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# **“Brief History and Overview of the Mining Sector”**

**Presentation to the Exxaro Mining & Resources Seminar**

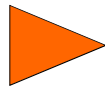
**By Roger Baxter, Senior Executive,  
Chamber of Mines of South Africa,  
13 April 2011**



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## **PRESENTATION OUTLINE**



**Mining and minerals, integral to modern society**

**Brief history of mining**

**The global mining industry**

**Back to the “BOOM”**

**The South African Mining Industry**

**The future**

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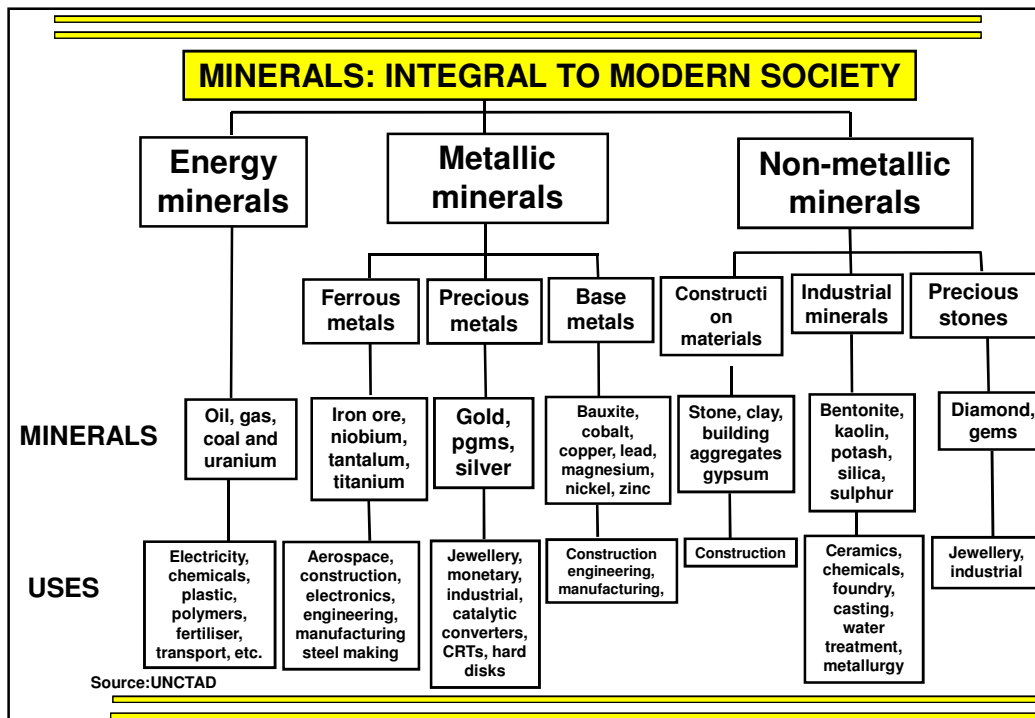
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## Minerals are essential for all economies

“Minerals account for a small share of world production and trade.

Nonetheless, their supply is essential for the sustainable development of a modern economy.

They are basic, essential and strategic raw materials for the production of a wide range of industrial and consumer goods, military equipment, infrastructure, inputs for improving soil productivity, and also for transportation, energy communications and countless other services”  
(Highley et.al.)



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## Some Key Minerals and their uses

- **Aluminum**  
Most abundant metal element in Earth's crust. Bauxite ore is the main source of aluminum and must be imported from Guinea, Australia, Jamaica, etc. Used in packaging (31%), transportation (22%) and building (19%).
  - **Antimony**  
A native element; antimony metal is extracted from stibnite and other minerals. Used as a hardening alloy for lead, especially storage batteries and cable sheaths; also used in bearing metal, type metal, solder, collapsible tubes and foil, sheet and pipes, and semiconductor technology. Used in fireworks. Antimony salts used in the rubber and textile industries, in medicine and glassmaking.
  - **Chromite**  
Found in South Africa and Zimbabwe. Used mainly in chemical and metallurgical industries (chrome fixtures, etc.)
  - **Cobalt**  
Used in superalloys for jet engines, chemicals (paint dryers, catalysts, magnetic coatings), permanent magnets, and cemented carbides for cutting tools. Comes principally from Zaire, Zambia, Canada, Cuba and Commonwealth of Independent States (CIS). United States uses one-third of world production.
  - **Copper**  
Used in electric cables and wires, switches, plumbing, heating; roofing and building construction; chemical and pharmaceutical machinery; alloys (brass, bronze and a new alloy with 3% beryllium that is particularly vibration resistant); alloy castings; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc. Leading producers are Chile, United States, CIS, Canada, Zambia and Zaire.
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## Some Key Minerals and their uses

- **Coal**  
Geographically abundant and diversified. Key ingredient in producing electricity (30% of electricity production, 23% of total primary energy) and key ingredient in making steel and chemicals.
  - **Gold**  
Used in dentistry and medicine; in jewelry and arts; in medallions and coins; in ingots as a store of value; for scientific and electronic instruments; as an electrolyte in the electroplating industry. Leading producers are South Africa, United States, Australia, Brazil, Canada, China and CIS.
  - **Iron Ore**  
Used to manufacture steels of various types. Powdered iron: used in metallurgy products; magnets; high-frequency cores; auto parts; catalyst. Radioactive iron (iron 59): in medicine; tracer element in biochemical and metallurgical research. Iron blue: in paints, printing inks, plastics, cosmetics, paper dyeing. Black iron oxide: as pigment; in polishing compounds; metallurgy; medicine; magnetic inks. Most U.S. production from Minnesota and Michigan. Australia, Brazil, China and CIS are major producers.
  - **Lead**  
Used in lead batteries, gasoline additives (now being eliminated) and tanks, and solders, seals or bearing; used in electrical and electronic applications; TV tubes and glass, construction, communications and protective coatings; in ballast or weights; ceramics or crystal glass; X-ray and gamma radiation shielding; soundproofing material in construction industry; and ammunition. United States is largest producer and consumer of lead metal.
  - **Manganese**  
Essential to iron and steel production. Major producers: South Africa and CIS.
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## Some Key Minerals and their uses

- **Nickel**  
Vital as an alloy to stainless steel; plays key role in the chemical and aerospace industries. Leading producers are Australia, Canada, Norway and CIS.
- **Platinum Group Metals (PGM)**  
Includes platinum, palladium, rhodium, iridium, osmium and ruthenium. Commonly occur together in nature and are among the scarcest of the metallic elements. Platinum is used principally in catalysts for the control of automobile and industrial plant emissions; in jewelry; in catalysts to produce acids, organic chemicals and pharmaceutical. PGMs used in bushings for making glass fibers used in fiber-reinforced plastic and other advanced materials, in electrical contacts, in capacitors, in conductive and resistive films used in electronic circuits; in dental alloys used for making crowns and bridge. Nearly all reserves are in CIS and South Africa. U.S. has one PGM mine.
- **Titanium**  
A metal used mostly in jet engines, airframes and space and missile applications. Produced in western and central U.S., the UK, China, Japan and CIS.
- **Uranium**  
Uranium is mostly used for generating electricity. It is also used for nuclear medicine, atomic dating, powering nuclear submarines and other uses in the U.S. defense system.
- **Vanadium**  
Used in metal alloys (titanium alloys important for aerospace); as a catalyst for production of maleic anhydride and sulfuric acid; in dyes and mordants; as target material for X-rays. CIS and South Africa are largest producers; large reserves also found in the United States and China.

## Metals and minerals in a Smart Phone



- **Copper (16 grams) <sup>1</sup>**
- **Silver (0.35 grams) <sup>1</sup>**
- **Gold (0.034 grams) <sup>1</sup>**
- **Palladium (0.015 grams) <sup>1</sup>**
- **Platinum (0.00034 grams) <sup>1</sup>**
- **Ceramic magnetic switches containing rare earths <sup>2</sup>**
- **Indium<sup>2</sup>**
- **Titanium dioxide <sup>2</sup>**
- **Indium tin oxide <sup>2</sup>**

<sup>1</sup> source – USGS <http://pubs.usgs.gov/fs/2006/3097/>

<sup>2</sup> source – NRC critical minerals report

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## Metals and Minerals in a car



- 960kg iron & steel
- 109kg Aluminum
- 22.7kg Carbon
- 19 kg Copper, 34kg for a hybrid
- 19kg Silicon
- 11 kg Lead
- 10kg Zinc
- 7.7kg manganese
- 6.8kg Chromium
- 4.1kg Nickel
- 0.4 kg Platinum

•+Antimony, barium, beryllium, cobalt, gallium, gold, magnesium, molybdenum, neodymium, indium, palladium, Sulphur, rhodium, silver, strontium, tin, titanium, tungsten, vanadium, zirconium.

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## Even a Wind Turbine uses a significant amount of metals and minerals



- 335 tons of steel
  - 4.7 tons of copper
  - 13 tons of fiberglass
  - 3 tons of aluminum
  - 1,200 tons of reinforced concrete
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## Solar panels need many metals and minerals

- Lead (batteries)
- Phosphate rock
- Selenium (solar cells)
- Silica (solar cells)
- Tellurium (solar cells)
- Titanium dioxide (solar panels)

- Arsenic (gallium-arsenide semiconductor chips)
- Bauxite (aluminum)
- Boron minerals (semiconductor chips)
- Cadmium (thin film solar cells)
- Coal (by-product coke is used to make steel)
- Copper (wiring; thin film solar cells)
- Gallium (solar cells)
- Iron ore (steel)
- Molybdenum (photovoltaic cells)

## Even a compact fluorescent light bulb is minerals intensive?



- Rare earths
- Silica (glass)
- Soda ash (soda-lime glass)
- Manganese (phosphor)
- Tin (end caps; filaments; glass coatings)
- Tungsten (electrodes; filaments)
- Zinc (end caps; filaments)

- Barite
- Bauxite (alumina for phosphor; aluminum for end caps & filaments)
- Copper (end caps; filaments)
- Lead (soda-lime glass; ballast; adapter unit)
- Limestone or dolomite (finely crushed stone to make soda-lime glass)
- Mercury (vapor in glass tubing)
- Nickel (end caps; filaments)
- Phosphate rock (phosphor)

**A bright smile, even comes from mining.....**



- Silica
- Limestone
- Aluminum
- Phosphate
- Fluoride
- Titanium
- Mica
- Petroleum

## **PRESENTATION OUTLINE**

**Mining and minerals, integral to modern society**

**Brief history of mining**

**The global mining industry**

**Back to the "BOOM"**

**The South African Mining Industry**

**The future**

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## Brief History of Mining

- Mining has played integral part in the development of civilization. Both cultural progress, human development and civilization were linked to mining.
  - Mining began with the Paleolithic people, perhaps 300 000 years ago, during the stone age, when flint implements were sought for agricultural and construction purposes. Like other aspects of human civilization, mining is thought to have originated in Africa.
  - The introduction of geomechanics (such as the use of heat to expand and water to crack rock) was the first major advance in mining technology.
  - Mining is linked to trade routes in ancient Egyptian times (4500 BC) as the Pharaohs sought gold and turquoise – resulting in first recorded mining, but also drove conflict with neighboring countries.
  - Gold and silver used as a key means of exchange and money (wealth).
  - The Mycenaean's followed by the Phoenicians then traded minerals, developing a large network of transport and shipping routes.
  - By 620 China had become most technologically and culturally advanced society, with good metallurgical and steel making skills.
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## Brief History of Mining

- Romans recognised the importance of mining and even allowed private ownership and operations of mines.
  - First initial “cost-book” companies formed by miners to find the resources to mine underground.
  - In 18<sup>th</sup> century large progress made in iron metallurgy, which enabled the Industrial Revolution in Britain and Europe. Machine power developed during the Industrial Revolution also greatly facilitated mining development and production (coal & iron ore).
  - Limited liabilities Act of 1855 enabled significant capital to be raised in Britain for mining worldwide.
  - During the latter part of the 19<sup>th</sup> century the growth of the mining sectors in the USA, Russia, Europe, played a significant role in the development and industrialisation of these countries.
  - Mining today plays a key role in many countries, but particularly in emerging economies.
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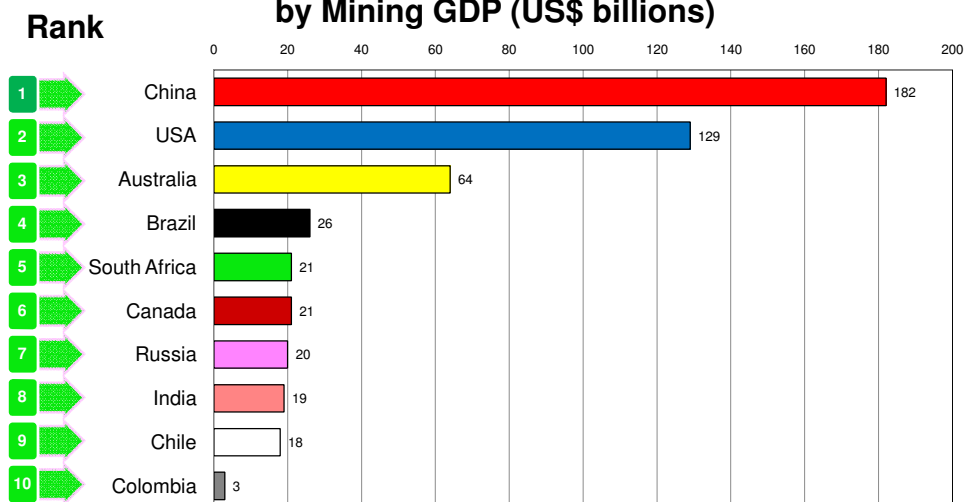
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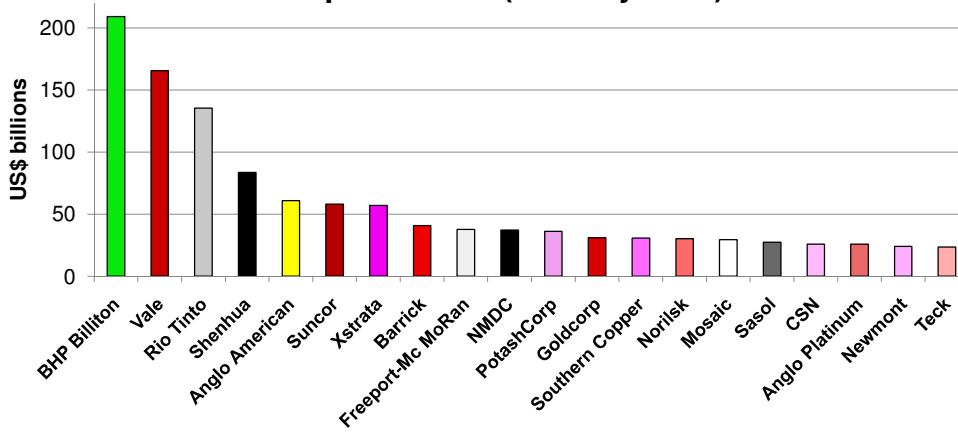
## China has the world's largest mining sector

The global top ten mining countries as measured by Mining GDP (US\$ billions)



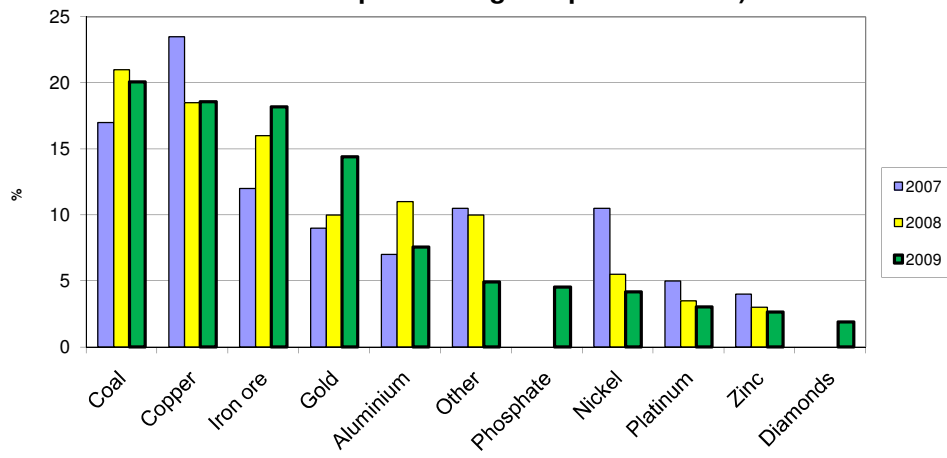
## World's Top 20 Mining Companies by market capitalisation

The world's largest mining companies by market capitalisation (January 2011)



## The "big 5" of minerals in demand are coal, copper, iron ore, gold and aluminium

Comparison of Revenue by commodity (composition of revenues of top 40 mining companies - PWC)



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## Back to the “Boom”

- Global economy is recovering from first global recession in 61 years.
  - Recovery is unevenly distributed, with advanced economies sluggish and developing countries growing strongly.
  - The risks of a “double dip” are fading but risks remain.
  - Mining companies are in better position having repaired balance sheets and sustained core projects.
  - The materials intensive nature of growth in emerging economies will escalate in next decade caused by continued urbanisation and industrialisation.
- **Can South Africa “cash in” on the boom?**
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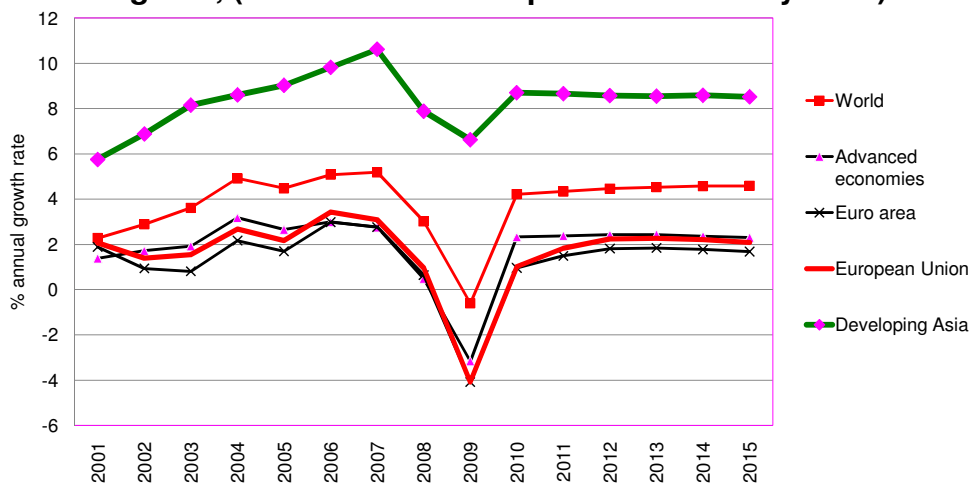
## Back to the “Boom”

### PWC ANNUAL MINING REPORT TITLES

- 2007 “Riding the wave”
- 2008 “as good as it gets”
- 2009 “When the going gets tough”
- **2010 “Back to the Boom”**

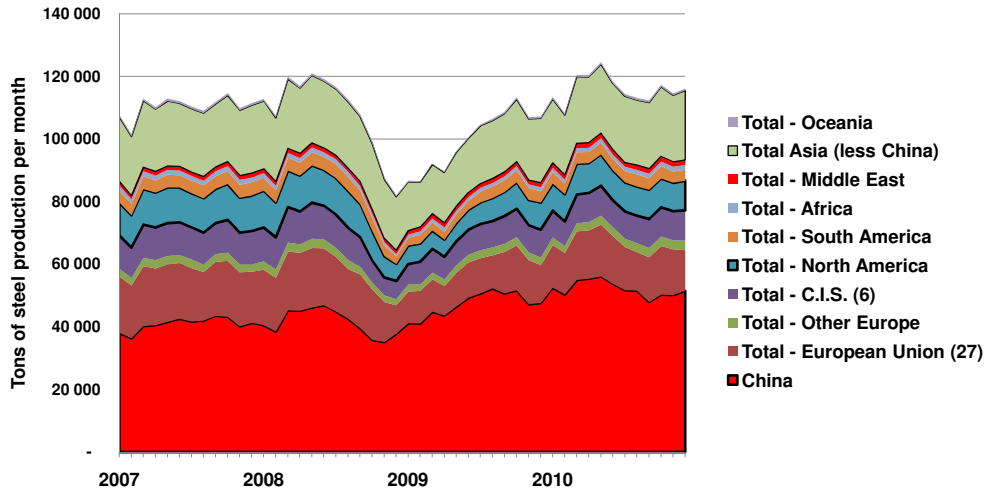
## World economy is recovering

IMF outlook for world economic growth for key regions, (source IMF WEO April 2010 and July 2010)



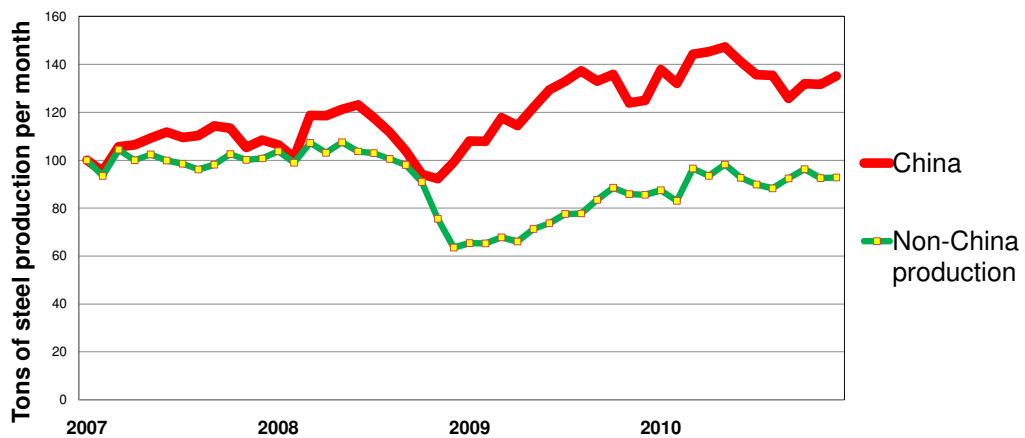
## World economy is recovering

Global steel production has recovered to pre-crisis levels  
(source: IISI)



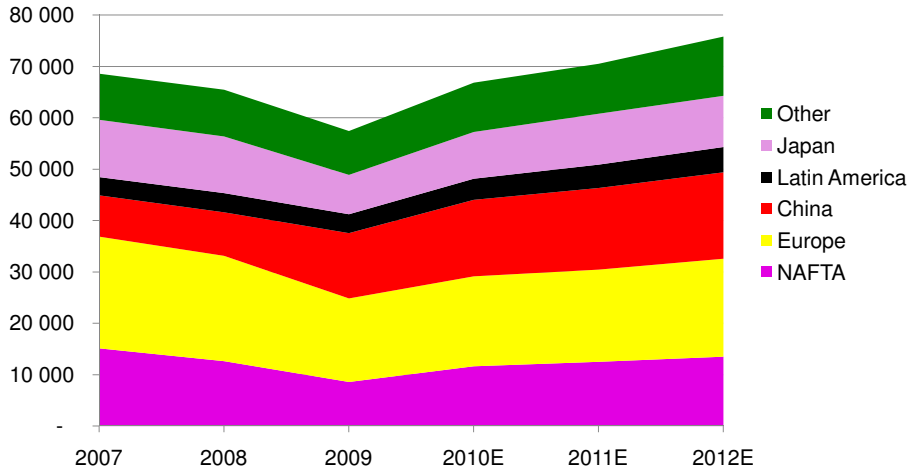
## World economy is recovering, but the recovery is unevenly distributed

Global steel production has recovered to pre-crisis levels  
(source: IISI)



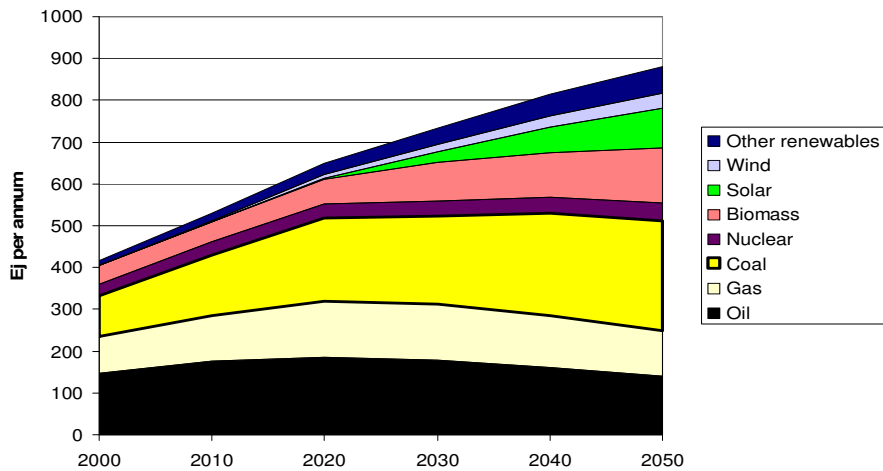
## World economy is recovering

Global automotive production by key region/country, (source: CSM and JDPowers)

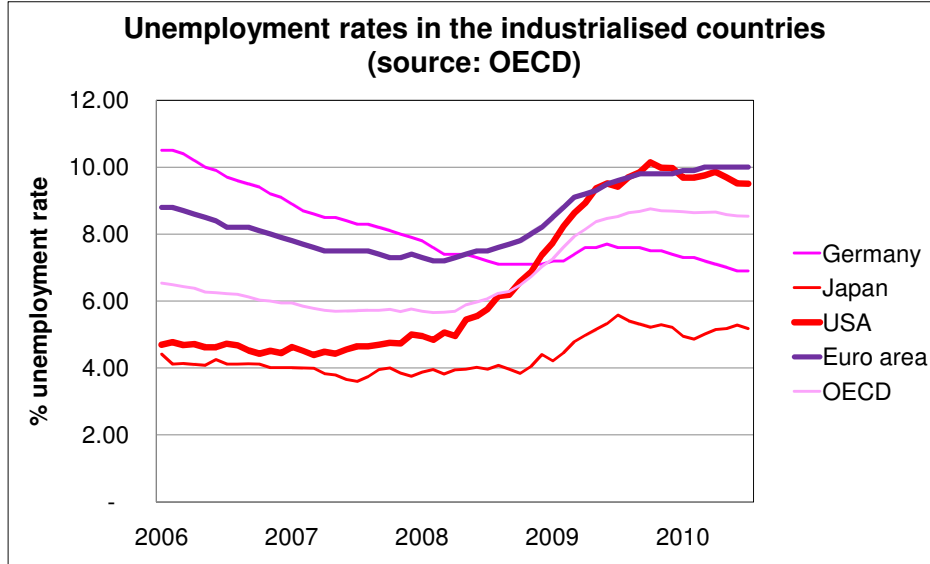


## Even in a carbon constrained world, energy demand still set to boom

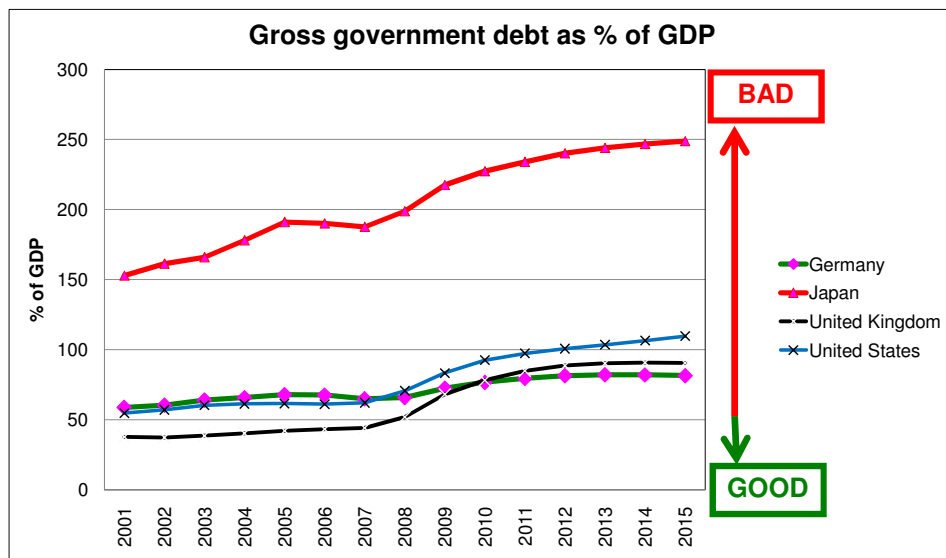
Shell energy scenario "scramble" to 2050, primary energy by source



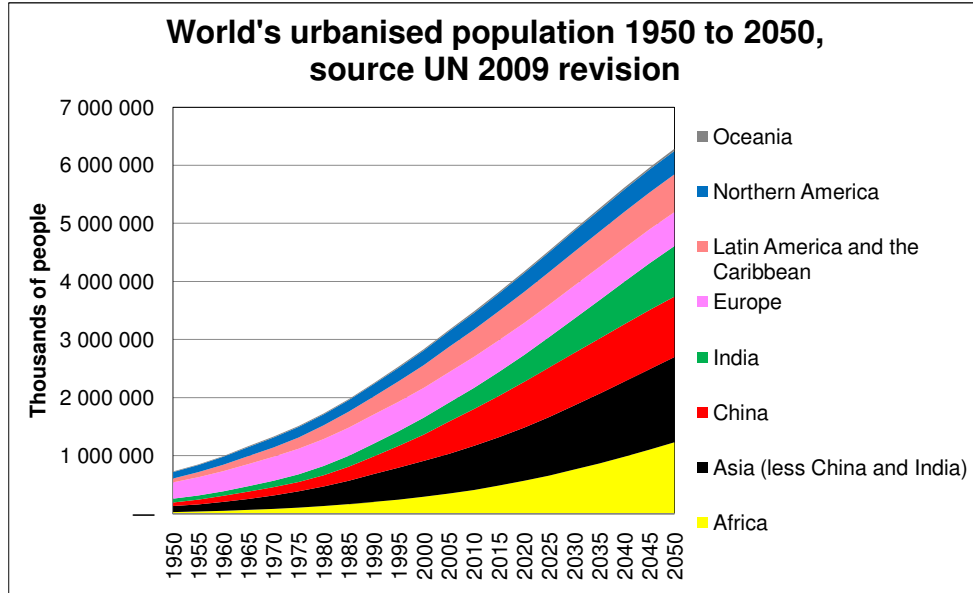
## Risks remain.....



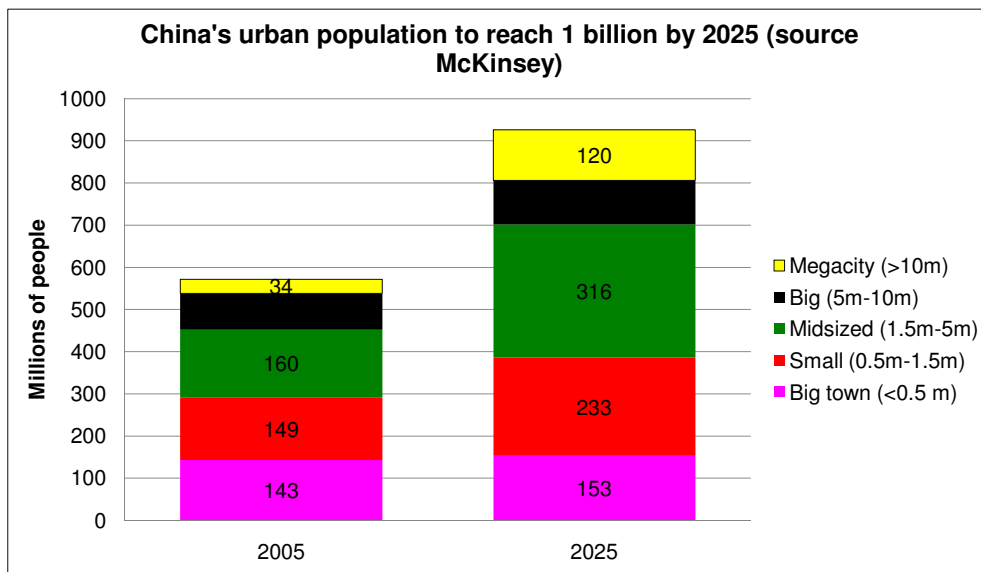
## Risks remain.....



## But the Structural Drivers of the Boom remain...

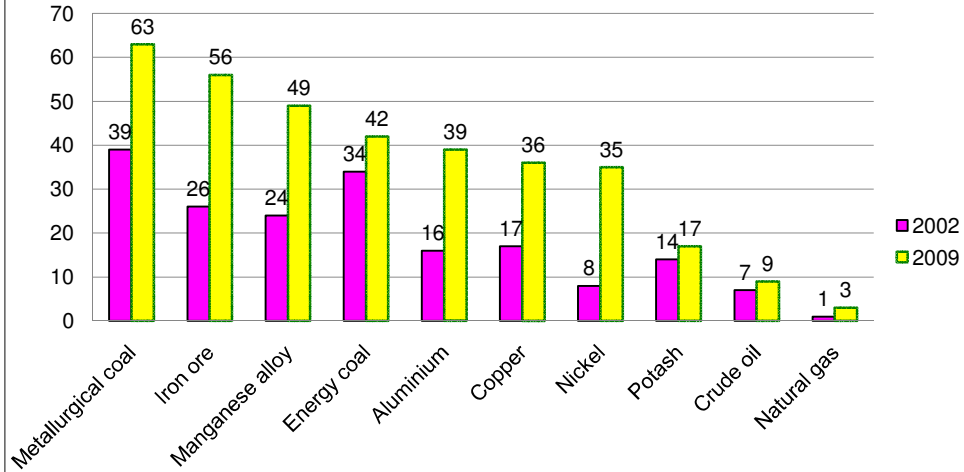


## Back to the Boom.....



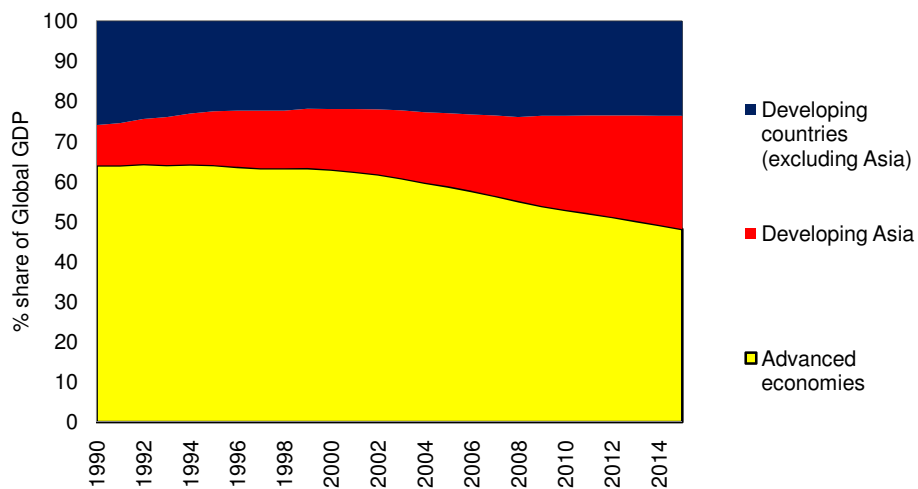
## Back to the Boom.....

**China's share of global commodity demand**  
(source: BHP Billiton)



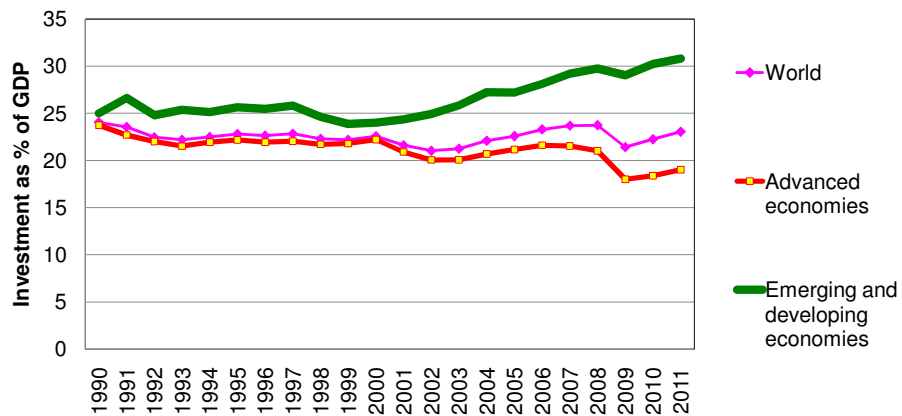
## Economic power is shifting to the East.....

**Composition of Global GDP, PPP basis,**  
(IMF WEO April 2010)



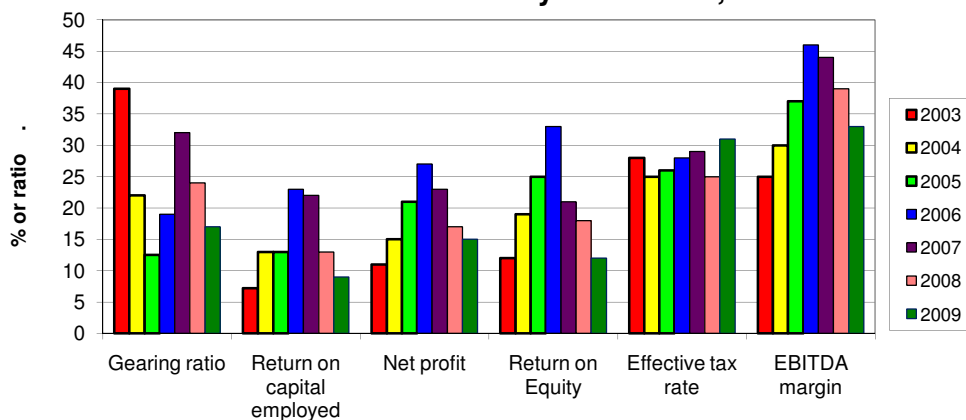
**Emerging economies must sustain high investment rates to accommodate urbanisation & industrialisation...**

**World investment trends, GFCF as % of GDP- (IMF WEO April 2010)**

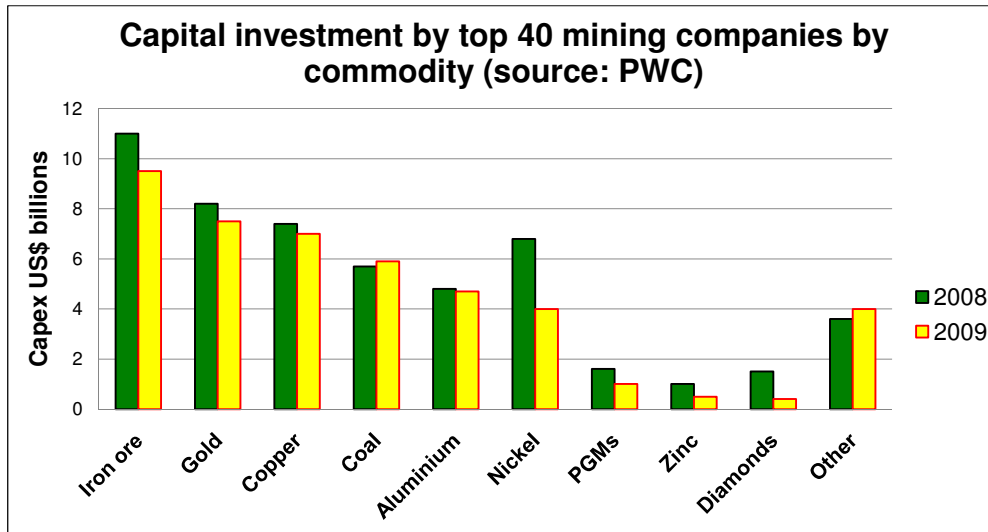


**World's top 40 mining companies have restructured balance sheets and are ready to grow.....**

**PWC Survey of top 40 mining companies "Mine: Back to the Boom" key indicators, 2009**



**Top 40 mining companies have sustained investment in core LT projects related to commodity boom.....**



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## **Role Of Mining Often Underestimated**

- **Key foundation industry (enabled SA to become the most industrialised country in Africa)**
  - **Large employer of semi-skilled and skilled workers**
  - **Critically important NET generator of FOREX**
  - **Significant multipliers into the rest of the economy (large procurement, investment and wage spender)**
  - **Equally important, very large magnet for foreign investment inflows (which help fund current account)**
  - **Significant contributor to transformation in the economy**
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## **Mining - The Essential Core Of SA Economy**

- **Creates 1 million jobs (500 000 direct & 500 000 indirect).**
  - **Accounts for about 18% of GDP (8% direct, 10% indirect & induced).**
  - **Critical earner of foreign exchange >50% (31% direct).**
  - **Accounts for 18% of investment (9% direct).**
  - **Attracts significant foreign savings (>30% of value of JSE).**
  - **~15%to 20% of corporate tax receipts (2008 R33 billion, 2009 R10 billion, 2010 R14 billion)**
  - **50% of volume of Transnet's rail and ports**
  - **93% of electricity generation via coal power plants**
  - **15% of electricity demand**
  - **About 37% of country's of liquid fuels via coal (R30 billion worth)**
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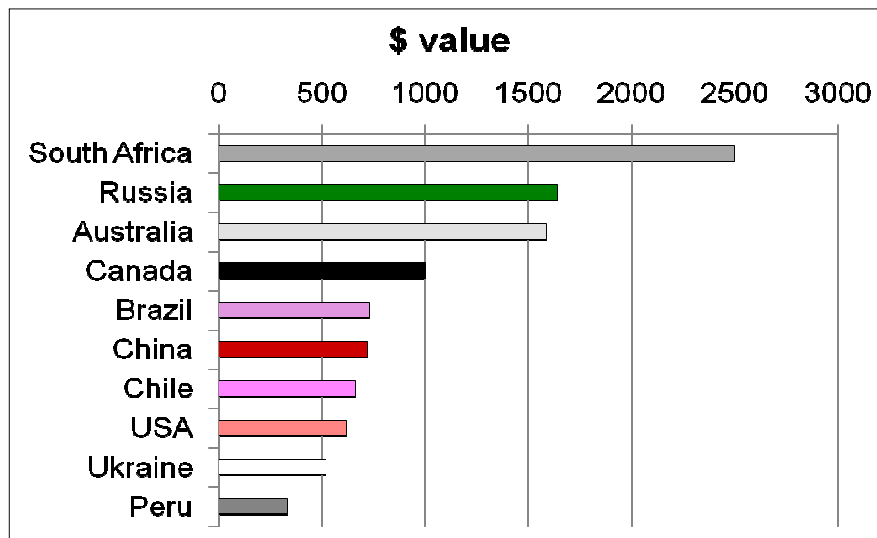
## Minerals & Metals in South Africa: A significant Value Added Cluster

**Mining is one of the most extensive and best developed South African industrial clusters**

- Extensive sciences & technology network/research
- Broad expertise in geoscience
- Large exploration expertise
- Large number suppliers of equipment and services
- World class educational and skills development systems and institutions
- Sophisticated financial institutions (JSE, banks, legal)
- Large scale smelting and refining.

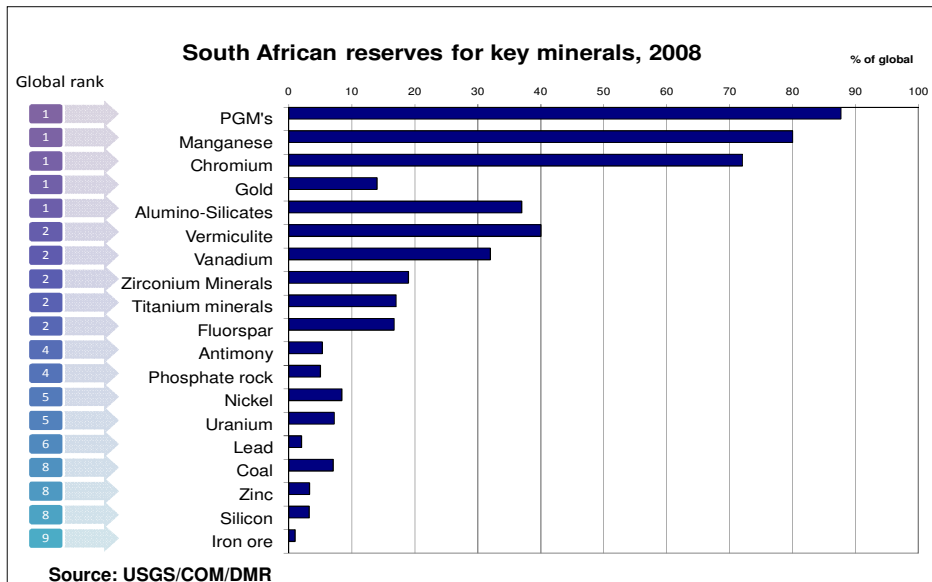


## Recent Citibank research note rates South Africa as the richest “in situ” mineral *resource* holder in the world:

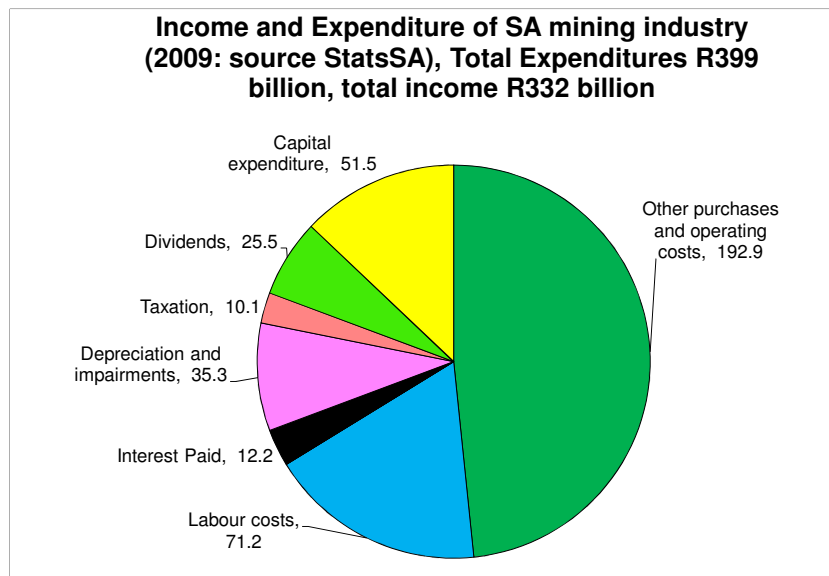


Source: Citibank

## SA has significant geological prospects.....



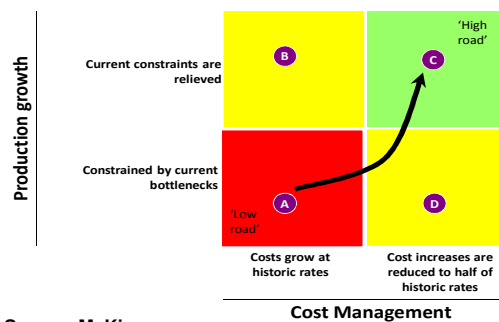
## A large share of the industry's expenditures are captured locally



**I.E. THE BENEFITS OF SOUTH AFRICAN MINING ARE MOSTLY CAPTURED LOCALLY!!**

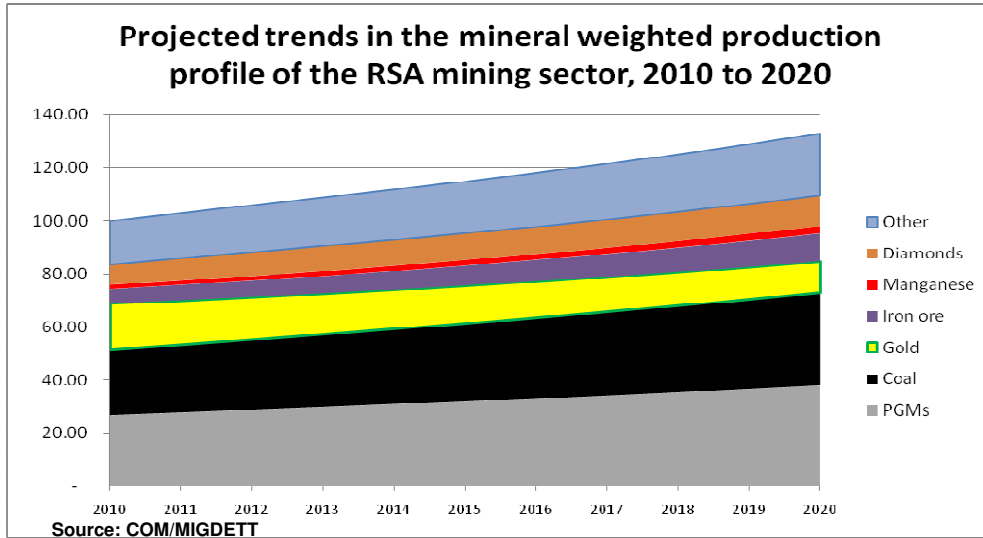
**A “high road” is very possible for South Africa’s mining industry.....**

**Two scenarios were developed for the forward looking scenarios**

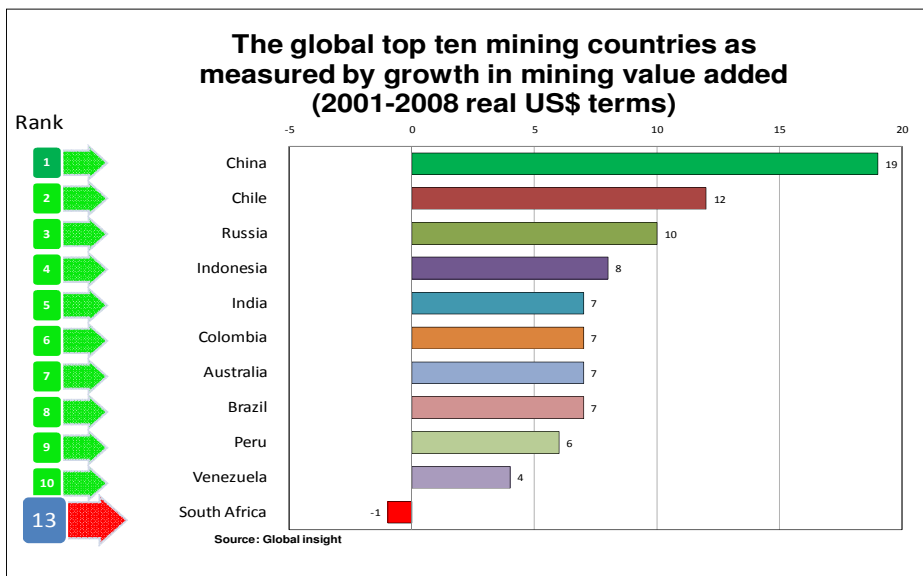


Source: McKinsey

For period 2010 to 2020, conservative modeling indicates that a 3.9% growth rate for the non-gold mining sector is realistically possible, with another >100 000 jobs possible.....

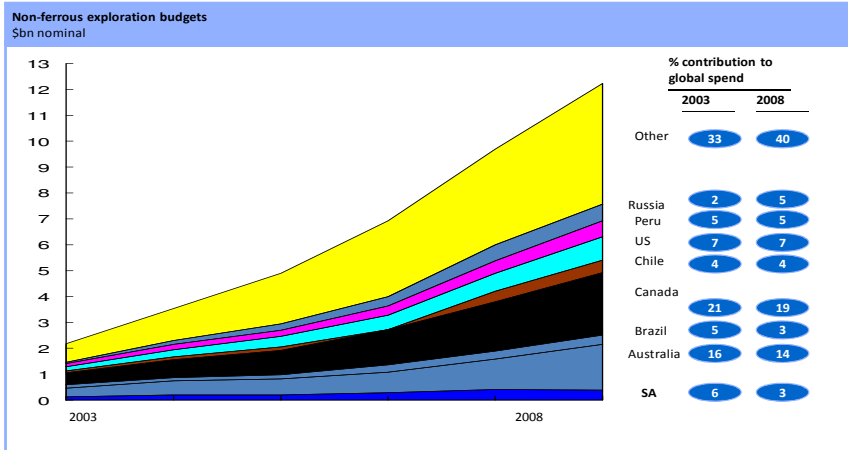


However, during the past commodity boom South African mining performed poorly versus its peers.....



## South Africa's share of global exploration spend has fallen

SA's contribution to global exploration expenditure has declined from 6 to 3% of global spend, between 2003 and 2008



SOURCE: MEG; McKinsey & Company analysis

## South Africa was unable to take advantage during the 2001 - 2008 commodity boom mostly due to domestic issues

### • Factors holding back the RSA mining sector's competitiveness

- Binding infrastructure constraints (electricity, rail,)
- Red tape constraints (e.g. water licenses)
- Policy uncertainty (changing the rules of the game)
- Mine closures for safety related issues (some valid, some not) -s54's
- Human capital constraints
- Stagnant productivity and rapidly escalating costs
- Volatility in rand-dollar exchange rate
- Then the global crisis hit

local

International

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## Mining Industry Growth, Development And Employment Task-team (MIGDETT)

Tripartite, leadership driven. Setup in December 2008.

- **Short-term mandate (2008/2009):** focus on limiting negative impact of global financial crisis on RSA mining sector.
  - **Long term mandate (2010-):** to reposition the industry for sustainable growth and meaningful transformation.
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## Agreement by tripartite MIGDETT leadership to develop “**Strategy For Sustainable Growth And Meaningful Transformation Of The South African Mining Sector**”

- To better understand the real potential of the RSA mining sector
- Unpack the competitiveness & transformation constraints
- Agree on a set of key priorities that need to be addressed
- Move to “**SA Inc**” approach
- Implement the agreed solutions

**SUBSTANTIAL WORK DONE IN PAST 14 MONTHS**

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## Assessing the competitiveness of the RSA mining sector

### •There are both

- Controllable factors** -infrastructure, regulatory environment, management efficiencies, etc.) and

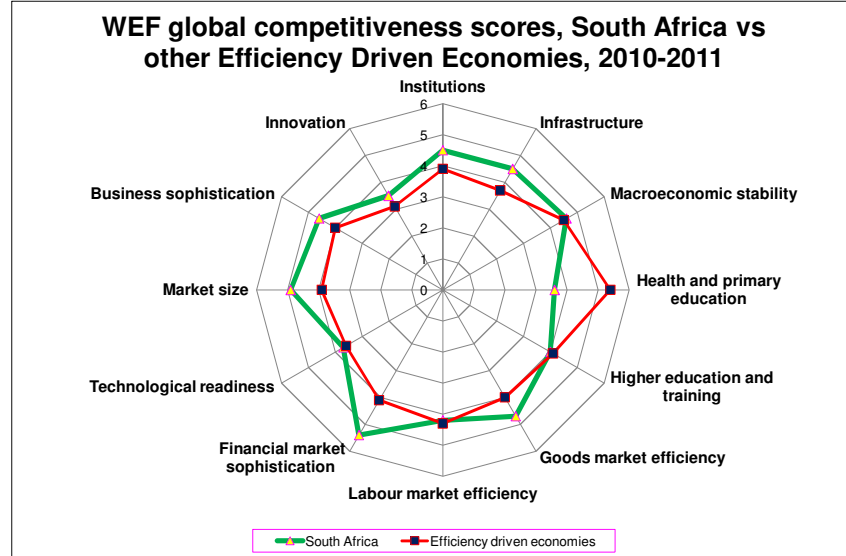
- uncontrollable factors** (geology, grade, location, etc),

### •that affect the competitiveness of the RSA mining sector.

### •The competitiveness assessment looked at six key areas:

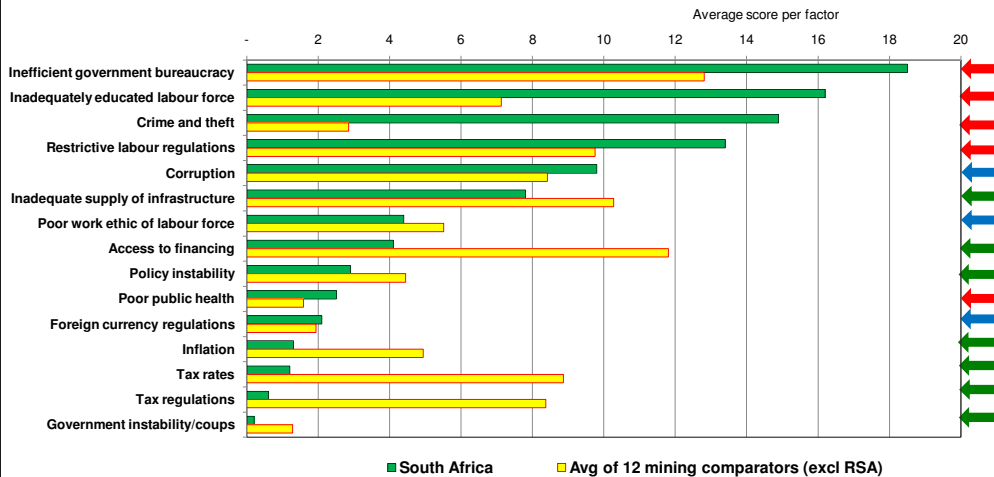
- General competitiveness
- Inherent potential
- Market context
- Product demand
- Regulatory environment
- Enabling factors

## At a general level South Africa ranked 54<sup>th</sup> most competitive economy in WEF 2010-2011 report out of 139 countries

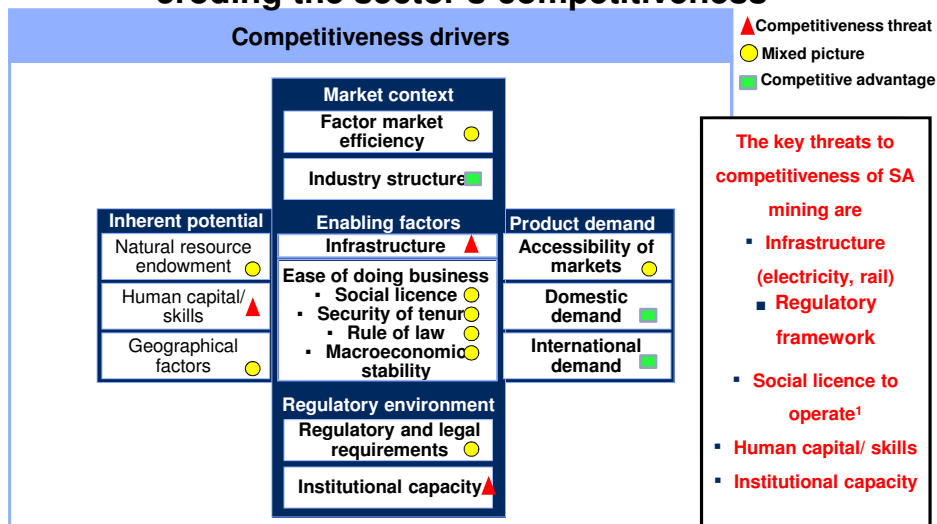


## RSA has some key advantages & disadvantages c.f. to 12 other key mining countries on problematic factors for doing business

WEF 2010-11, survey of most problematic factors to do business, South Africa vs average of 12 other key mining comparator countries



## The lack of growth is due to a combination of drivers eroding the sector's competitiveness



<sup>1</sup> Dealt primarily in sustainability and transformation workstreams  
SOURCE: McKinsey & Company

### Regulatory environment:

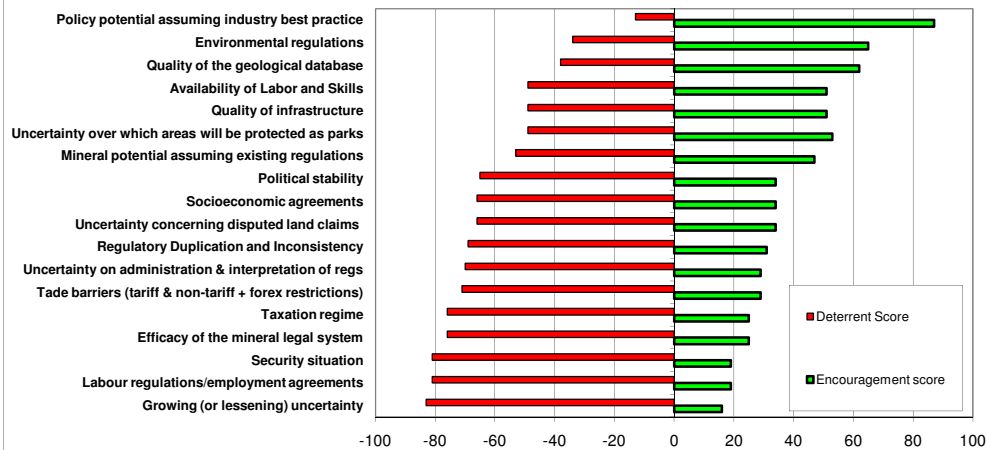
- General agreement that objectives of MPRDA of promoting a **sustainable, safe, environmentally responsible, growing & transformed industry** are NB and globally aligned.
- However, certain gaps in the mining laws, inconsistent application of the laws and long processing times have created uncertainty.
- Other regulatory areas have presented challenges (e.g. environmental permitting).
- The lack of a functioning mining cadastre system has compounded the negative perceptions about the regulatory framework.
- Recent court cases and the nationalisation issue are causing uncertainty.
- Despite the country's significant policy potential, it has slipped down the global rankings to position 67 out of 79 countries in the Fraser Institute Survey for 2011 for prospecting potential.

### UN survey of priority investment criteria for exploration and mining

Decision criteria	RANKING	
	Exploration Stage	Mining Stage
Geological potential of target mineral	1	N/A
Measure of profitability	N/A	3
Security of tenure	2	1
Ability to repatriate profits	3	2
Consistency and constancy of mineral policies	4	9
Company has management control	5	7
Mineral ownership	6	11
Realistic exchange regulations	7	6
Stability of exploration and mining terms	8	4
Ability to predetermine tax-liability	9	5
Ability to predetermine environmental obligations	10	8
Stability of fiscal regime	11	10
Ability to raise external financing	12	14

## Despite good potential, the current view of South Africa's investment environment is negative

### Frazer Institute Survey 2010/11 factors encouraging investment in exploration versus deterrents to investment for South Africa

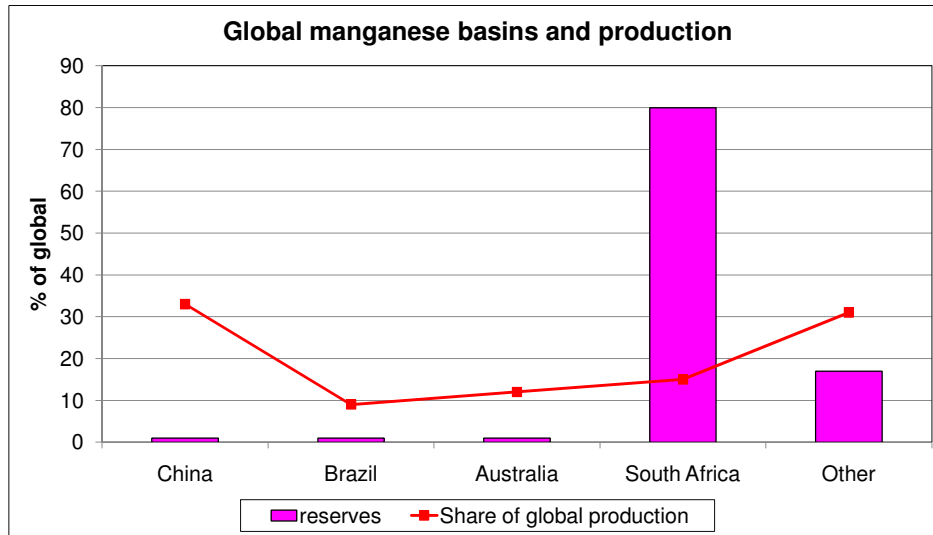


## Infrastructure challenges/opportunities:

### Example of Rail

- Only 13% of SA's freight is carried by rail, but more than half of Transnet's business is bulk commodities.
- High rate of derailments and collisions unacceptably high.
- Coal exports have fallen in the last five years as efficiencies on RBCT line & some supply challenges from mines affected exports.
- Cost effective rail capacity critically important for growth of the coal, manganese and ferro-chrome sectors.
- Getting rail right presents significant opportunities for unlocking growth in bulk commodities.

**Despite having 80% of the world's HG manganese, RSA accounts for only 15% of supply, rail is both a challenge & an opportunity**



### **Proposals to help SA Mining Industry Back on to Growth Trajectory**

- **Substantive tripartite declaration on 13 topics signed on 30 June:**
  1. Promoting growth and transformation
  2. Resolving infrastructure constraints
  3. Promoting innovation, productivity and cost competitiveness
  4. Promoting sustainable development in mining
  5. Encouraging greater beneficiation
  6. Improving the Regulatory framework
  7. Encouraging human resource development
  8. Promoting employment equity
  9. Facilitating mine community development
  10. Improving housing and living conditions
  11. Encouraging local procurement
  12. Broadening ownership and funding
  13. Monitoring and evaluation

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## PRESENTATION OUTLINE

Mining and minerals, integral to modern society

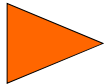
Brief history of mining

The global mining industry

Back to the “BOOM”

The South African Mining Industry

The future



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### MIGDETT Stakeholders have recognised challenges & are working on the appropriate solutions

- The MIGDETT stakeholders **recognise** the challenges.
- **Realistic** assessment of the constraints has been completed.
- **Work** is underway to resolve the constraints.
- By 2012 South Africa **will** start doing better on the global rankings (such as the Fraser Institute Survey).
- By 2014, MIGDETT **focus** is on getting South Africa back into top half.

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## **Substantial work is being done to get the “rubber” to “hit the tarmac”**

- **Sector growth strategy completed.**
  - **Mining now back on the top 5 sector priority list.**
  - **The regulatory task team is discussing amendments to MPRDA.**
  - **There is a review in DMR of problems on licenses.**
  - **The infrastructure task team is working on a matrix of infrastructure constraints per commodity.**
  - **Industry is cooperating with government on wide range of areas to promote competitiveness and growth.**
  - **The future is in our hands.....**
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## **Mining is now back on top 5 priority sector list of government (MIGDETT has played large role)**

- **All government Ministers need to indicate in their plans and performance agreements how they are going to assist the priority sectors.**
  - **Government is increasingly recognising the important role that mining does play and can play.**
  - **Government has recognised that the exchange rate is too strong.**
  - **Mining has the opportunity to turn around its recent slow growth performance.**
  - **The future is in our hands.....**
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**We have a Vision of a**

**Vibrant, growing, transforming mining sector that helps contribute substantively to growing the economy, reducing unemployment and making South Africa a better place for all**

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**MINING AND MINERALS MATTER FOR THE GROWTH, DEVELOPMENT AND TRANSFORMATION OF SOUTH AFRICA**

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