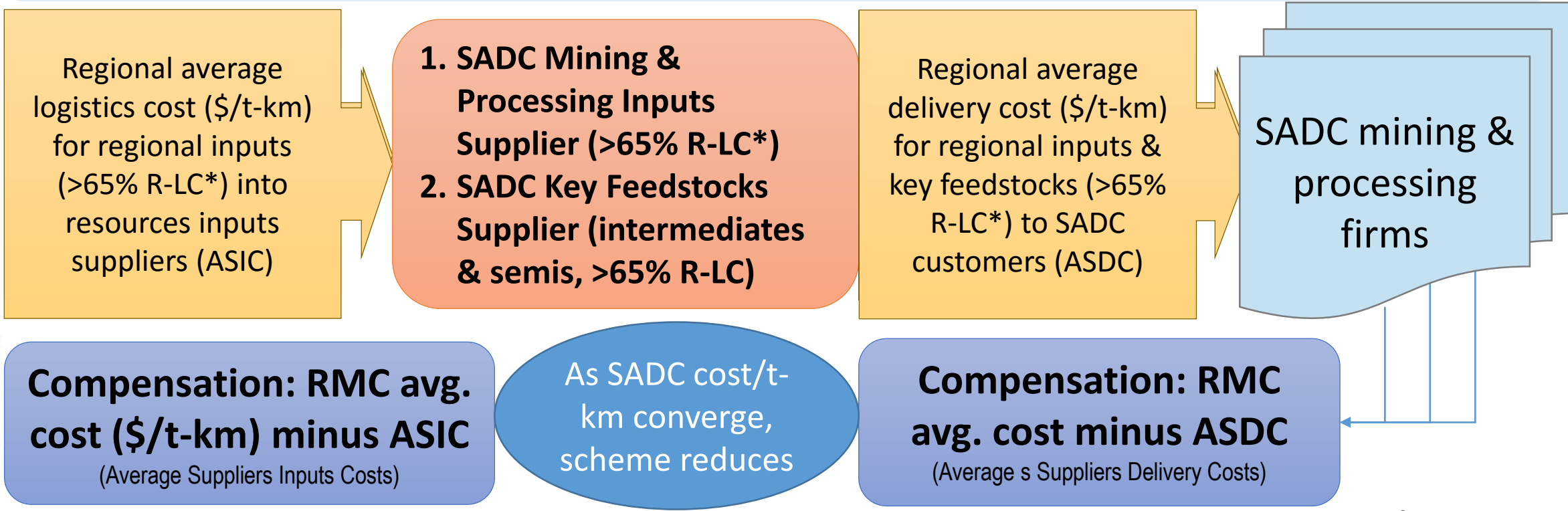


Debt at LIBOR plus; Equity return target $\geq 10\%$

* Enhanced 20% for >50% indigenous-owned projects

4. Proposed intra-SADC Mining Inputs/feedstocks Logistics Compensation Scheme?

- To compensate for RMC mining inputs suppliers logistics cost (inputs and delivery) and key feedstock suppliers intra-SADC logistics costs greater than regional average;
- To “level the playing field” for inputs producers and feedstocks consumers;
- To ameliorate the bambazonke effect.



*R-LC: Regional-Local Content

Funding: From Outer tariffs &/or mining inputs levy (<1%) in participating RMCs??

5 Regional Strategies: Regional Mining Inputs & Key Feedstocks

***To ameliorate
the variable
geometry of
RMCs, need
instruments
that favour
less developed
RMCs!***

1. Realise the regional market: outer tariffs & intra-SADC free trade

2. Regional-Local Content
R-LC credits at 50-90%, @ 1/GDPpc

3. REC Mining VA VCF
PFS, Debt & Equity @
1/GDPpc

4. REC Linkages
Logistics Equalisation
Logistics costs above
REC average

5.
Regional
STEM
skilling
strategy



Realise the regional feedstocks and market to grow the minerals linkages

Need a Regional Mining Vision (RMV)

Thank you

Paulj1952@gmail.com



Extra Slides

Capital Equipment: SA market share in SADC

	Average (2012-2014) US\$ Bn	SA %
Botswana	1.22	67%
Madagascar	0.41	7%
Malawi	0.41	26%
Mozambique	1.79	40%
Namibia	1.48	67%
Tanzania	2.07	10%
Zambia	2.56	39%
Zimbabwe	1.31	47%
Angola	0.26	6%
DRC	0.54	48%

....but losing out to competition (capital equipment)

Product cluster	Exports to Zambia		Market share	
	2014 (US\$ mn)	10 yr CAGR	2014	Change from 2004
Mineral processing equipment	45.7	11.7%	26.7%	-33.4%
Offroad special vehicles	104.5	12.9%	54.3%	-18.6%
Conveyor systems and others	8.2	20.5%	52.3%	-5.9%
Pumps and valves	79.2	13.8%	58.1%	-14.8%

Resource-based Industrialisation?

Equitable Growth and Development (G&D)

3 broad trajectories:

1. “Normal” Regimes

(Most of Europe & Developmental states- PRC, Japan, Malaysia, et al)

Mainly indigenous capital

Strong Linkages dev.:

- >Fiscal (often thru' equity)
- >>Downstream VA
- >>Upstream (inputs)
- >Knowledge (STEM, RDI)
- Spatial (infrastructure)

Indigenous Development

Inter-generational Equity (IGE)
High G&D (Growth & Development) and high industrialisation

2. Post-Colonial Regimes

(Most 3rd World states: ex-Euro-Imperial) WB “Free Mining” FIFA

Mainly FDI (tax havens)

Poor linkages dev.:

- << Fiscal take (leakage)
- << Downstream VA
- < Upstream (inputs)
- << Knowledge (STEM, RDI)
- Poor Spatial (infrastructure)

Low Indigenous Development

Inter-generational Inequity
Low G&D, low skills/RDI and negligible industrialisation
Cycle of poverty

3. Conquistador Regimes

(Euro-Settler Colonies: US, Oz, Canada, L.America, etc) FIFA

Settler Capital & FDI

Mixed linkages dev.: (> for *invasions from N.Europe*)

- ~<Fiscal and <SMCs (ideological)
- ~Downstream VA
- >Upstream (inputs)
- >>Knowledge– imports/settlers
- >Spatial (infrastructure)

Indigenous wipe-out

Inter-generational Settler Equity
(indigenous marginalisation & extermination)
Med-high G&D and indust.

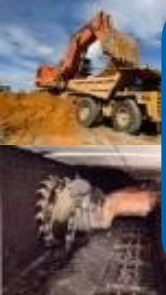
African States broadly are on the #2,
 Post-Colonial (net dis-savings), trajectory

*Need to move to trajectory #1 –
 “Normal” Mineral Regimes*

**WE MUST ALIGN OUR MINERAL
 REGIMES TO OPTIMISE TO
 REALISATION OF THE SEMINAL
 LINKAGES**

1. “
 (Mo
 sta

nes
 da,

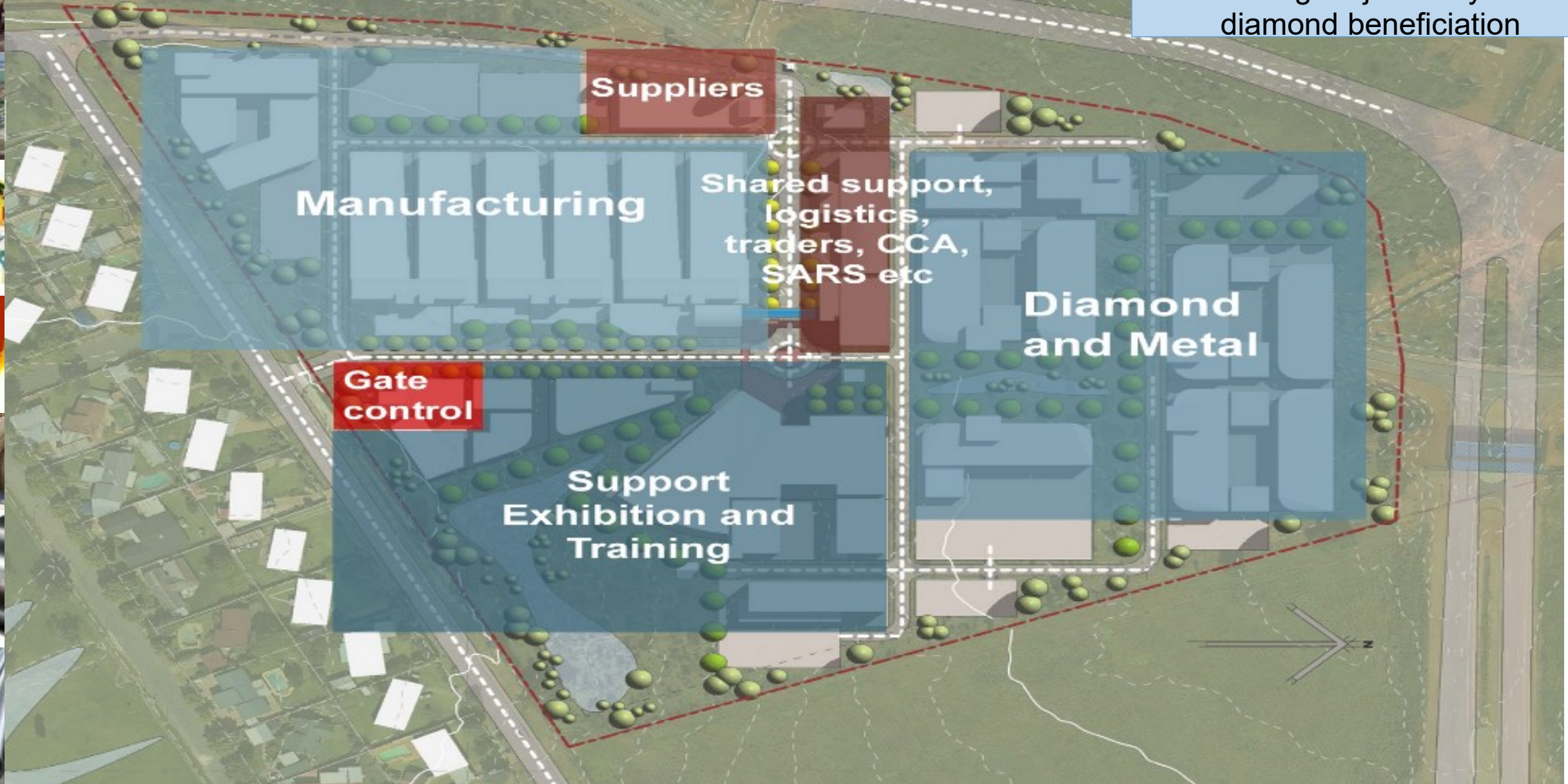


Inter-generational
 High G&D
 Development) and
 industrialisation

Equity
 Realisation &
 (Information)
 High G&D and indust.

GDDA: ORTIA IDZ

A mixed used Light Manufacturing Precinct with 30 295m² of infrastructure space focusing on jewellery and diamond beneficiation



GGDA ORTIA IDZ: Phase I -JMP

Details	Key Stakeholders	Aspects identified for collaboration / support	Status	Follow up / additional comments
<p>This is Phase 1 of the Gauteng IDZ Programme located at OR Tambo International Airport. The project is a green field development, with bulk infrastructure construction currently underway and a skills development project also already underway over the last three years</p>	<p>Gauteng IDZ; EMM's Economic Development Department; EMM's Planning Department and the dti's SEZ Unit</p>	<ul style="list-style-type: none"> • Approvals of Wayleaves • Finalisation of services agreement • Assistance in conducting land audit for pieces of land identified for the IDZ. • Stakeholder Engagement with the Bonaero Park community • Investment promotion of the IDZ/ Aerotropolis 	<ul style="list-style-type: none"> • Overall bulk infrastructure development plan is on track; Site handover scheduled March 2017 • Wayleaves and services agreement needs to be finalised before June 2016 • Political intervention required for Bonaero Park community • Collaborative meetings with potential stakeholders being facilitated 	<ul style="list-style-type: none"> • The development plan is scheduled to start with storm water excavation on Bonaero Drive during the third week of March 2016. This cannot be done without approvals of wayleaves. • Notifications were issued to the Bonaero Park community regarding the commencement of upgrading the Bonaero Drive, there is some resistance from the community regarding the GIDZ using the Bonaero drive as the entrance to the Precinct. <p>The above issues might delay completion of bulk infrastructure for the JMP</p>