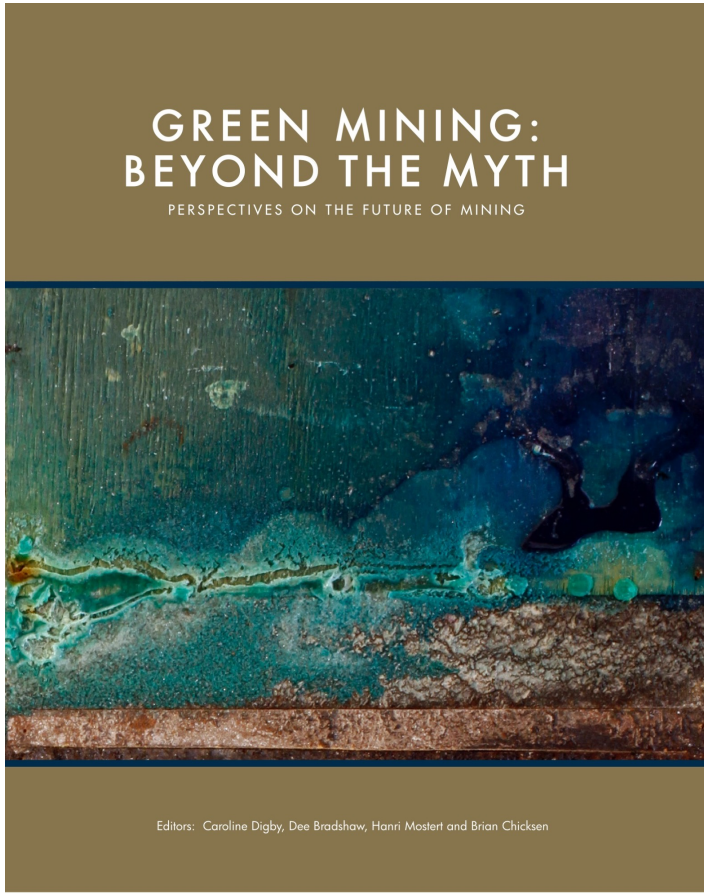
Post-Mining Transformation through the Fibrous Plant Economy

Economic Succession Planning on South African Mines

Prof Michael Solomon
Towards Resilient Futures Workshop
Monday 28 May 2018

UCT's Green Mining Imperative

The MineCare Imperative is completely located within the UCT focus on Green Mining…



minerals to metals

MINERAL LAW IN AFRICA

minerals to metals

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FUTURE WATER

Mineral Law in Africa (MLiA)

Source: World Economic Forum

World Economic Forum Mining & Metals Industry Partnership' in collaboration with Accenture, Feb 2014

The MineCare Concept

MineCare seeks to change the narrative from Mine Closure to Economic Succession Planning on Mines

- Economic Succession Planning for Mines incorporates
  - Diversification of Land, Infrastructure and Water
  - Leveraging balance sheet and institutional capacity for linked commercial investments
  - Providing for alternative employment during the currency of mining operations that will substitute for the loss of mining jobs on mine downscaling
- Operationalising the SDGs around mining activity
- Providing for sustainable benefit to mining dependent communities
  - Local mine community
  - Remote labour sending areas
  - Secondary and tertiary indirect employment
- Innovative models for land transformation compliant with:
  - NDP, IPAP and APAP
  - Mining and Agricultural Phakisa principles

The MineCare Imperative

The MineCare, which is directed towards changing the narrative from 'Mine Closure Planning' to 'Economic Succession Planning' for mining properties

- The imperative is highly pragmatic and provides a sound business case for mining companies to implement the programme;
- In essence it seeks to provide an economic business case to change the mindset of mining companies from being 'diggers of holes in the ground' to highly competent and efficient managers of natural resources;
- The concept relies on the economic catalysis of the mining of non-renewable resources to provide the balance sheet and enabling environment for the development of sustainable economies centred around food production;
- MineCare is specifically geared towards leveraging the land, water, infrastructure and balance sheets of mining companies to timeously create economic activity and employment that will succeed and substitute that of mining as mines deplete their resources and downscale towards closure.

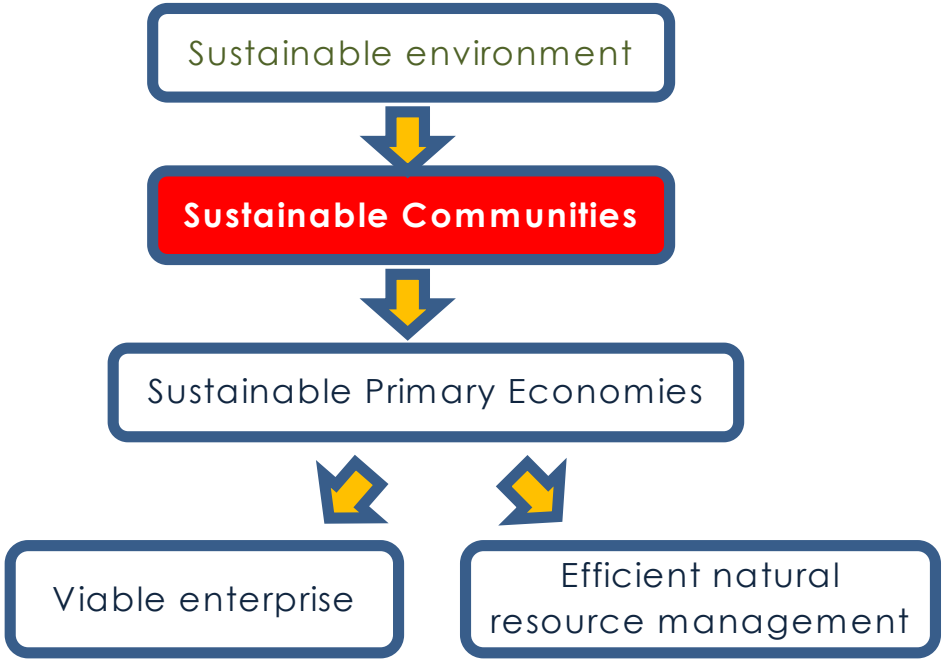
Economic succession planning on mines

Mining companies need to see themselves through the lens of being natural resource economic management specialists as opposed to being pure diggers of holes on the ground

By nature, successful mining companies have critically important characteristics:

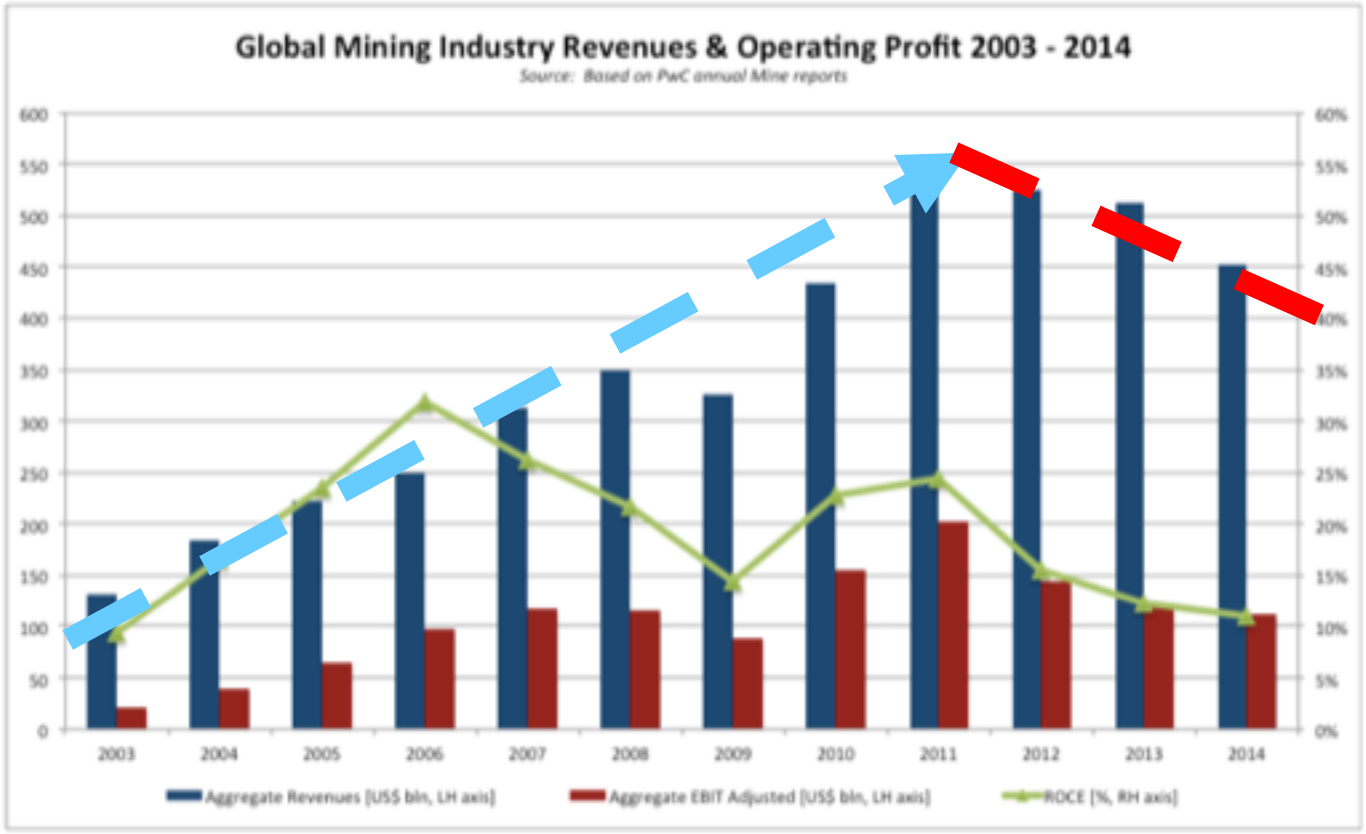
- Long-term, well-structured planning horizons;
- Long gestation periods and lead times to production and cash flow generation;
- Large capex requirements
- Appetite for risk with the innate ability to manage diverse elements of risk:
  - Environmental
  - Political - Government
  - Political - Community
  - Economic
- Solid management teams and project management capabilities;
- Strong balance sheets; and
- The propensity and ability to catalyse extensive economic multipliers

Hierarchy of sustainability

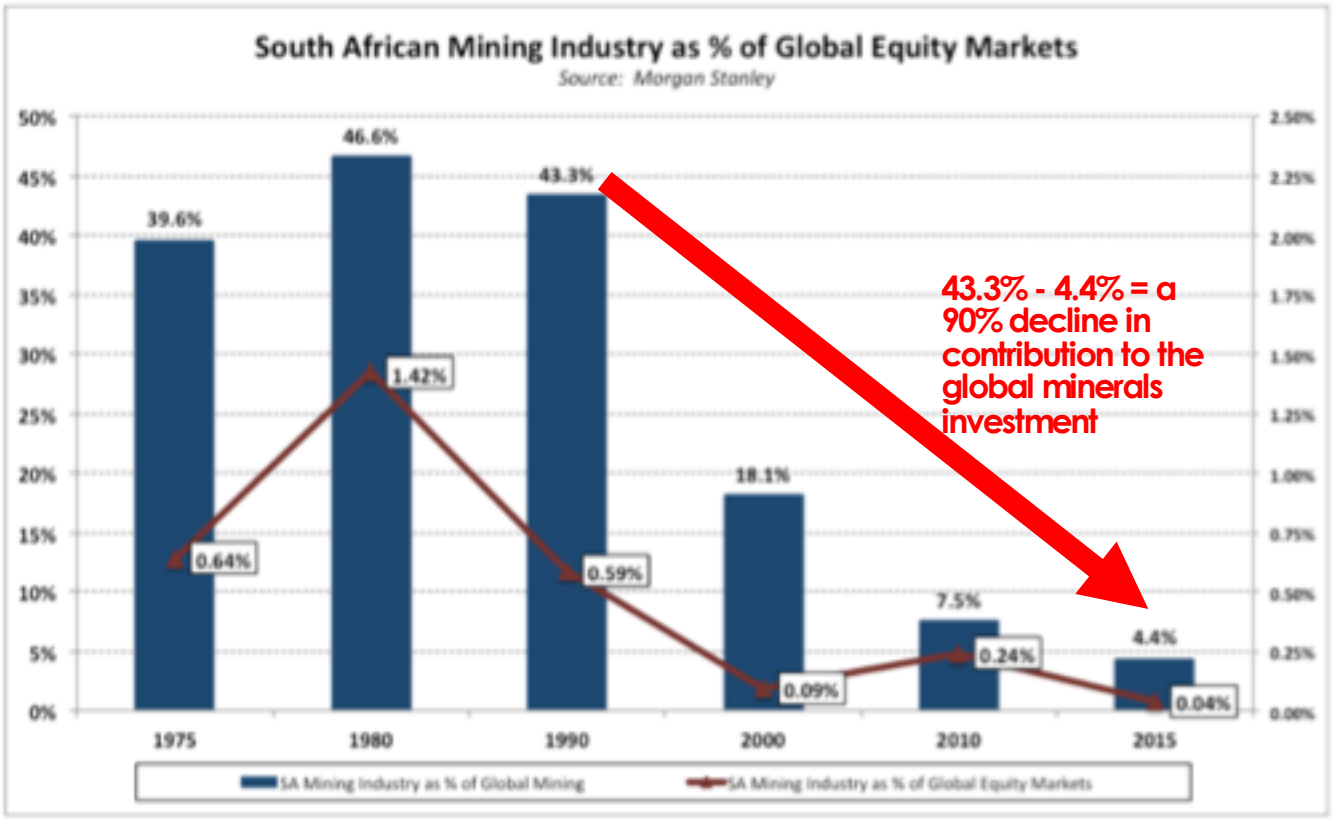


The Economic Context…..

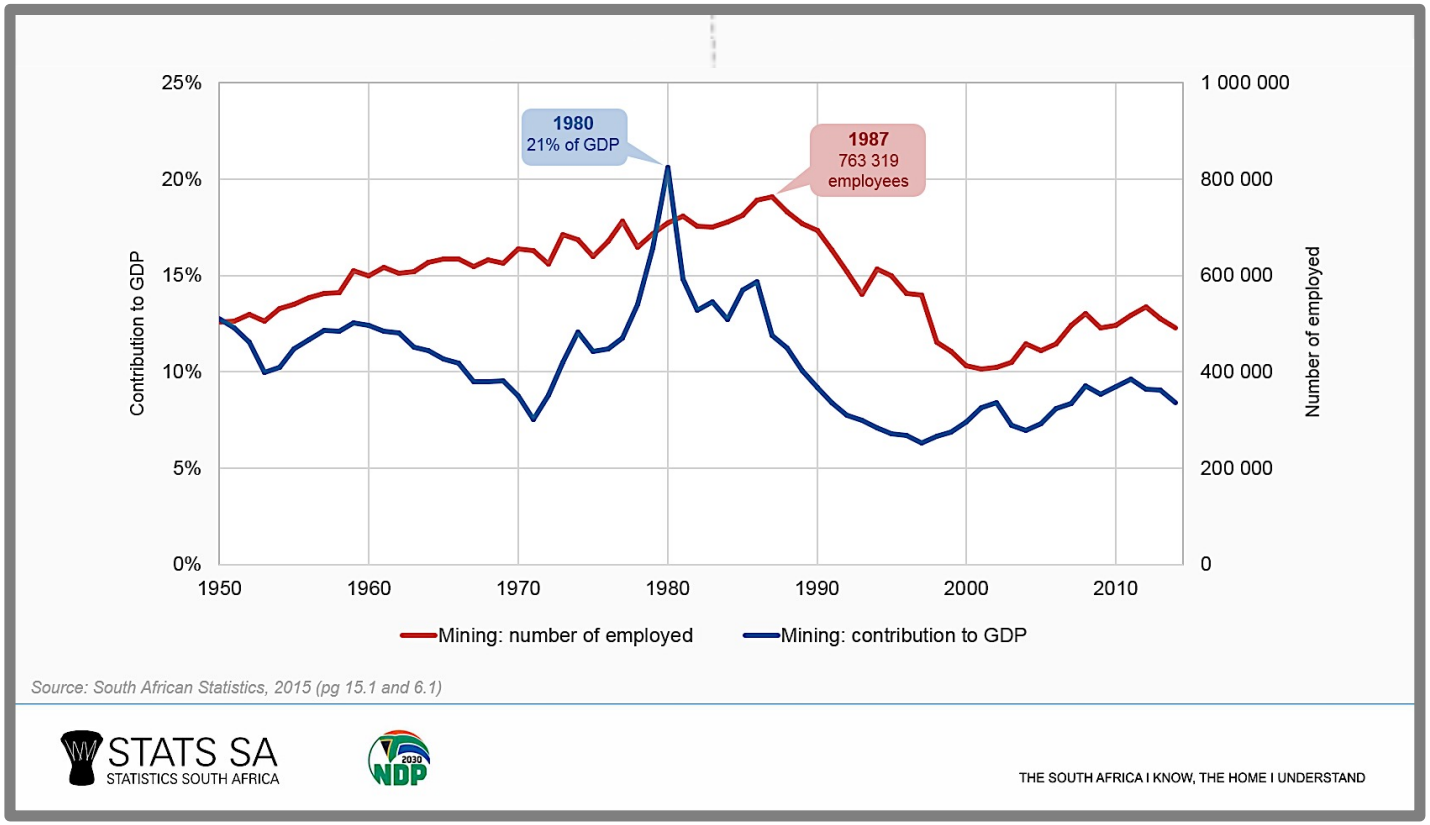
Global Industry capital costs are rising and profits are declining…..



….but more seriously, South Africa's mining industry as an investment venue has declined dramatically…

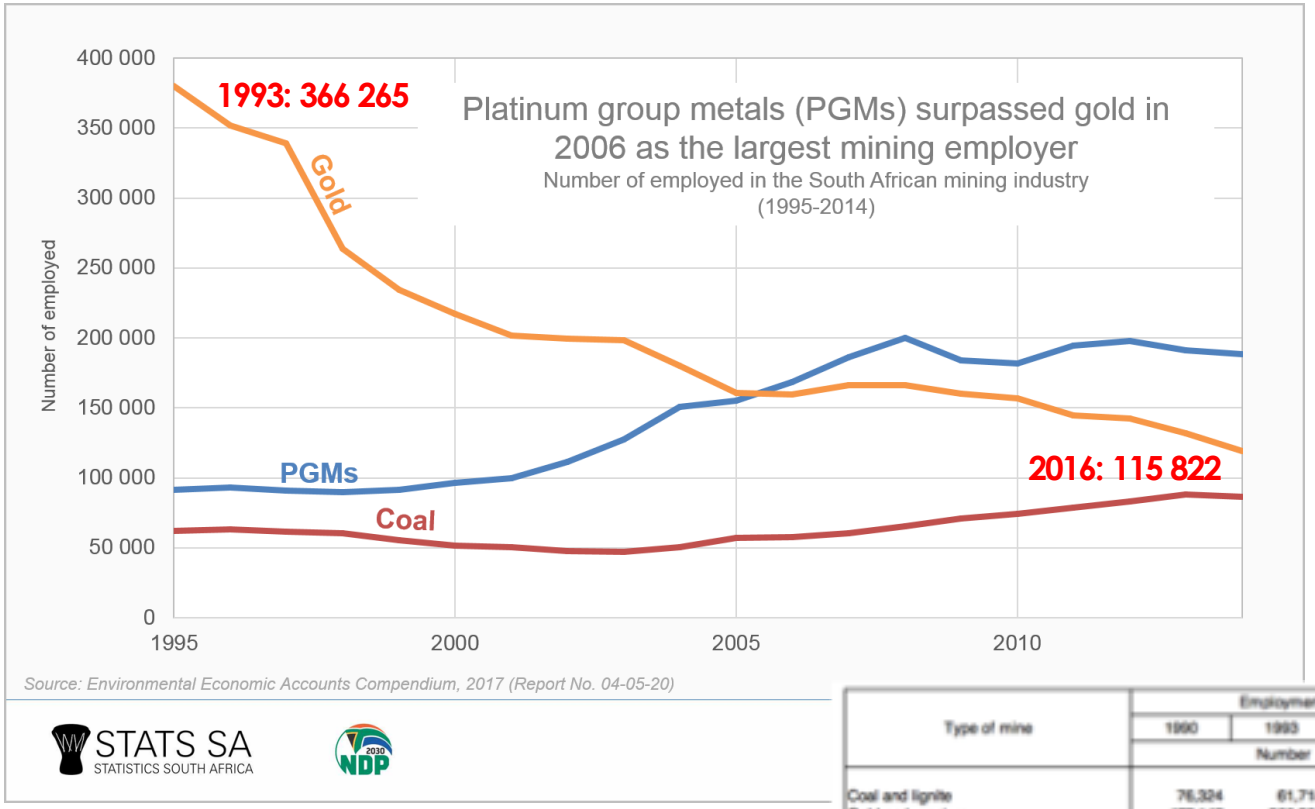


This decline has hit the country, and more importantly its people, hard



….where have all the miners gone….long time passing….

1990: 477 147



Type of mine	Employment		
	1990	1993	1996
	Number		
Coal and lignite	76,324	61,718	62,956
Gold and uranium	477,147	366,264	345,797
Chrome	8,383	4,575	6,291
Dimension stone	3,483	2,226	3,990
Limestone and lime works	2,874	2,810	3,255
Stone crushing	6,047	4,422	4,972
Other stone, clay and sand	2,205	3,375	3,862
Salt, other chemicals and fertilizers	4,496	3,245	2,915
Other mines	95,461	91,201	129,215
All mines	676,380	539,836	563,253

minerals to metals

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Mineral Law in Africa (MLiA)

The Platinum sector is in crisis….

ARMSCOR

GATEWAY TO DEFENCE SOLUTIONS

BUSINESS REPORT

SOUTH AFRICA'S NATIONAL FINANCIAL DAILY

BORDERS OF ETHICS
Why some organisations don't appear to learn from crises

ALEXANDER FORBES APPOINTMENT
Nonkululeko Nyembezi becomes first woman to chair financial services group

7 000 to go at Sibanye mines

Jobs to be shed at Cooke

COMPANIES & MARKETS

Sibanye pulls plug on mines

Miner will spend R900m in laying off 7,000 workers

FINALLY CUTTING COOKE OUT

FOOTNOTES

INITIAL PUBLIC OFFERING

NUM to march against Sibanye retrenchments

SOUTH AFRICA Monday 6 November 2017 - 12:18pm

File: Sibanye-Stillwater sent retrenchment termination letters to more than 2,000 workers at its Cooke 1 to 3 operations near Randfontein. Photo: Official Sibanye-Stillwater corporate website

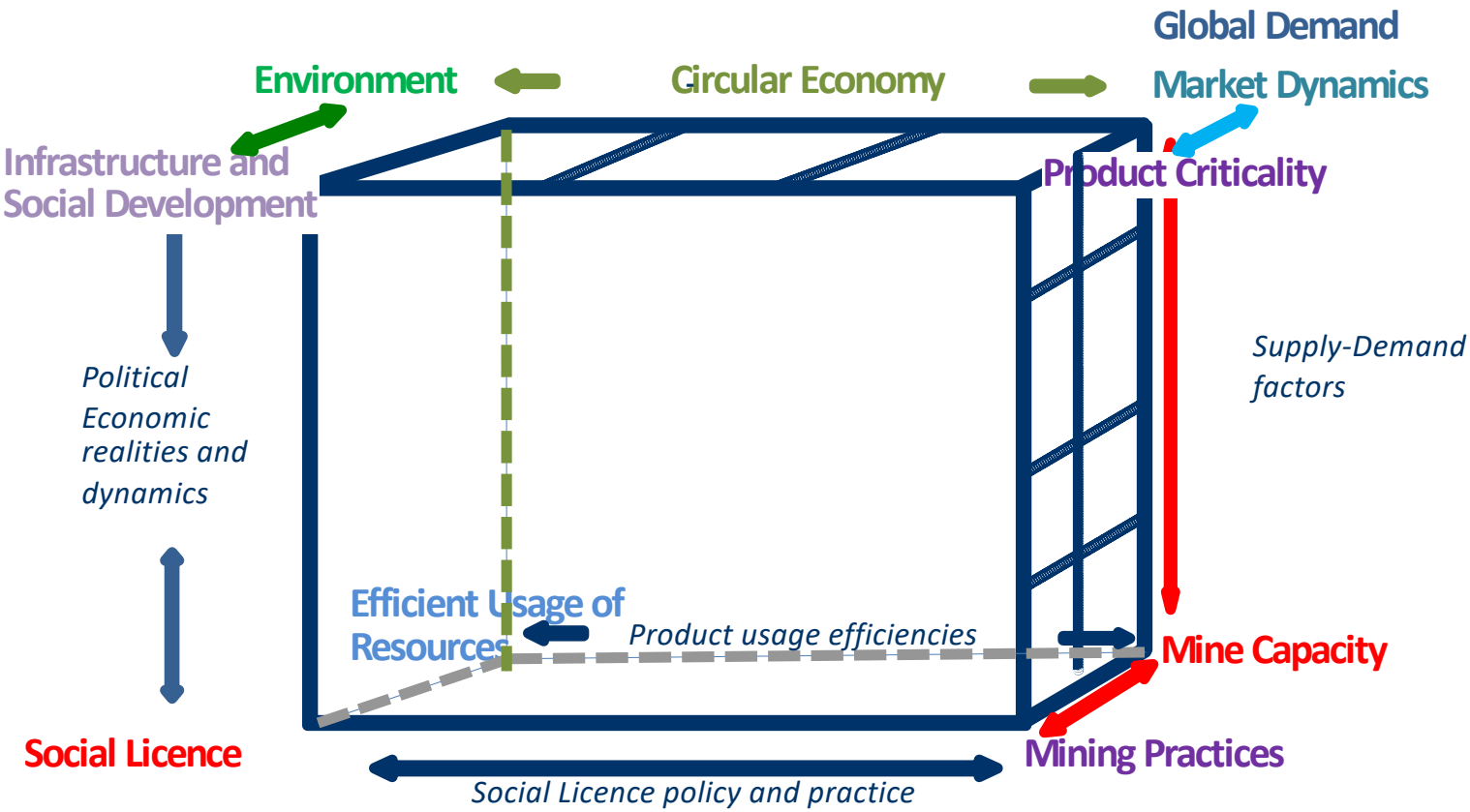
Retrenchment bloodbath as Sibanye Gold aims to chop 7400 jobs

CAPE TOWN - The retrenchment bloodbath continued after Sibanye Gold said yesterday that 7400 jobs were on the line as it planned to restructure its loss making Beatrix West and Cooke operations.

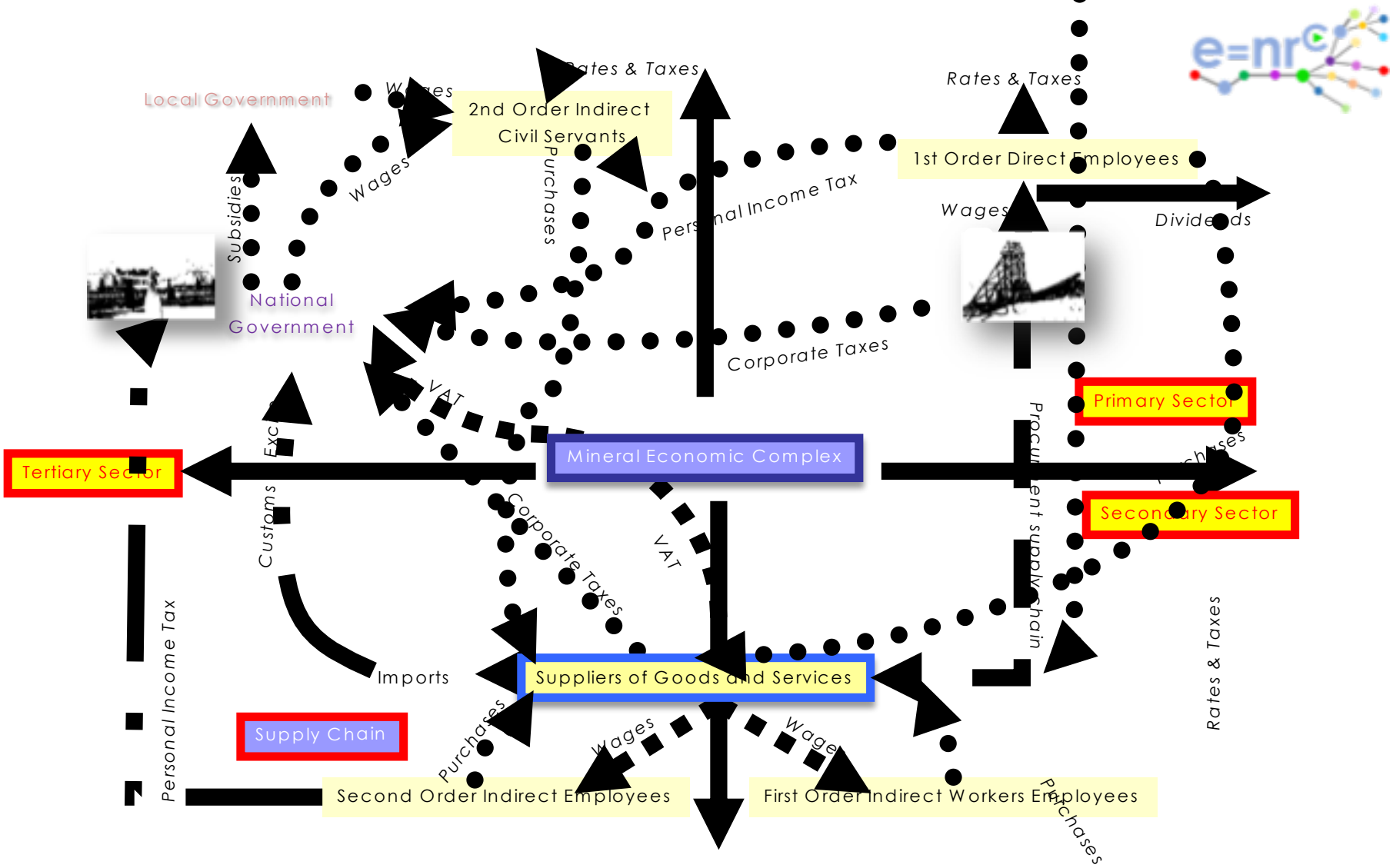
The retrenchments at Sibanye, South Africa's biggest gold producer, follow similar plans by AngloGold Ashanti, the world's third biggest gold producer, which said last month 8500 jobs would be lost as it considered placing some of its ageing domestic operations on care and maintenance.

Understanding the economic complexity of mining….

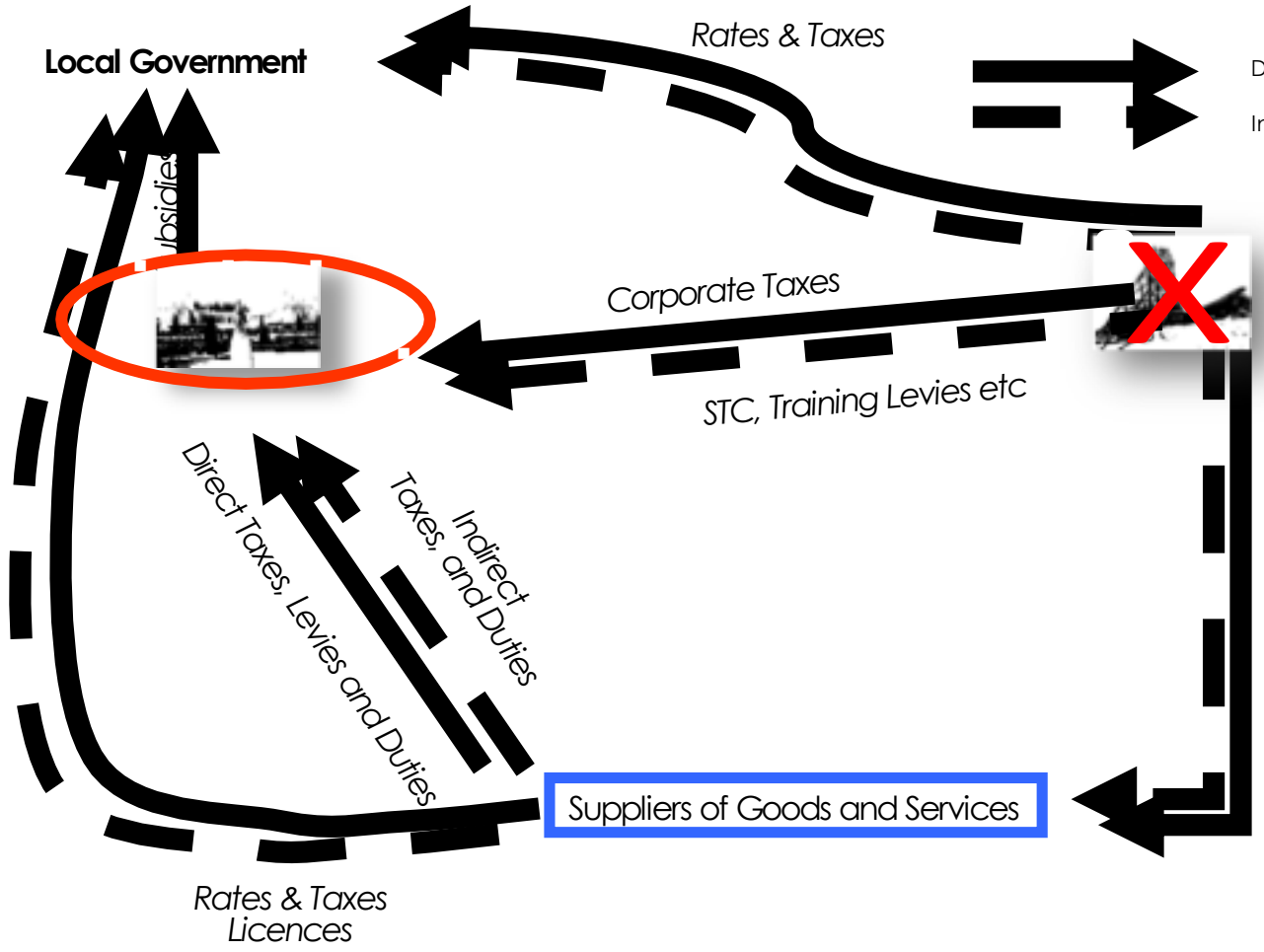
The fault lines of sustainability



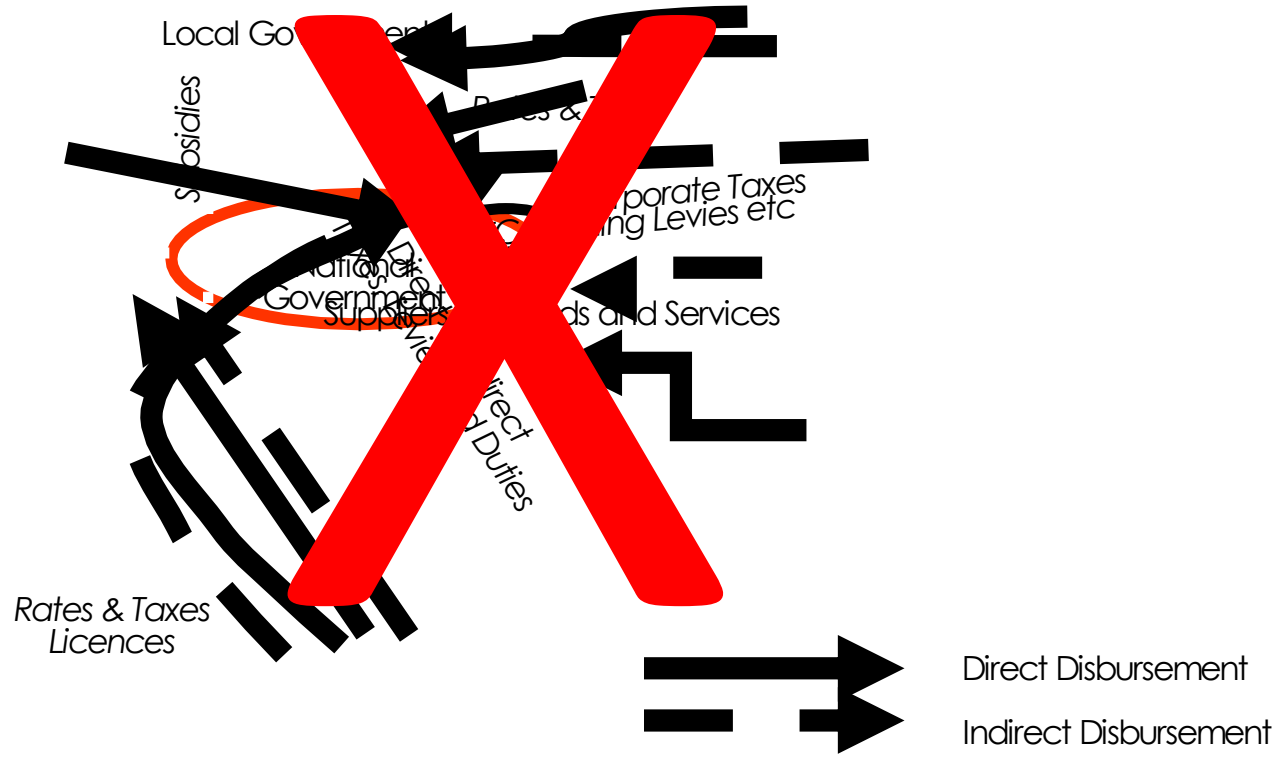
Adapted from Prof Philip Crowson, University of Dundee



Understanding the economic flows is critical



When the mines close, the economic support implodes…….



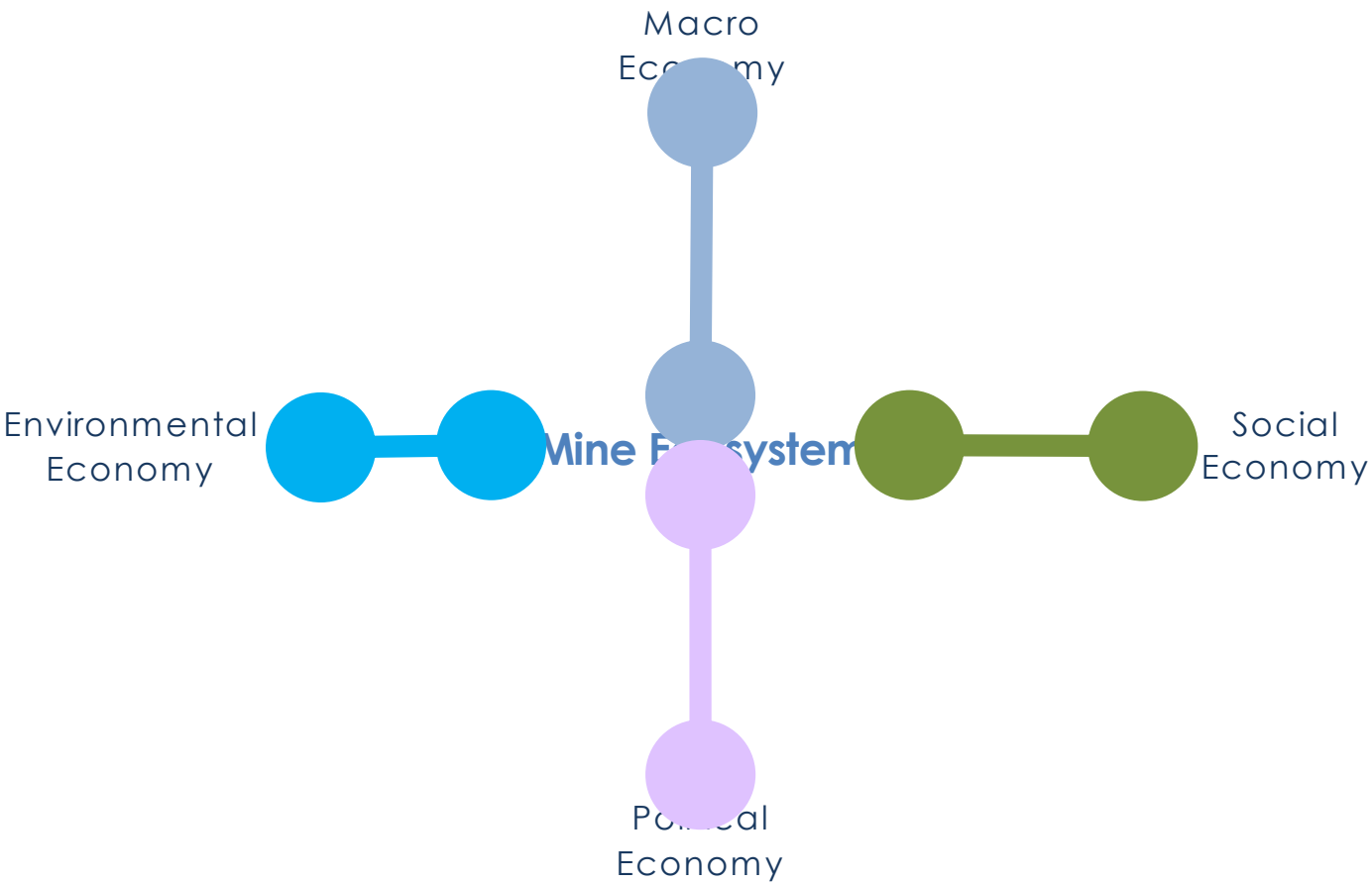
Do the math…….its *that* simple and *that* serious

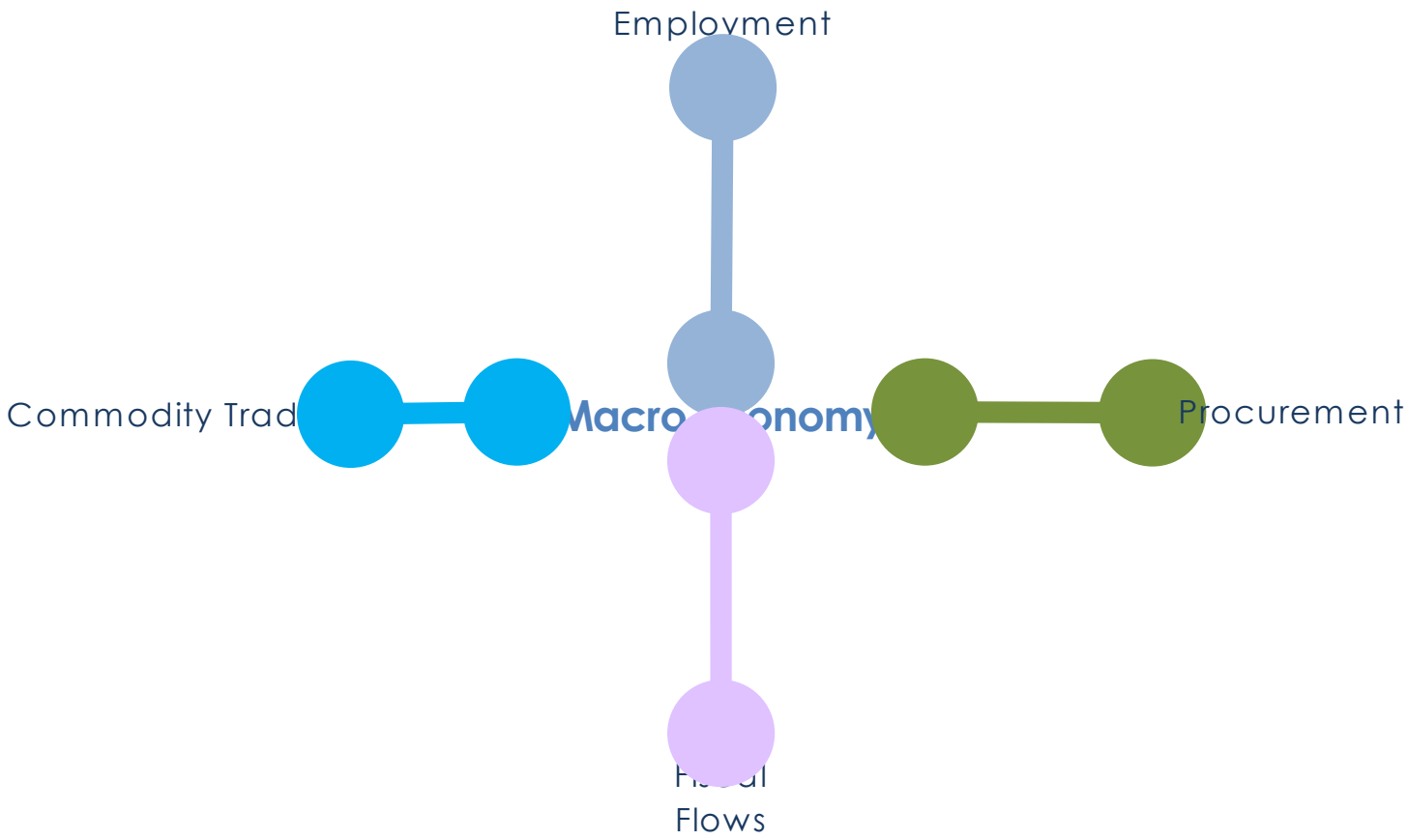
Employees in Gold Mining 1990	477 147
Employees in Gold Mining 2016	115 822
Job Losses	361 325
Livelihoods/1000 workers	26 875
Livelihoods lost	**9 710 609**
South African Population 2016	55 910 000
Unemployment 2016	26.5%
% Population, Livelihoods lost due to decline in mining sector	**17.4%**

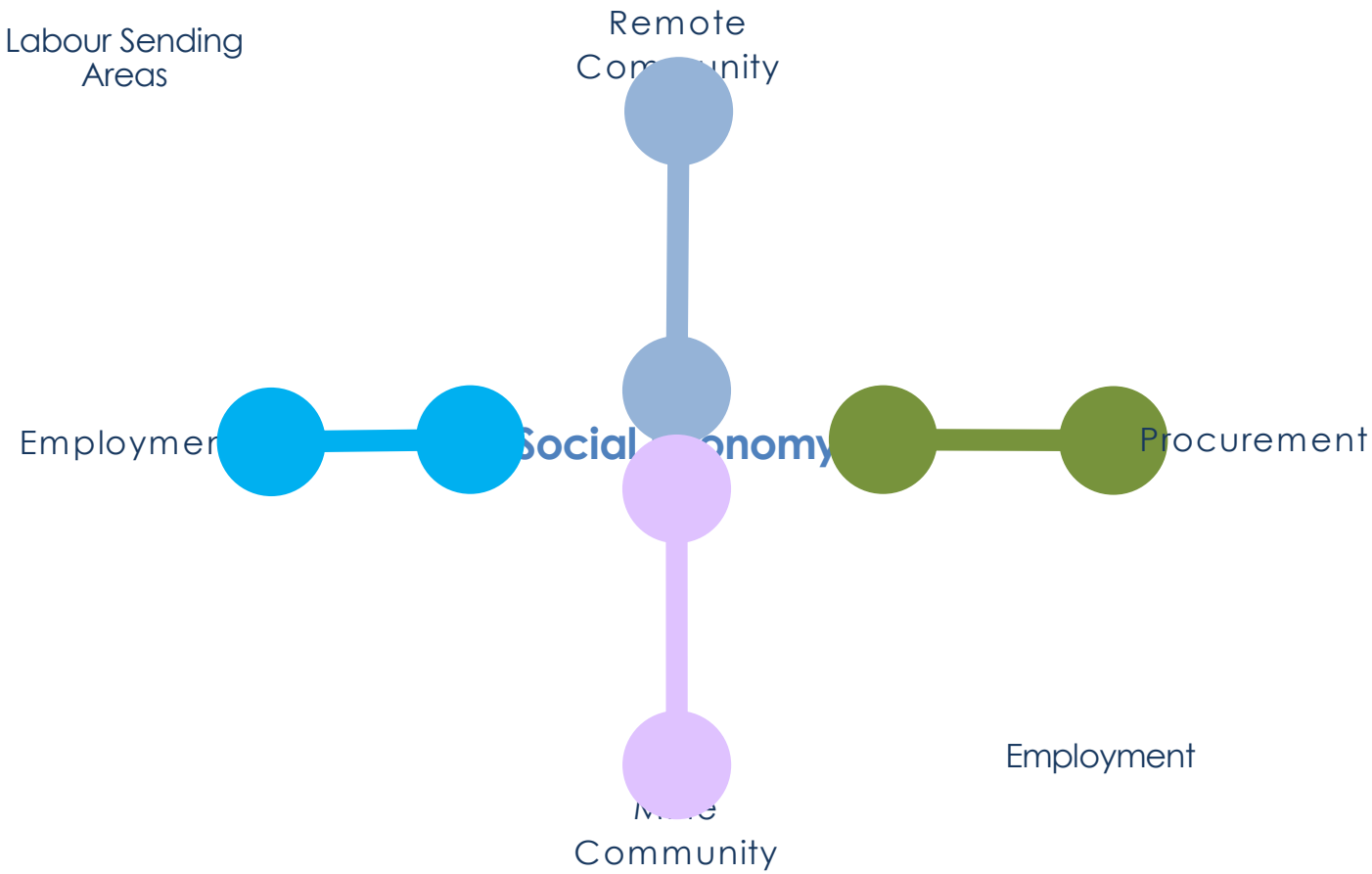
Labour Sending Area	Urban/Peri-urban		Rural
		75%	25%
Mineworkers	1000	750	250
Dependencies		*4.5*	*17.5*
		3375	4375
Secondary and Tertiary Sector Workers	*2.5*	2500	
Dependencies		11250	
Total indicative formal sector livelihoods	**22500**		
Informal sector breadwinners reliant on mining wage	*0.5*	375	125
Dependents on informal sector workers		1687.5	2187.5
Informal sector livelihoods	**4375**	2062.5	2312.5
Total livelihoods supported/1000 mineworkers	**26875**		

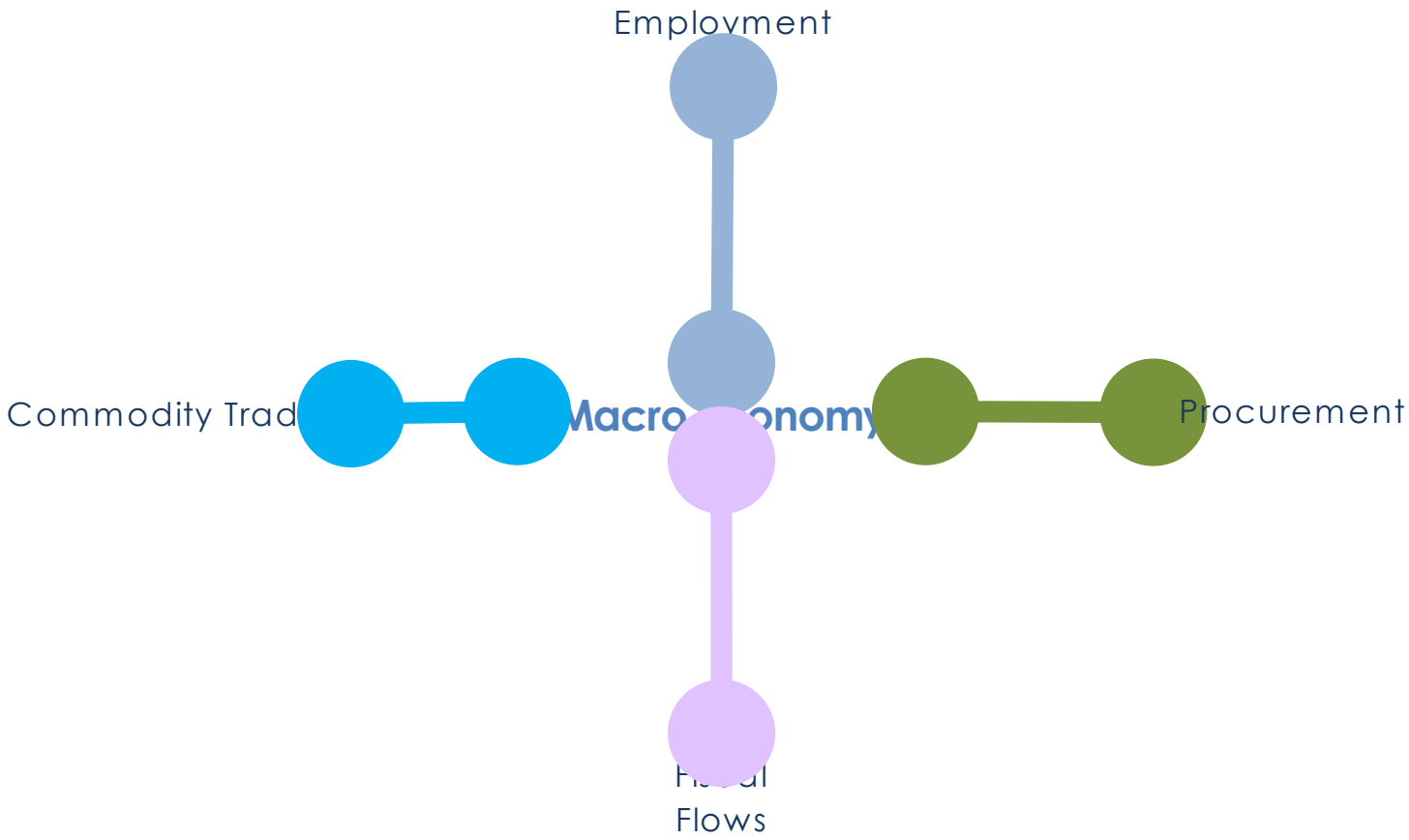
**This includes the primary, secondary and tertiary sector wage earners and their dependents*
*** Schneider, 2004*

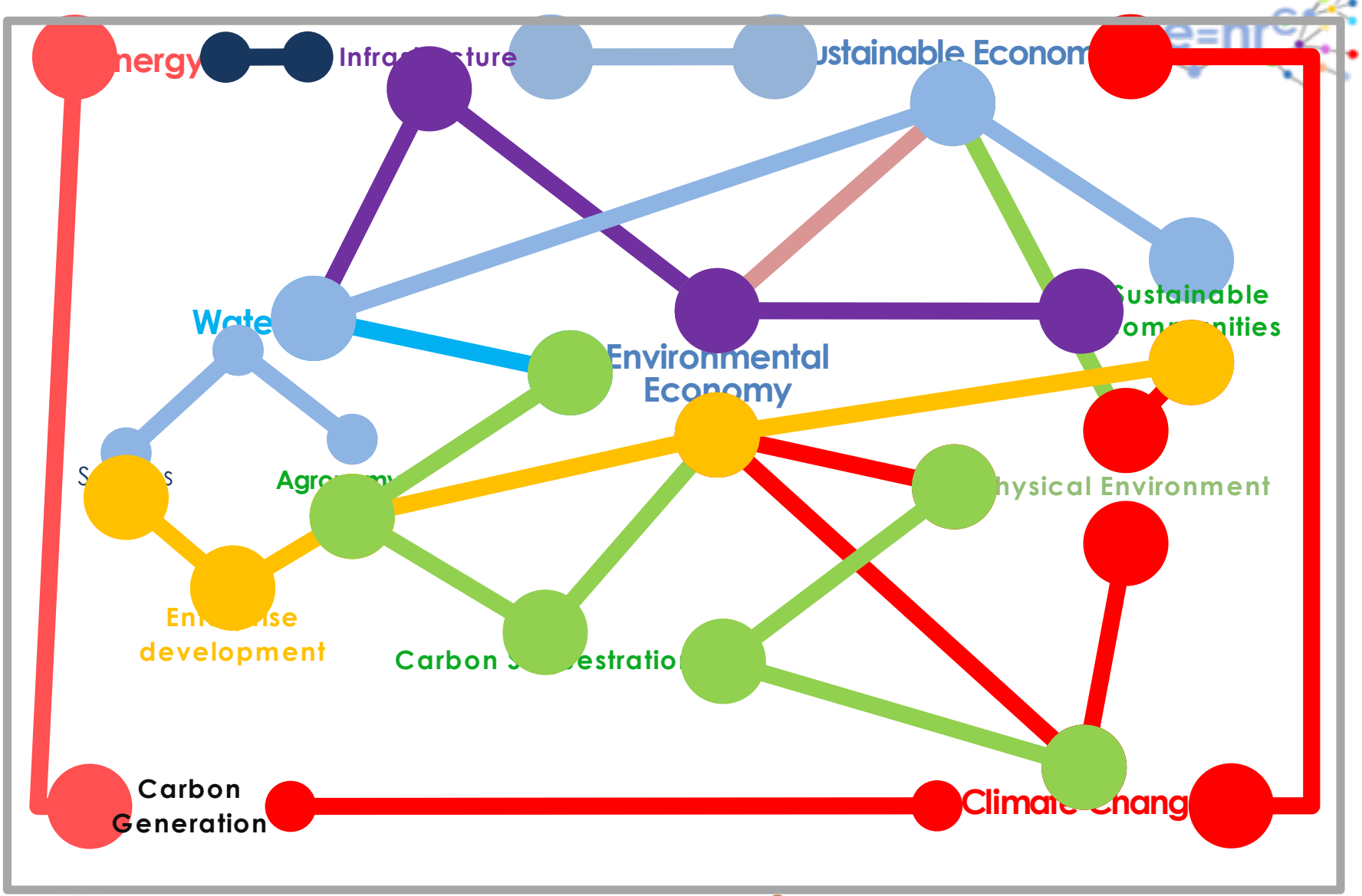
Complexity Mapping

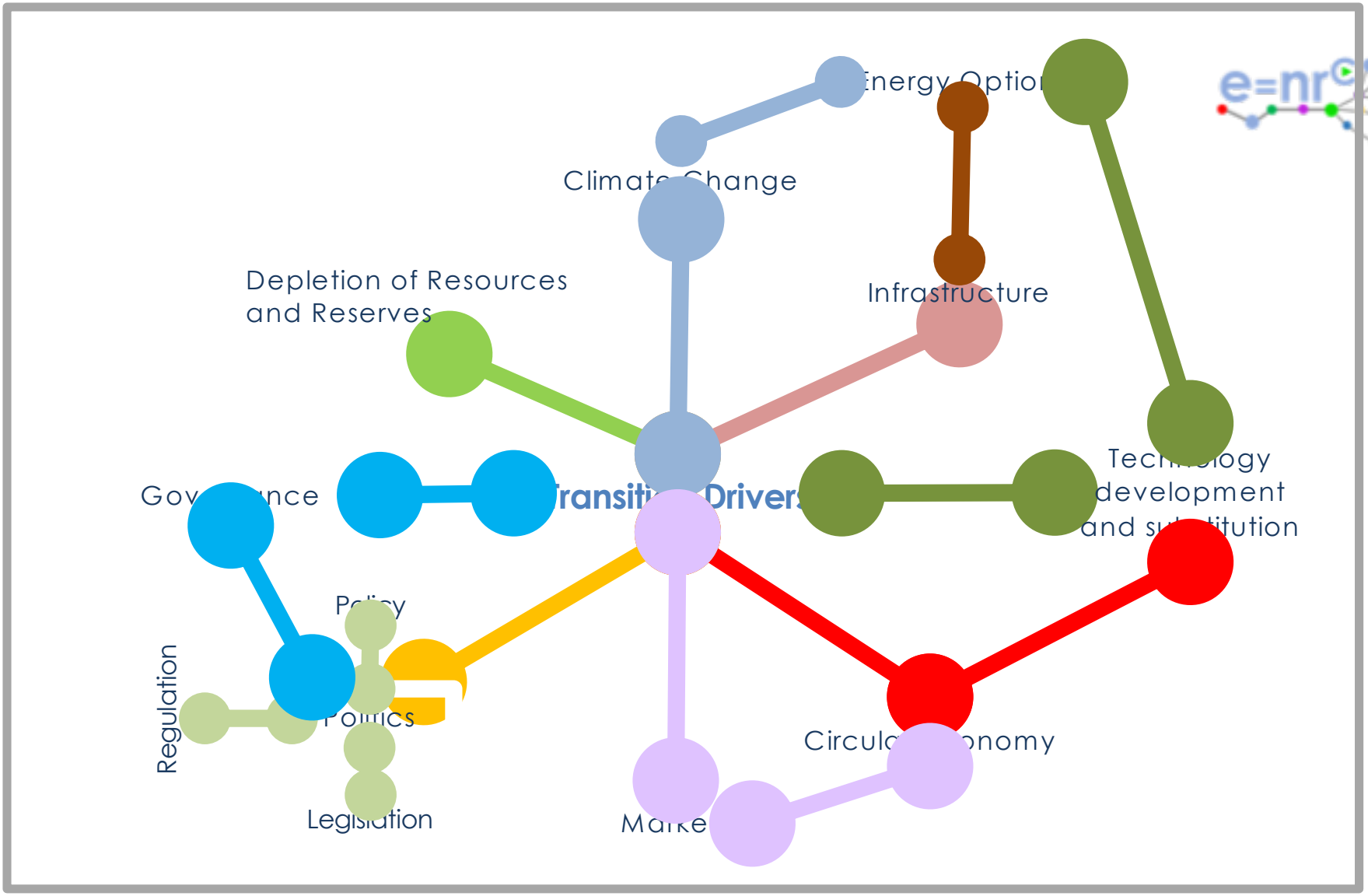


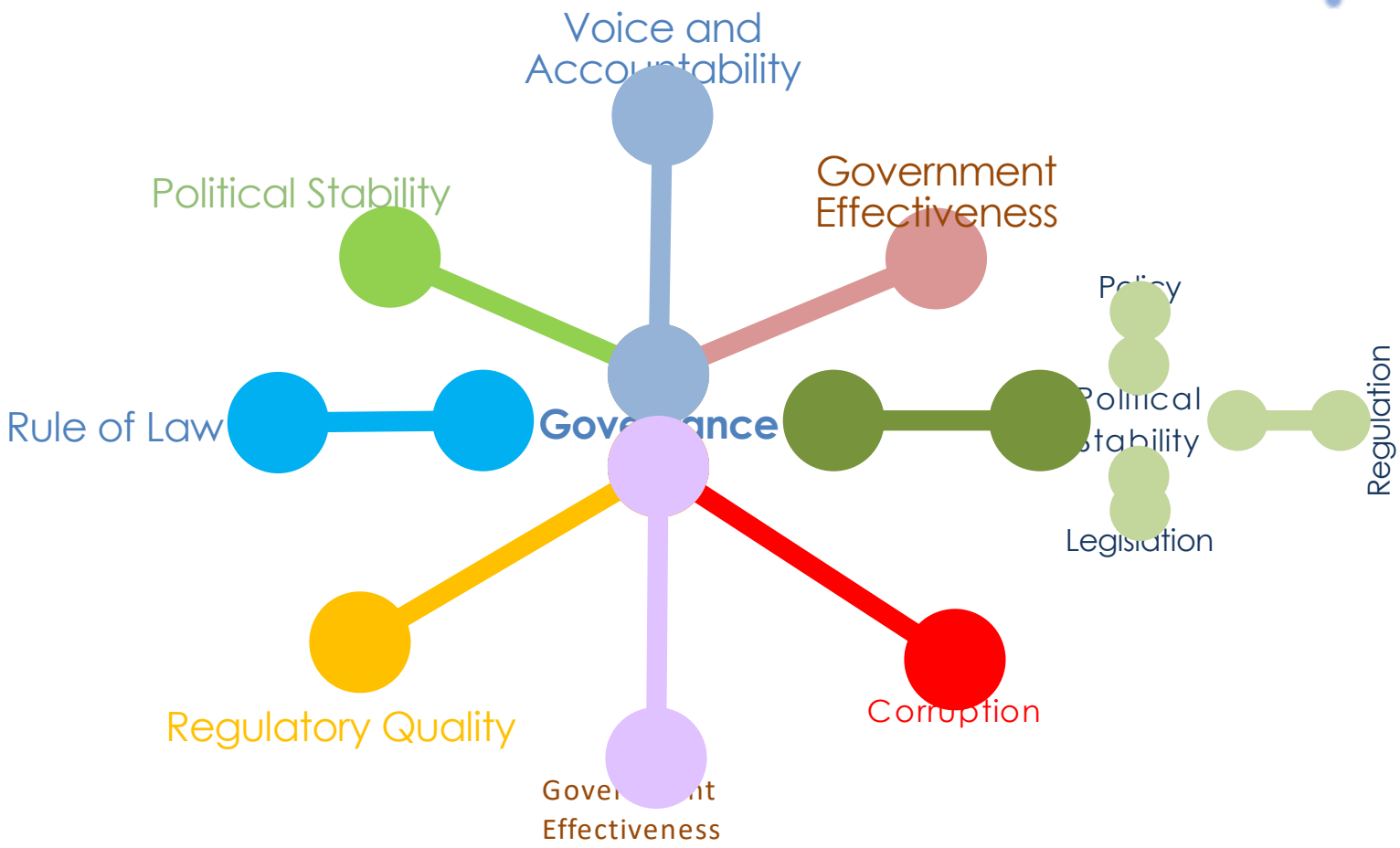


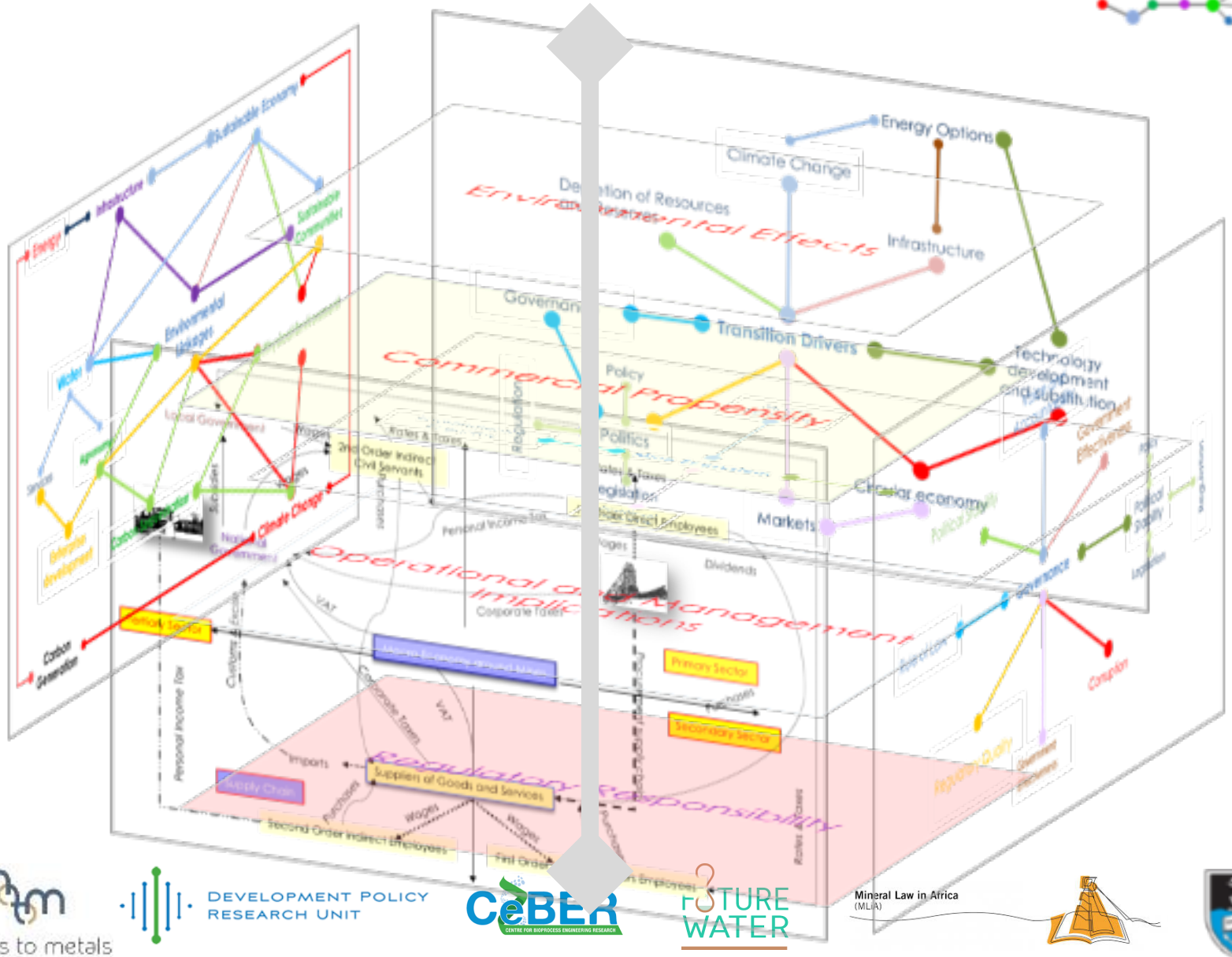












minerals to metals

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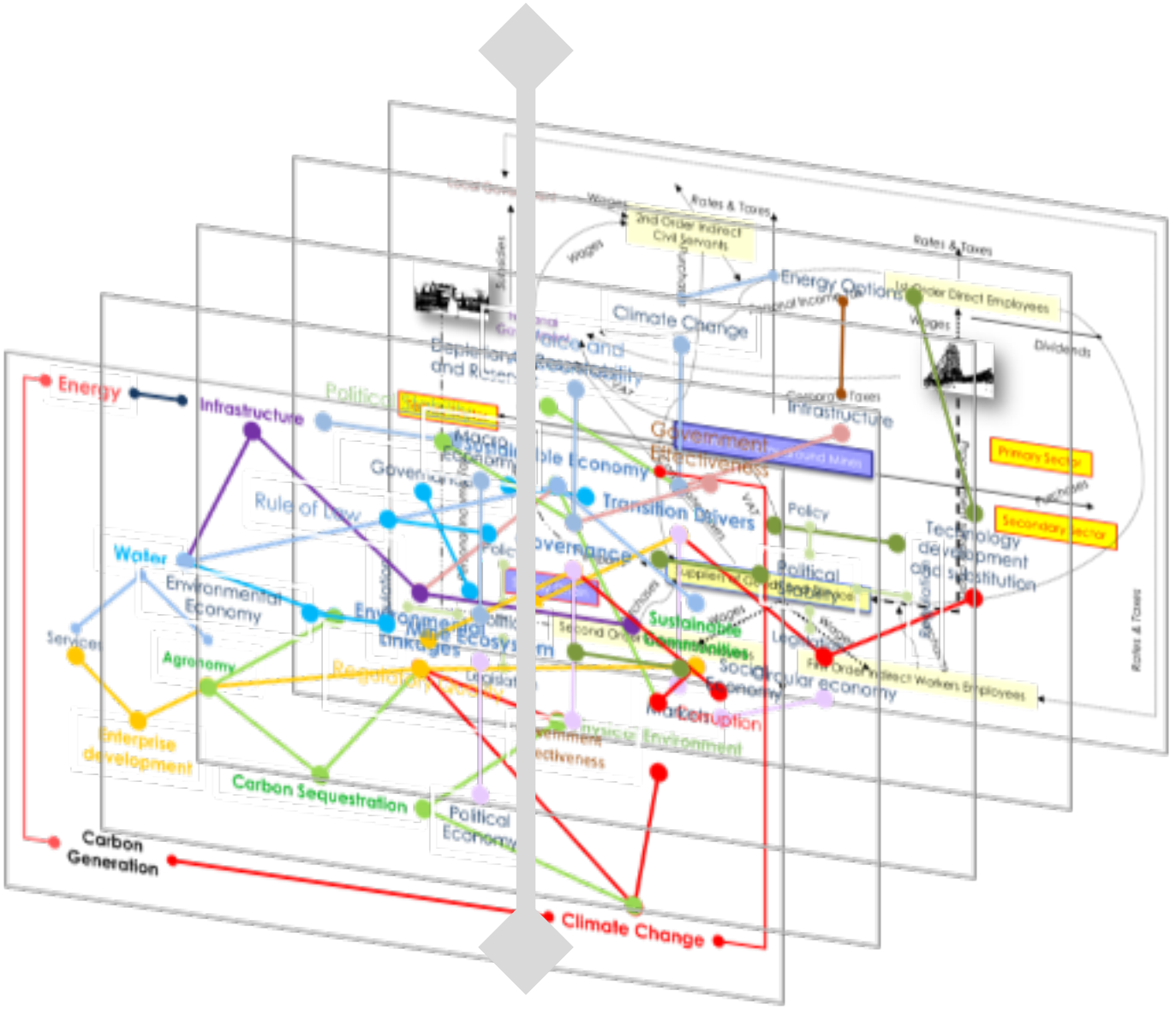

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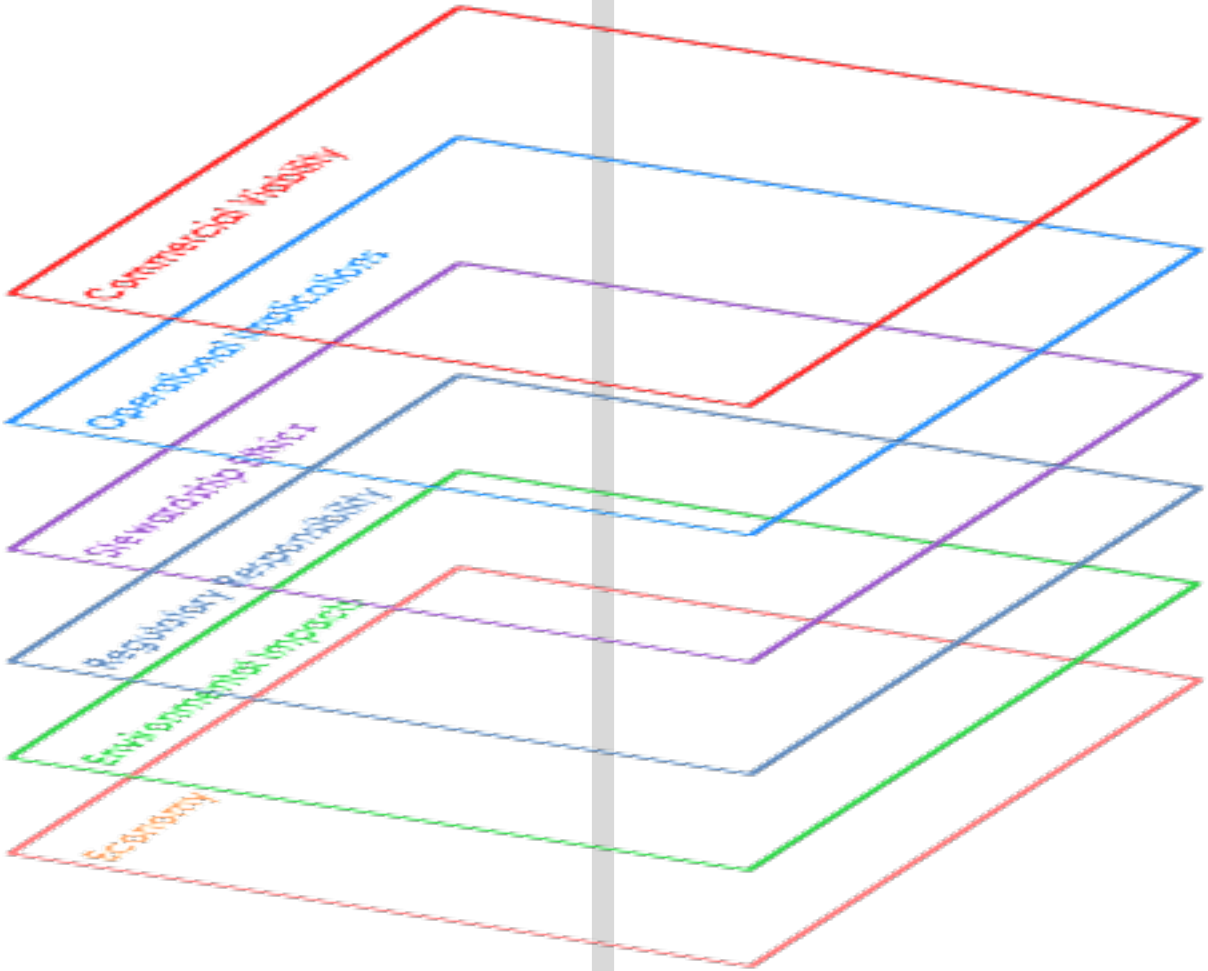

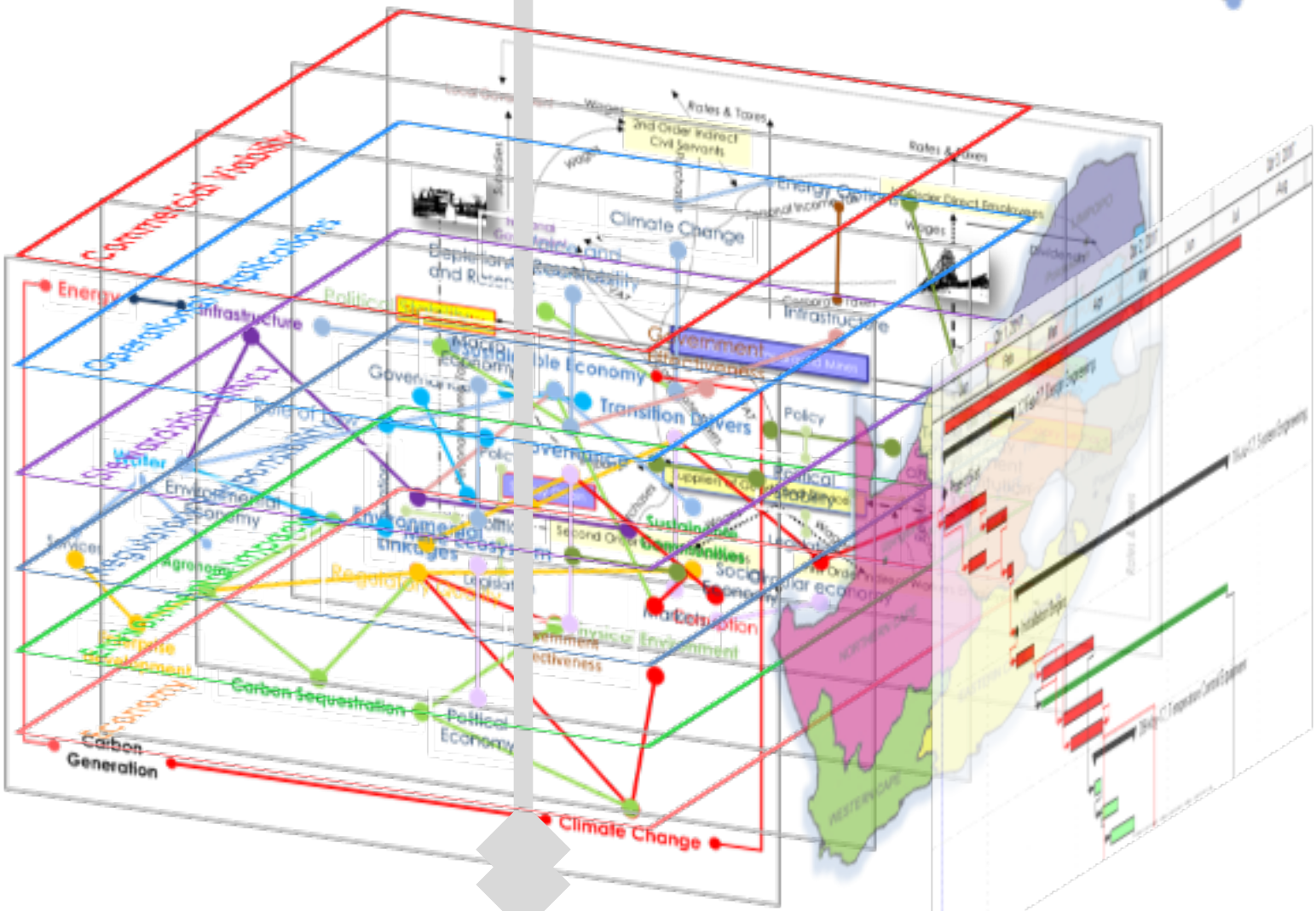

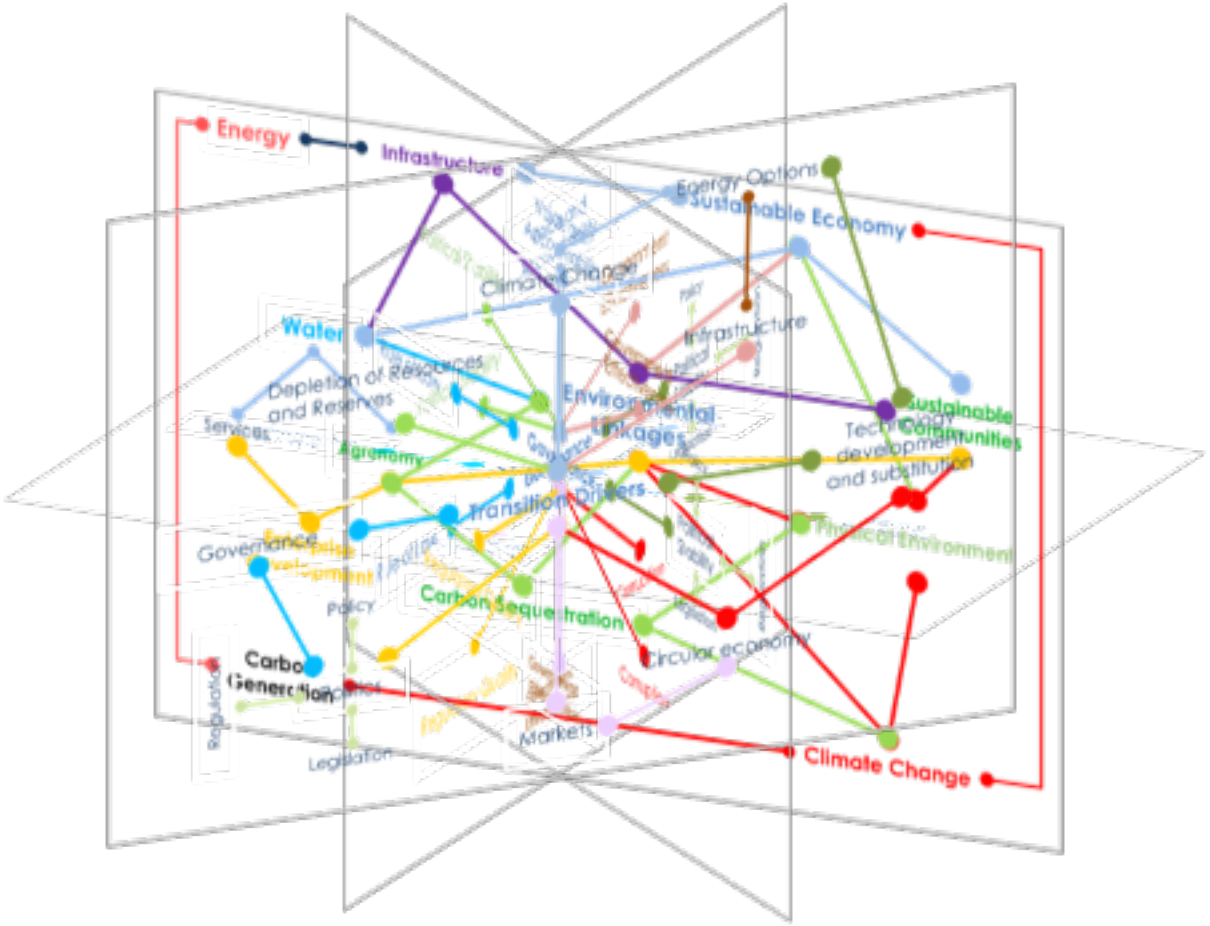

Quantifying the economic multipliers from mining….what does this mean for communities….

Dependency Ratios

	Urban Peri-urban	Rural Labour sending areas	Totals
Mineworkers*	4597	1399	**5996**
Urban Rural Split	76.7%	23.3%	100.0%
Average dependencies in labour sending areas**	4.7	17.3	**7.64**

**Employees aggregated from the primary labour sending areas for the mine in question*

***Statistics SA Census 2000 data*

Labour Sending Area	*Urban/Peri-urban*		*Rural*
		75%	25%
Mineworkers	1000	750	250
Dependencies		*4.5*	*17.5*
		3375	4375
Secondary and Tertiary Sector Workers	*2.5*	2500	
Dependencies		11250	
Total indicative formal sector livelihoods	**22500**		
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*** Schneider, 2004*

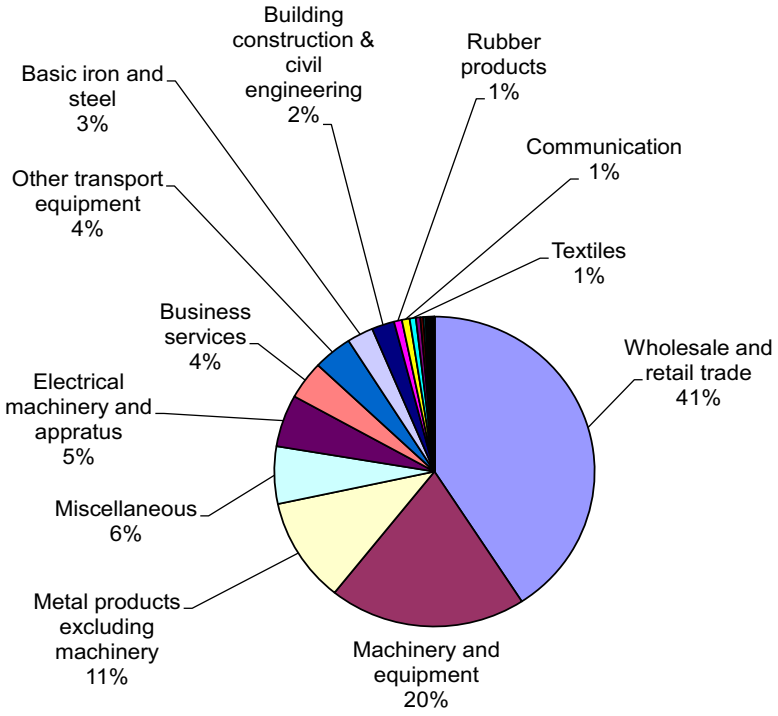
Economic Mapping by Geographic Region

Platinum Minng Areas

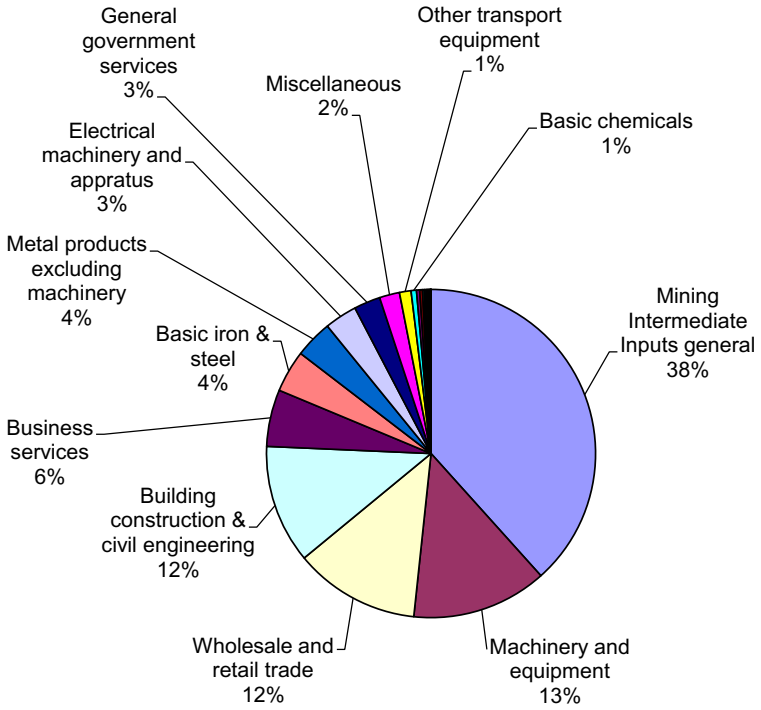
Gegraphic Reach	National	Limpopo	North West	Mpumalanga	Gauteng	Eastern Cape	KwaZulu Natal	Northern Cape	Western Cape	Free State	SADC	Unkonown
Salaries and Wages (After Tax)	456.2	128.0	132.6	5.9	33.6	81.3	1.7	1.9	0.5	14.5	56.3	0.0
Procurement	718.7	23.9	79.1	0.3	578.5		1.3		0.03	4.9		30.7
Royalties (Private)	12.4	-	12.4	-	-	-	-	-	-	-	-	-
Socio-economic Development	2.6	2.6		-	-	-	-	-	-	-	-	-
Total ZARm excluding fiscal flows	**1189.9**	**154.5**	**224.1**	**6.2**	**612.1**	**81.3**	**3.0**	**1.9**	**0.6**	**19.4**	**56.3**	**30.7**
Fiscal Flows*	773.6	92.92	51.86	61.80	143.29	111.33	163.61	21.80	77.89	49.10	-	-
Total ZARm	**1963.5**	**247.4**	**275.9**	**68.0**	**755.4**	**192.6**	**166.6**	**23.7**	**78.5**	**68.5**	**56.3**	**30.7**
**Redistribution by Treasury*	**39.4%**											

Gegraphic Reach	National	Limpopo	North West	Mpumalanga	Gauteng	Eastern Cape	KwaZulu Natal	Northern Cape	Western Cape	Free State	SADC	Unkonown
Salaries and Wages (After Tax)	38.3%	10.8%	11.1%	0.5%	2.8%	6.8%	0.1%	0.2%	0.0%	1.2%	4.7%	-
Procurement	60.4%	2.0%	6.6%	0.0%	48.6%	-	0.1%	-	0.0%	0.4%	-	2.6%
Royalties (Private)	1.0%	-	1.0%	-	-	-	-	-	-	-	-	-
Socio-economic Development	0.2%	0.2%	-	-	-	-	-	-	-	-	-	-
Total ZARm exncluding fiscal flows	**60.6%**	13.0%	18.8%	0.5%	51.4%	6.8%	0.3%	0.2%	0.0%	1.6%	4.7%	2.6%
Flows to Govt as a % of economic benefit	39.4%	4.7%	2.6%	3.1%	7.3%	5.7%	8.3%	1.1%	4.0%	2.5%	-	-
Total ZARm including fiscal flows	**100.0%**	12.6%	14.1%	3.5%	38.5%	9.8%	8.5%	1.2%	4.0%	3.5%	2.9%	1.6%

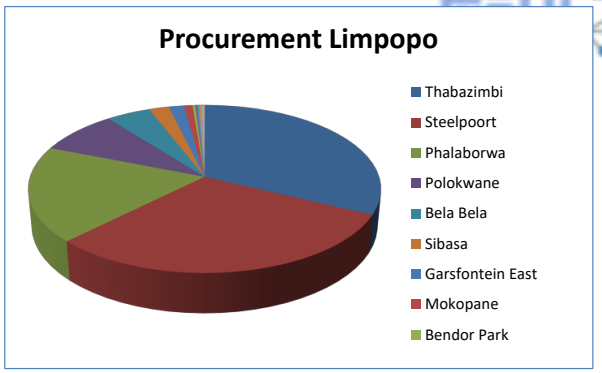
Cross Sectoral Impact of a large precious metals mine: Local and Regional (North West Province)



Cross Sectoral Impact of a Large Precious Metals Mine: Industrial Centre (Gauteng)



Limpopo



Limpopo		
Thabazimbi	32.1%	R 15,393,591
Steelpoort	30.4%	R 14,568,253
Phalaborwa	18.5%	R 8,843,355
Polokwane	8.5%	R 4,060,838
Bela Bela	4.6%	R 2,222,909
Sibasa	2.1%	R 1,015,700
Garsfontein East	1.6%	R 770,203
Mokopane	0.9%	R 428,325
Bendor Park	0.3%	R 135,320
Superbia	0.2%	R 111,050
Nylstroom	0.2%	R 105,500
Magna Via Polokwane	0.1%	R 65,938
Pietersburg	0.1%	R 34,199
Potgietersrus	0.1%	R 33,600
Roedtan	0.1%	R 30,809
Lebowakgomo	0.05%	R 23,927
Chuenespoort	0.04%	R 20,000
Groothoek	0.04%	R 17,000
Whitfield	0.02%	R 9,610
Hwelereng Village	0.02%	R 8,000
Tzaneen	0.01%	R 6,288
Zebediela	0.01%	R 5,500
Grand Total	**100%**	**R 47,909,913**

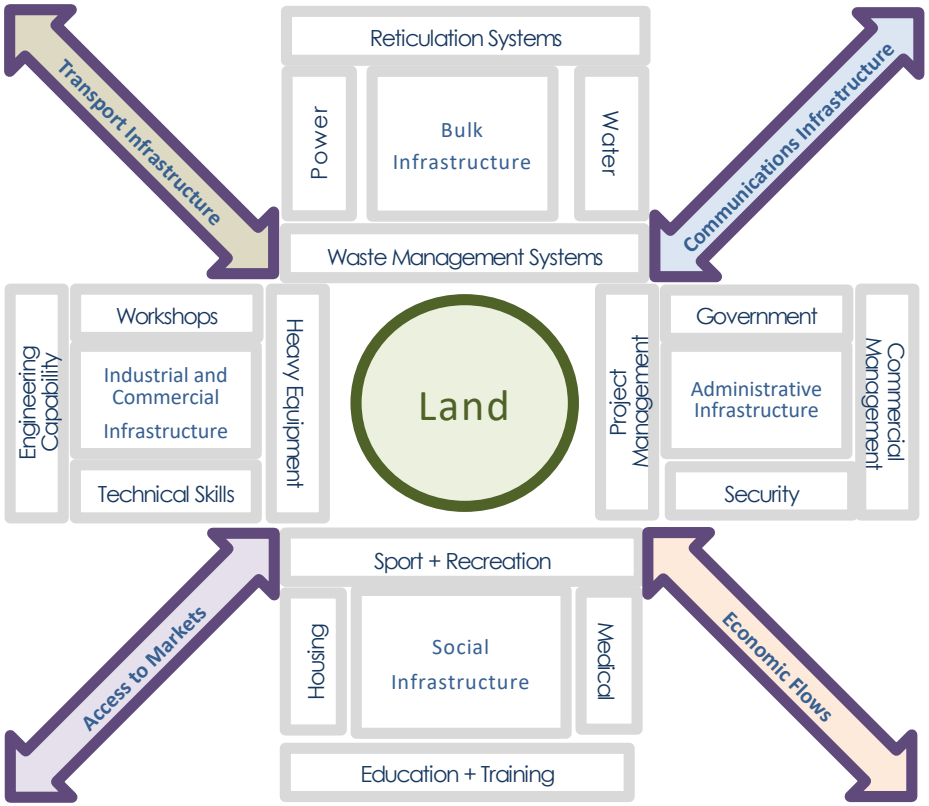
Cross Sectoral Impact		
Business services	46.3%	R 22,202,569
Building construction & civil engineering	27.6%	R 13,223,149
Metal products excluding machinery	16.7%	R 8,022,266
Electrical machinery and appratus	2.7%	R 1,296,561
Machinery and equipment	2.5%	R 1,180,626
Wholesale and retail trade	1.5%	R 731,171
General government services	0.6%	R 273,635
Basic iron and steel	0.5%	R 261,459
Miscellaneous	0.4%	R 185,651
Plastic products	0.4%	R 177,887
Communication	0.3%	R 132,606
Non-metallic minerals	0.2%	R 115,578
Catering and accommodation services	0.1%	R 42,439
Other producers	0.1%	R 31,350
Transport and storage	0.0%	R 20,815
Television, radio and communication equipment	0.0%	R 7,676
Textiles	0.0%	R 4,475
	100%	**R 47,909,913**

Gauteng

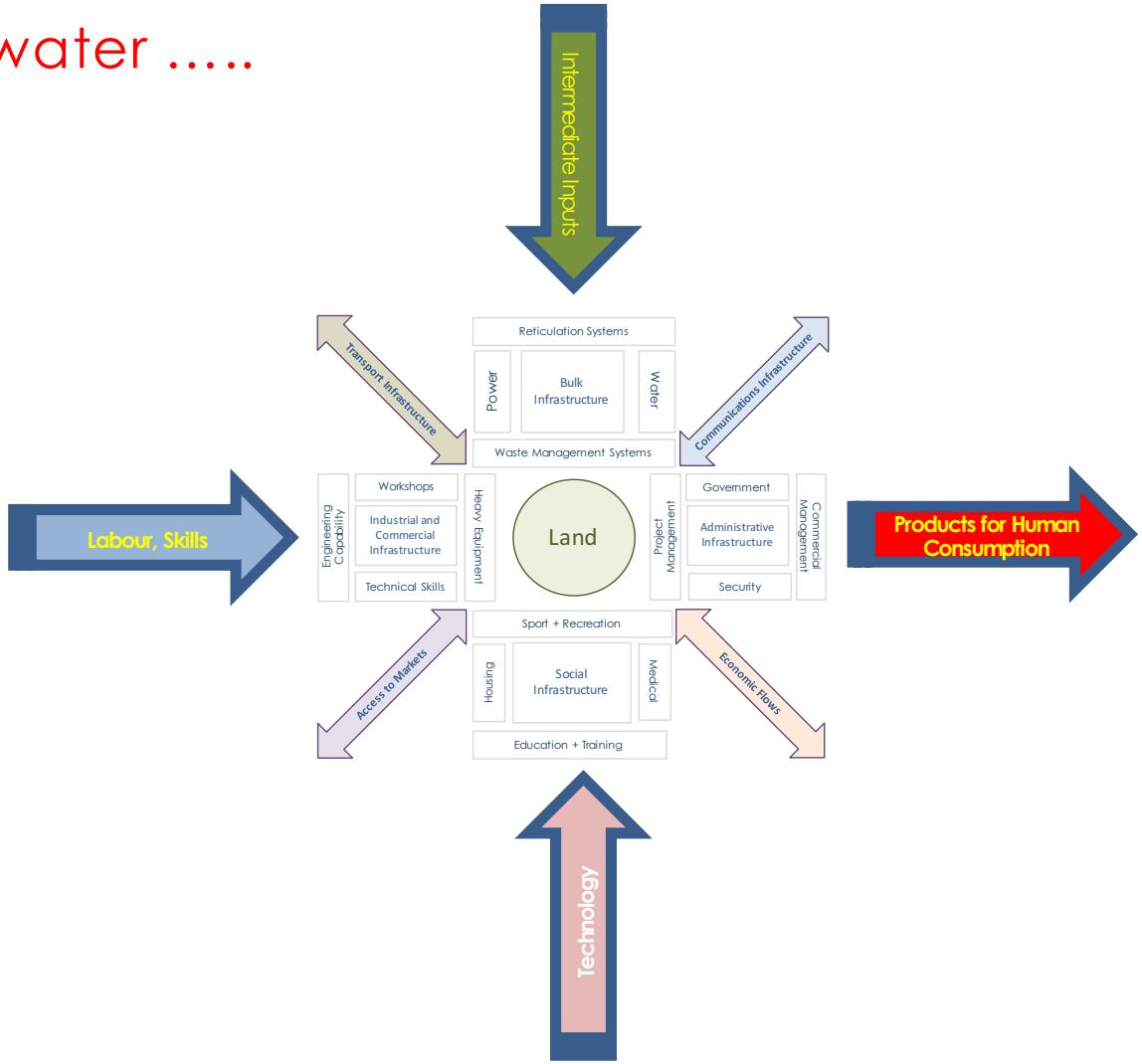
Cross Sectoral Analysis		
Business services	29.5%	R 1,803,720,469
Building construction & civil engineering	24.3%	R 1,485,273,662
Wholesale and retail trade	11.2%	R 686,418,947
Machinery and equipment	8.4%	R 513,708,040
Electrical machinery and appratus	6.1%	R 372,848,305
Transport and storage	4.1%	R 248,283,672
Basic chemicals	2.8%	R 171,147,377
Non-metallic minerals	2.4%	R 146,382,485
Basic iron and steel	2.4%	R 145,405,373
Metal products excluding machinery	2.0%	R 119,436,813
Other mining	1.6%	R 96,294,511
Other transport equipment	1.5%	R 94,333,807
General government services	1.5%	R 89,122,141
Other producers	0.7%	R 43,127,142
Miscellaneous	0.7%	R 42,411,441
Television, radio and communication equipment	0.5%	R 28,905,694
Textiles	0.4%	R 23,829,132
Other chemicals and man-made fibres	0.1%	R 5,233,699
Plastic products	0.04%	R 2,488,307
Communication	0.04%	R 2,343,118
Glass and glass products	0.03%	R 1,611,190
Catering and accommodation services	0.01%	R 423,374
Professional and scientific equipment	0.00%	R 237,967
Rubber products	0.00%	R 30,538
Wood and wood products	0.00%	R 23,000
	100%	**R 6,123,040,205**

Economic Succession Planning within the construct of sustainability and mining….
The Green Mining perspective

Every mining project creates critical ecosystems for development, usually in remote, undeveloped rural areas…..

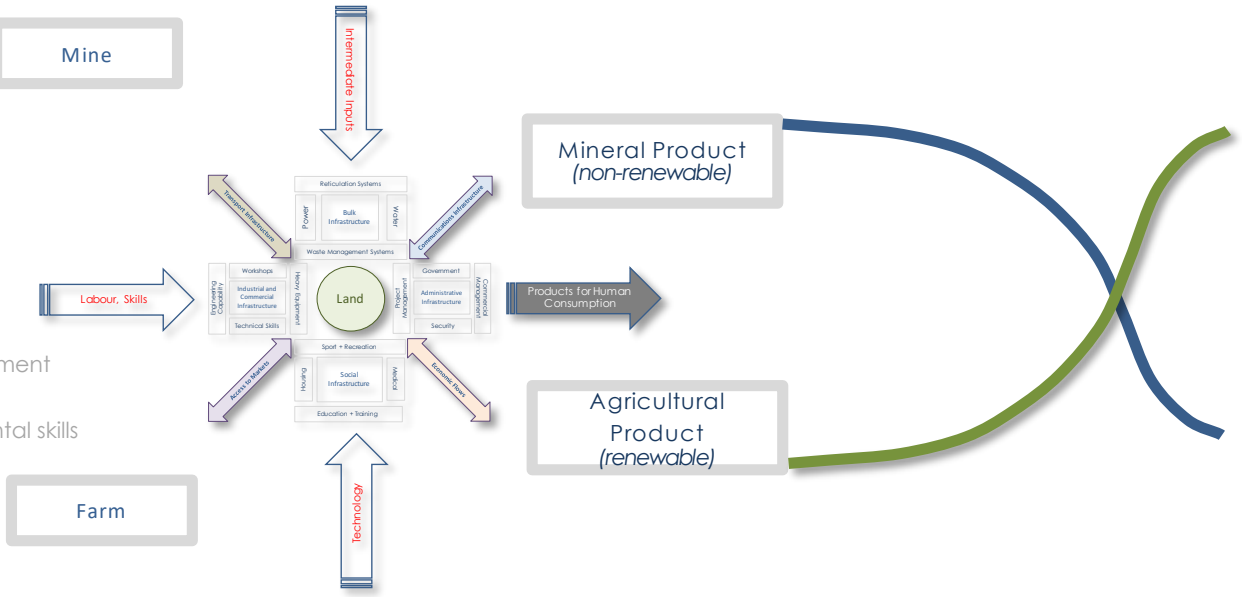


Just add water .....



The future…..the two activities can quite feasibly co-exist with minimum disruption concurrent with mining operations

- Land
- + Minerals
- +Water
- + Power
- + Chemicals
- + Physical infrastructure
- + Cables
- + Pumps
- + Pipes
- + Diesel Hydraulic Equipment
- + Electrical equipment
- + Labour with fundamental skills
- + Good technical skills
- + Good management
- **= a Mine and/or a Farm**



Understanding the ground

Mining provides for greater economic multipliers than any other primary industry.

- Unless economic succession planning is actively undertaken and implemented, many if not most of these multipliers are revered on mine closure;
- However, mining economies are highly complex and in order to effectively undertake and implement an economic succession programme, this complexity needs to be intimately understood;
- This economic complexity goes well beyond the traditional vertical and lateral linkages into secondary and tertiary economic sectors and ventures into muti-dimensional linkages which include *inter alia*:
  - Social economics;
  - Environmental economics;
  - Water economics
  - Land use and landscape planning; and
  - Climate change (carbon generation and carbon sequestration).

R+D collaboration with all mining-related universities

The Key Objectives of the Economic Complexity Study

Economic diversification of mining properties can be optimized and its socio-economic, environmental and political economic impacts maximized by developing and intimate understanding of a mines economic complexity,

The key objectives would be in initially to:

- Undertake a baseline study of the economic, environmental and social linkages of all mining companies Mines, but with emphasis on the mines on which the land and infrastructure diversification is taking place;
- To use this baseline to optimise the substitution of non-mining economic activities on the mining companies mine land in terms of primary economic development as well as linkages i.e. through a provisional complexity study the proposals will be adjudicated against their direct and indirect job creation, vertical and lateral linkages and social and environmental impacts;
- These projects would be assigned clear evaluation metrics and would be closely monitored by the research project.

The Elements of Complexity

The complexity thesis is premised on an integrated understanding of the direct and indirect, vertical and lateral linkages of the current mining activity.

- The substitutive economic, social and transformative impacts are not well understood or quantified in a standard fashion.
- Complexity analysis incorporates:
  - Local regional and national economy;
  - Economic impacts by geography and demographics;
  - Cross sectoral economics;
  - Enterprise development architecture and institutional support;
  - Physical environment;
  - Social environment;
  - Climate change (Carbon generation and sequestration propensities of mining and the substitutive agricultural and industrial land uses proposed); and
  - Mine water dynamics.

Environmental Economics

It is critical to understand the environmental dynamics of the changes to land use and water extraction as mining activity declines

- Climate change (Carbon generation and sequestration propensities of mining and the substitutive agricultural and industrial land uses proposed); and
- Water: A long term and intensive study of the reducing the current rate of dewatering of the West Rand Dolomites with respect to:
  - General water quality,
  - The impact on acid mine drainage
  - hydrographic behaviour of the replenishment of dolomitic chambers (aquifers);
  - Geography of water egress as the water level in the dolomites rises;
  - water sharing with and preparation for agricultural use
- Energy diversification (use of mine land and infrastructure for renewable energy options for mining companies)

Process

In order to succeed each project needs to be scoped within the structure of a generic architecture

- Scoping the Project
  - Commercial Framework
  - Packhouse: Head of the Food Chain
    - Fresh Packaged Produce for Premium Offtakers (15%)
    - Food Processing (35%)
    - Marketing of Balance (50%)
  - Land use by Farm/Package of Land to meet needs of Packhouse and Food Processing Units
    - Tunnels
    - Open Field Intensive
    - Open Field General
      - Vegetables
      - Grains
    - Animal Husbandry
  - Energy and Water
    - Biomass Energy
      - Hydrogen for Fuel Cells
      - Methane for Industrial Use (Sasol Pipeline)
      - Thermal Energy
      - By-Products for Animal Feed
    - Water
      - Agricultural Complex
      - Mines
      - Urban Use