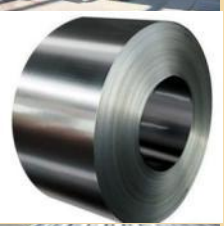




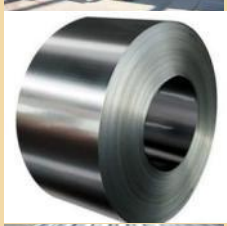
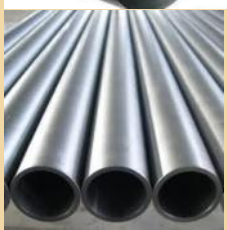










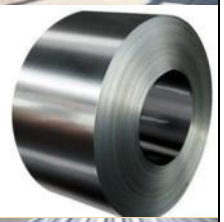
The Interface Between Mining and Manufacturing: Beneficiation?

Paul Jourdan
IDC, Sandton, August, 2013



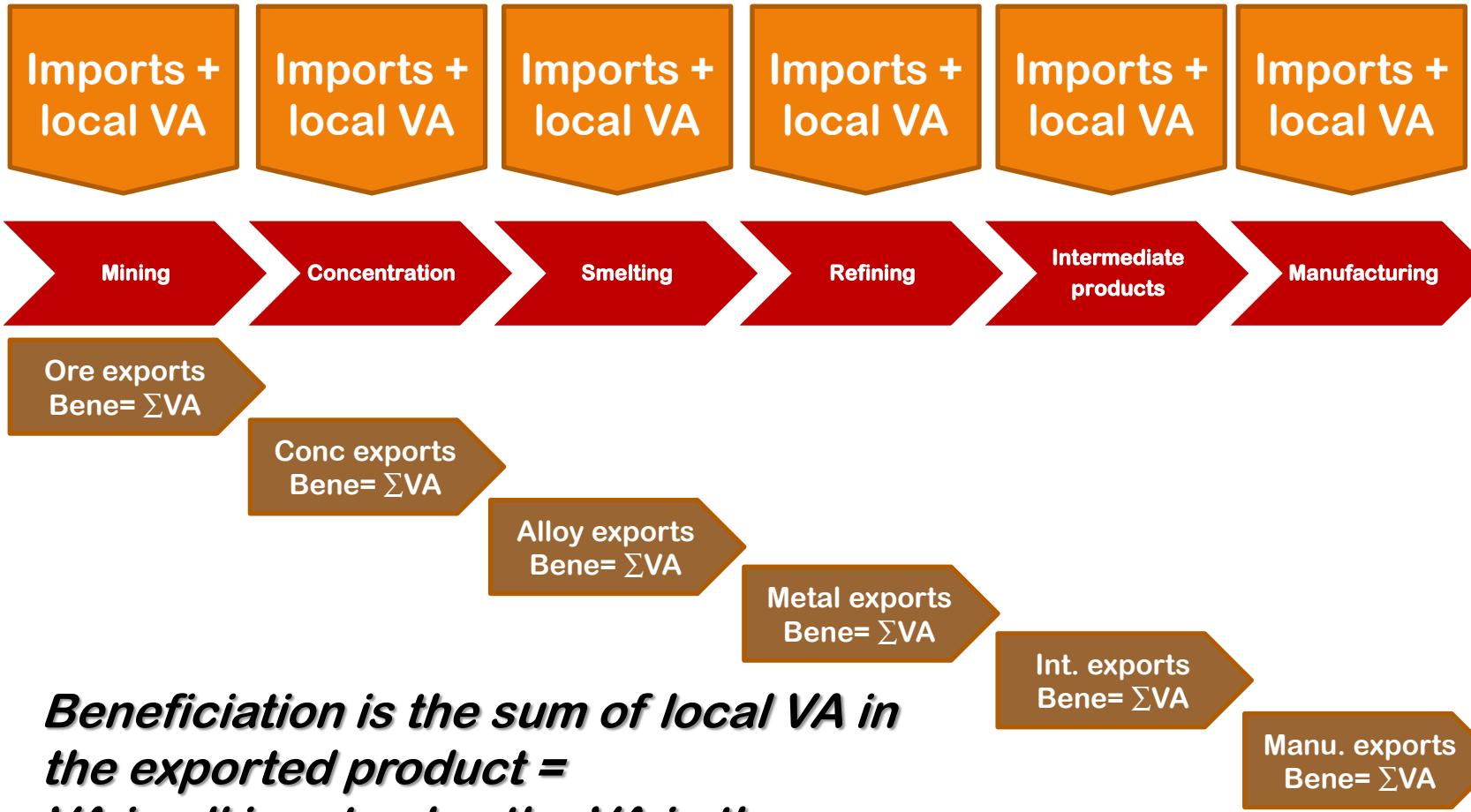







What is Beneficiation?

- **Narrow definition:**
  - Value-added above a "base" state (ore, conc, metal)
- **Broader definition:**
  - Total domestic value-addition (excluding all imported inputs)

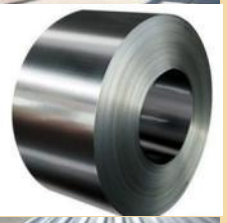


Beneficiation is the sum of local VA in the exported product =
VA in all inputs plus the VA in the process.
= both backward and forward linkages










However,

In addition to the beneficiation embodied in the final exported product (∑VA = all up/downstream VA), there is also *indirect "beneficiation"* to the wider economy through building the national factor & infrastructure endowments.

Justin Lin argues that "*a developing country can change its industrial and economic structure by changing its endowment structure*" consisting of both its factor endowments (land/natural resources, labour, and physical & human capital) and its infrastructure endowments: both hard/tangible infrastructure and soft/ intangible infrastructure (institutions, regulations, social capital, value systems, etc.).

Thus, indirect beneficiation in the wider economy includes:
- **Building the knowledge linkages (human capital & tech)**
- **Building the spatial linkages (hard infrastructure)**

However, in order to change the factor and infrastructure endowments, the resource rents need to be reinvested in building them. = *Fiscal Linkages*

The MVC "cluster"
= the 5 key beneficiation *linkages*

Use depleting assets to change national endowment structure

1. FISCAL: Capture & invest of resource rents (RRT) in long-term economic physical & human infra (inter-generational)

2. SPATIAL
Puts in critical infra-structure to realise other economic potential & could stimulate LED

3. BACKWARD
Inputs: Capital goods, consumables, services, (also export)

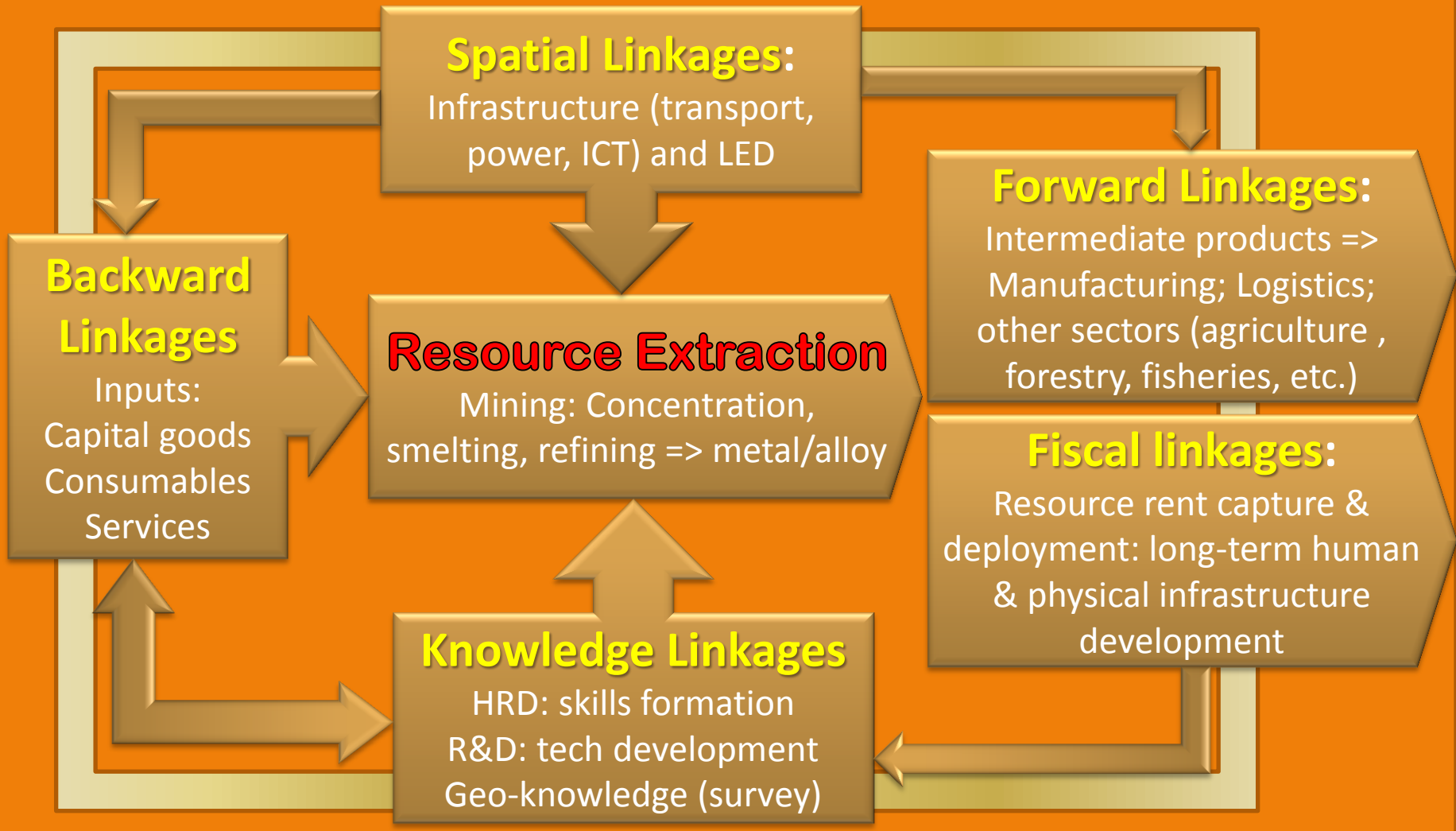
4. KNOWLEDGE Linkages (HRD & R&D):
"Nursery" for new tech clusters, adaptable to other sectors

HRD, R&D

5. FORWARD
Value-addition: (beneficiation) Export of resource-based articles

Narrow "beneficiation" = forward linkages;
Total product beneficiation = back- & forward linkages (∑VA),
Total economy-wide beneficiation = all the linkages

The MVC "cluster" (Mineral Linkages)



Knowledge linkages are a <u>prerequisite</u> for developing the crucial back/forward beneficiation linkages!

Catalyse other Sectors & areas (agri, tourism, etc.)

Linkages Recap:

Infrastructure: transport, energy, skills (SDP)

Exploitation capital goods:
e.g. plant, equipment, after-ma

Processing

Intermediates

BEYOND COMMODITIES?

Use Asian resource demand to kick-start an integrated Resource-based Development Strategy

Exploitation services:
e.g. financial, technical, consumables, logistics, energy, skills, etc.

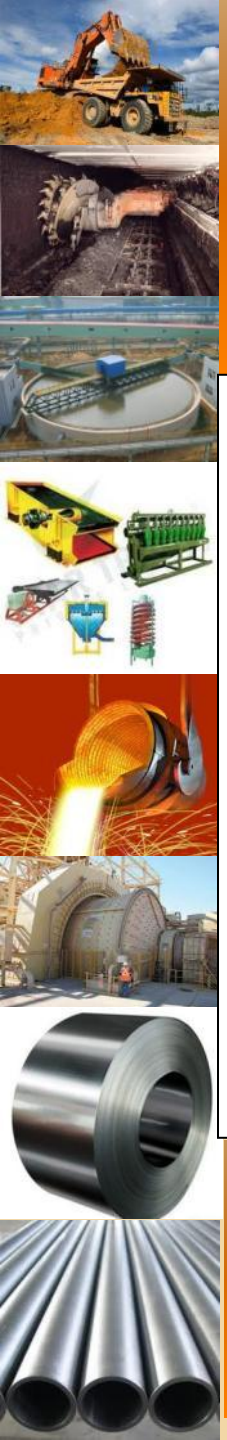
Processing services

Intermediates services

Feedstock (bene.)

Manufacturing (e.g. cap goods)

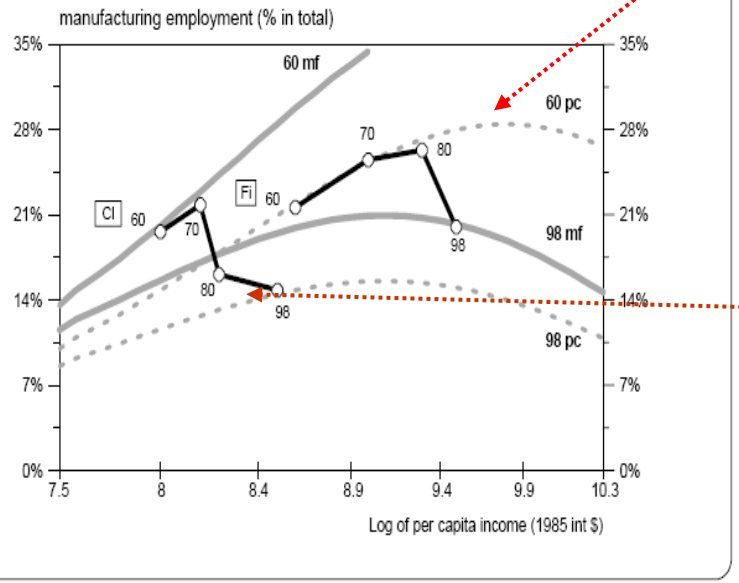
Resource inputs key to diversification (e.g. Nordics)



The resource curse can be avoided!

"Deepening" the resource sector linkages: *development of the resource inputs & outputs industries is critical , but requires the development of a resources tech capacity!*

B. Finland & Chile: an 'anti'-Dutch disease and a Dutch disease industrialisation?



Finland: 1970 on primary commodities (pc- mining & forestry) inverted U-curve, but shifts to 1998 manufacturing curve (mf- resources inputs & outputs/beneficiation).

Chile: 1970 on manufacturing U-curve (ISI), but shifts to 1998 primary commodities (mining & agriculture) curve, after opening up its economy (coup) in the 70's.

Finland managed to shift from a 1970 resources (pc) trajectory to a 1998 manufactures (mf) trajectory, through the development of its resources inputs (machinery) and outputs (value-addition) sectors (source Palma, G. 2004)

Using a *natural comparative* advantage to develop a *competitive advantage*

Finland: The mature forestry industrial cluster 1997[a]

BACKWARD LINKAGES

1. **Specialized inputs**
   Chemical and biological inputs (for production of fibres, fillers, bleaches)
2. **Machinery and equipment**
   For harvesting (cutting, stripping, haulage)
   For processing (for production of chips, sawmills, pulverization)
   For paper manufacture (30% of the world market)
3. **Specialized services**
   Consultancy services on forest management
   Research institutes on biogenetics, chemistry and silviculture

NATURAL COMPARATIVE ADVANTAGE

Abundant forestry reserves and plantations
(400-600m^3 per capita)[b]

SIDE LINKAGES

Related activities

Electricity generation
Process automation
Marketing
Logistics
Environment industries (paper)
Mining (sulphuric acid)

FORWARD LINKAGES

1. **Roundwood**
   Sawnwood
   Plywood (40% of the world market)
2. **Wood products**
   Furniture
   For construction
3. **Wood pulp**
4. **Paper and cardboard**
   Newsprint
   Art paper (25% of the world market)
   Toilet paper
   Packaging
   Special products

Source: Ramos 1998 p111 (CEPAL Review, #68, 12/1998);

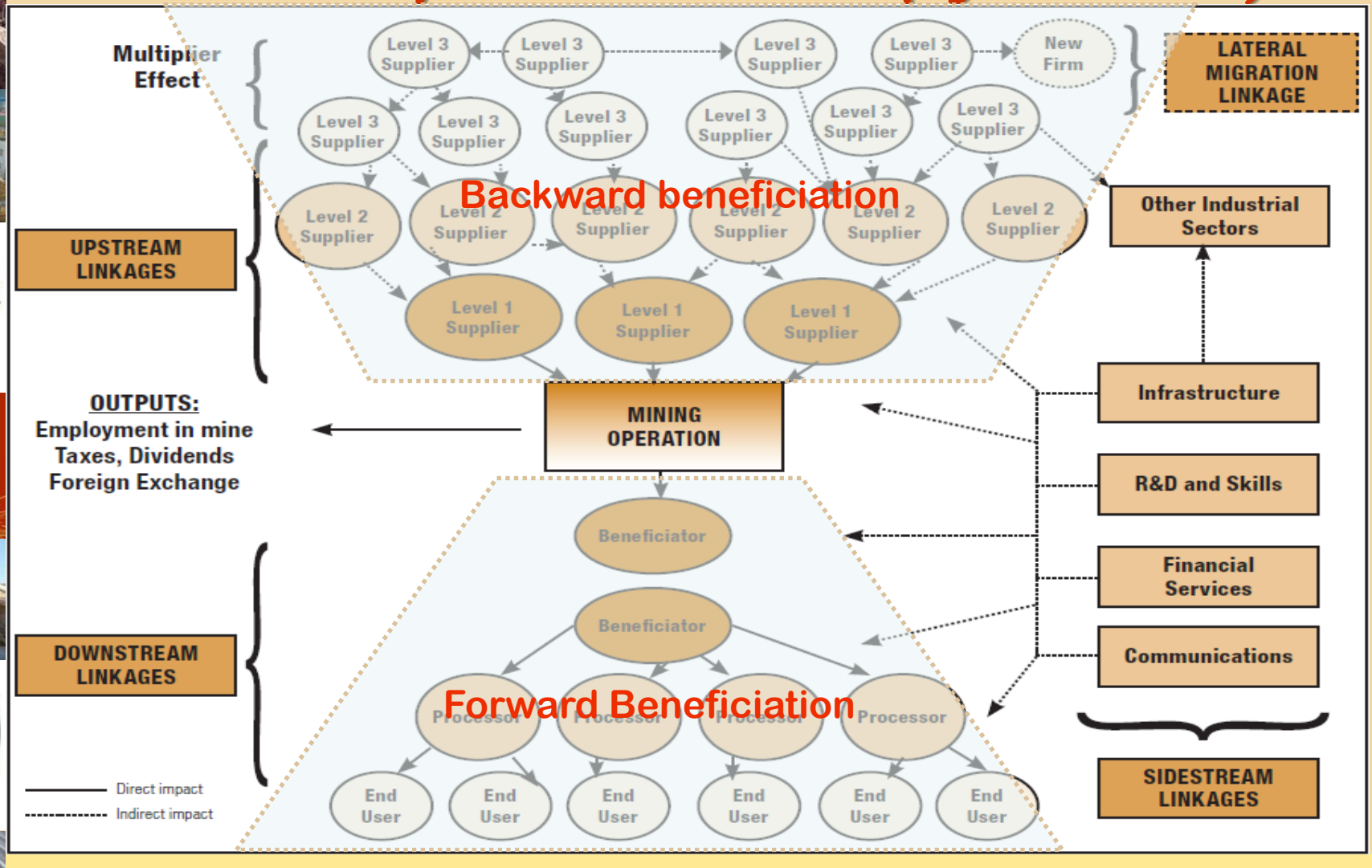
a: Generates 25% of Finland's exports;
b: Compared with 25-30m3 per capita in the rest of the world.
(SA has a similar comparative advantage in minerals)








Linkages in the SA PGM industry and the relationship between firms (Lydall 2011)

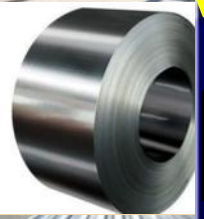


However, in SA the linkage sectors only provide ~1 job for every mining job (CoM), cf 1:3 in Finland





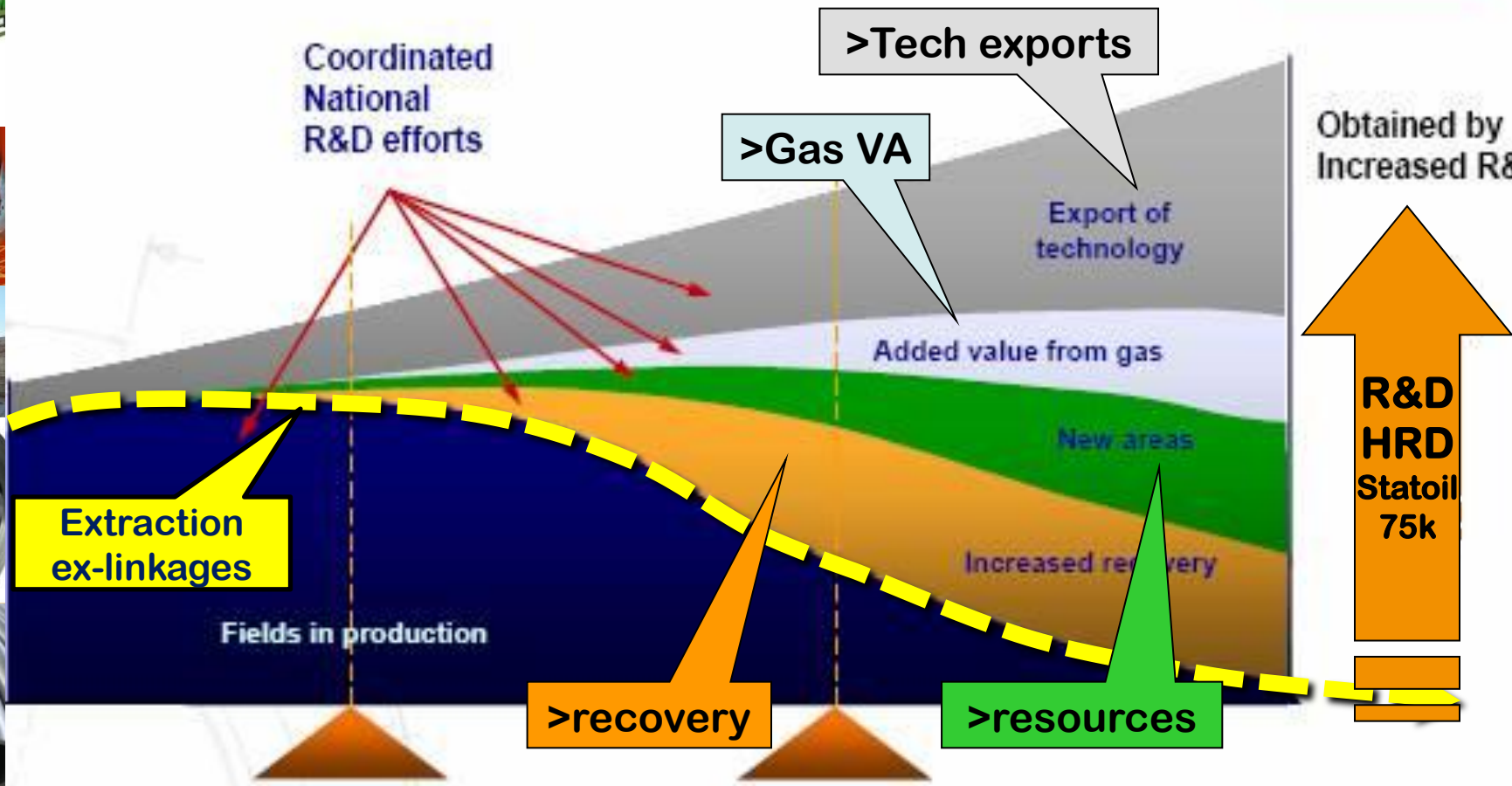





e.g. HC Development Strategy:

(Norway: OG21 tech strategy)

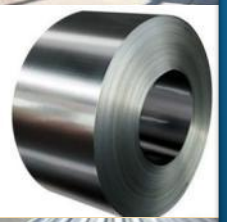
Prolong the life of the resources, migrate to exports of resource techs and value-added products: *survive beyond resource depletion!*



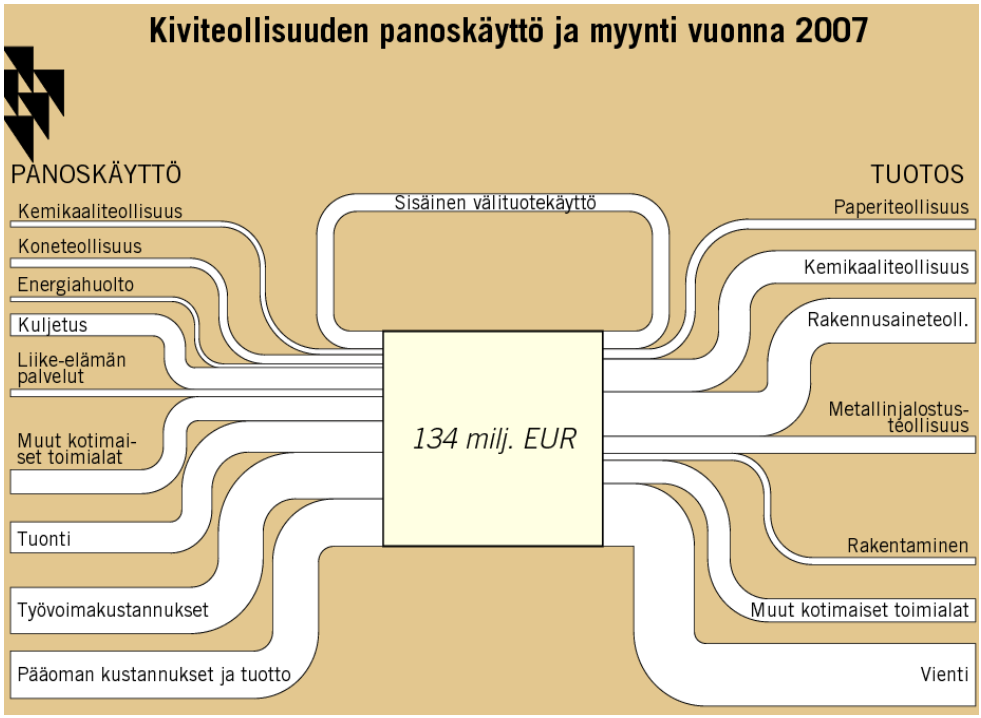









Finland: Minerals Sector Purchases and Sales 2007



INPUTS
Chemicals industry
Machine industry
Energy Supply
Transport
Business services
Other sectors
Imports
Labour costs
Cost of capital

OUTPUTS
Paper Industry
Chemicals Industr
Building materials Industry
Metals Processing Industry
Construction
Other domestic sectors
Exports

In 2011 The Research Institute of the Finnish Economy (ETLA) completed a major study on the broader economic impact of their minerals sector and showed a 6:1 employment generation (50% abroad) in other upstream and downstream industries, due to their well-developed mineral linkages.

Tech Development (VTT) and STEM skills were seminal to developing the inputs cluster








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

expl. capital goods
- *geophysical*
- *drilling*
- *survey*
- *etc.*

mining capital goods
- *drilling*
- *cutting*
- *hauling*
- *hoisting, etc.*

processing cap. goods
- *crushers/mills*
- *hydromet plant*
- *materials handling*
- *furnaces, etc.*

Refining Cap. Goods
- *Smelters*
- *Furnaces*
- *Electro winning cells*
- *Casters*

Fabrication Cap.goods
- *Rolling*
- *Moulding*
- *Machining*
- *assembling*

Exploration → **Mining** → **Mineral Processing** → **Smelting & Refining** → **Fabrication (manufacturing)**

exploration services
- *GIS*
- *analytical*
- *data processing*
- *financing*
- *etc*

mining services
- *mine planning*
- *consumables/spares*
- *sub-contracting*
- *financing*
- *analytical, etc*

processing services
- *comminution*
- *grinding media*
- *chem/reagects*
- *process control*
- *analytical, etc*

Refining services
- *Reductants*
- *Chemicals*
- *Assaying*
- *Gas & elec supply*

Value adding services
- *Design*
- *Marketing*
- *Distribution*
- *Services*

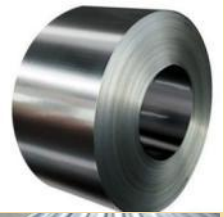
Resources inputs sector (up-stream) has a comparative advantage in:

1. ***Relatively large local market***
2. ***Development of techs for local conditions***
3. ***National asset: permits for concessioning with strong linkages conditionality***



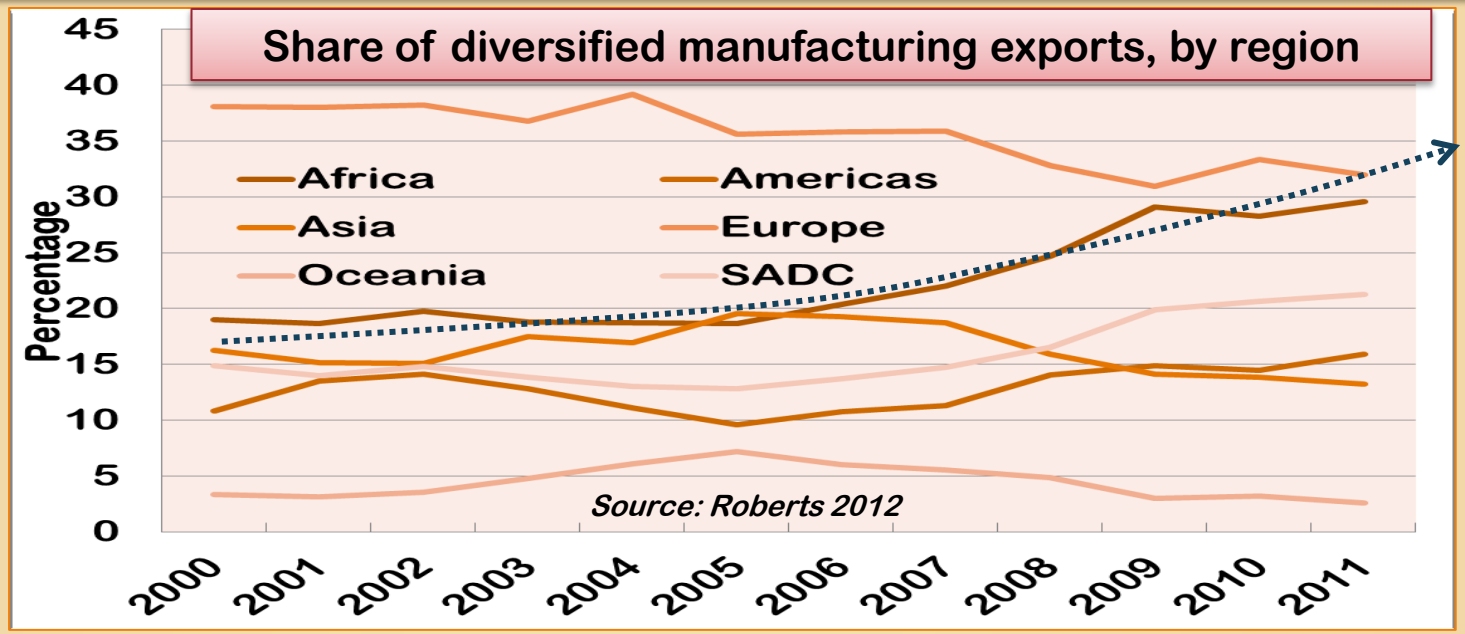


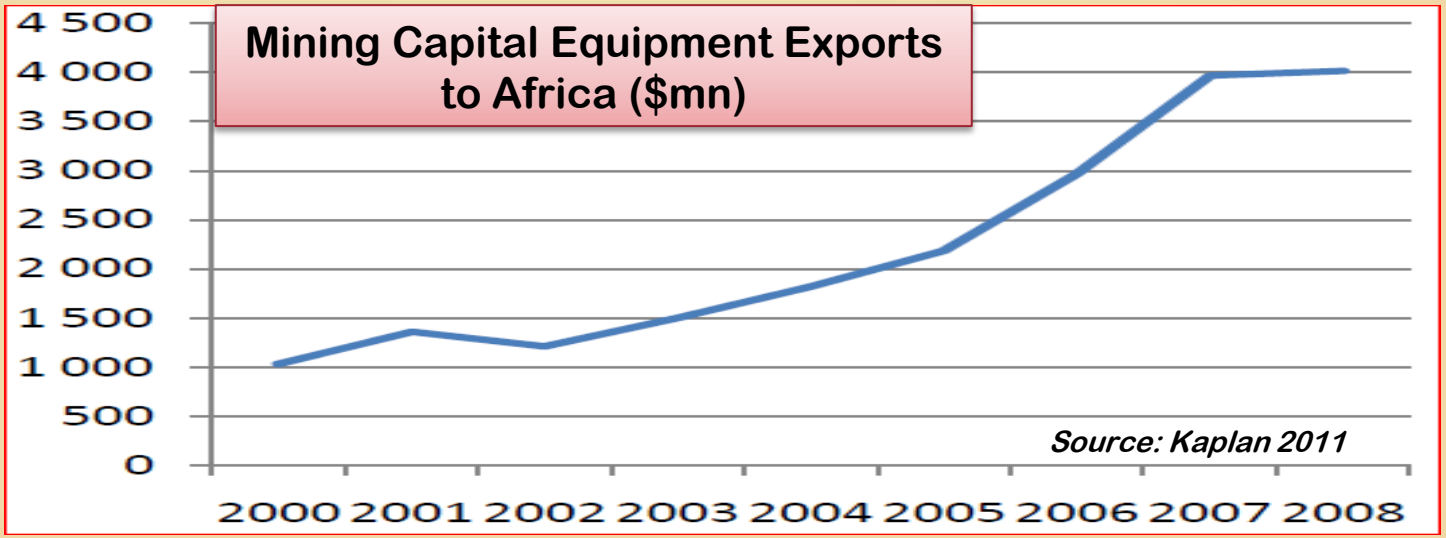





Backward (upstream) Value Addition (Inputs)

Economies of Scale (exports) are critical to growing mineral inputs



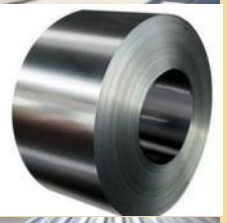


Note that this excludes mining based services. The export of mining-based services is extensive and growing very rapidly.

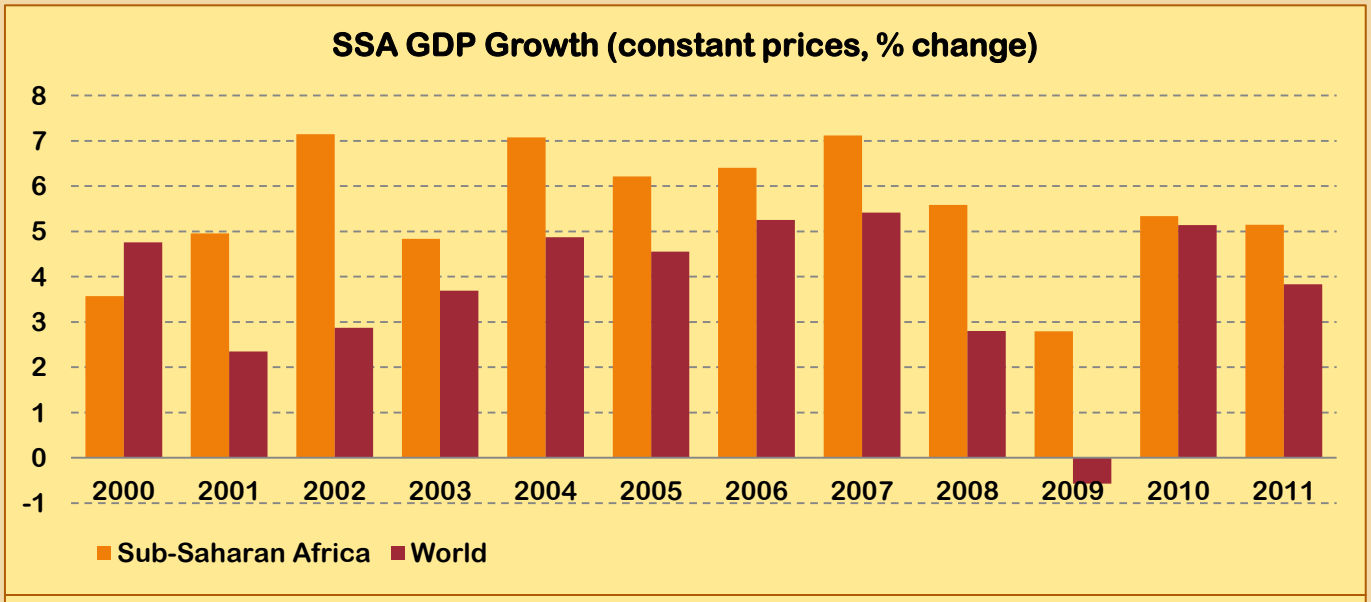









Markets: Sub-Saharan Africa & World GDP Growth

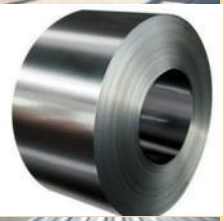


Regional Trade Strategies are Critical to Growing the Backward MVCs









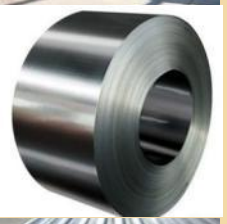

Putative policies to grow the interface (local content & beneficiation)

- Discipline IPP (steel, polymers, etc.) abusers (ComCom, MPRDA, IPP/EPP compensation;
- Introduce a RRT of 50% after ROI >15% and deploy on STEM skills, tech development (R&D) geo-survey, regional trade infrastructure.
- Offset RRT rate against degree of VA above “base state”
- Amend the MPRDA to include linkages milestones in mining concession (license).
- Make local content commitments a bid variable with significant weighting (30%?) for all new competitive mineral concessions (auctions);
- Re-establish a national mining tech R&D capacity (ex-COMRO) as a PPP
- Establish a Mining inputs industrial cluster of national private sector (cap goods, consumables, services) state (DTI, DMR, EDD and DST), HRD/R&D (HEIs, Sci-Councils) to jointly develop comprehensive industrial sub-sectoral strategies to grow the mineral inputs sectors including the use of instruments such as tariffs, investment incentives, innovation stimuli, market access, access to finance, competitive inputs (subsidies), tech development, etc.
- Task the nascent SMC and IDC with developing appropriate capital goods, with the private sector and technology institutions.
- Establish “Beneficiation SEZs” e.g. The mooted “PGM SEZ”?
- Develop Regional Trade Strategies for growing mining inputs markets










Way Forward?
Mining Inputs Sub-Cluster?

- STEM skills: HEIs-FETs, etc.
- Tech Dev: Science Councils, HEIs, etc.

- Govt: DTI, DST, DMR, EDD/IDC, DPE, Treasury
- Strategies-Policies-Instruments

Infrastructure: Skills-R&D-Transport-energy-ICT

Incentives: capex, opex, exports, SEZ?

Trade: Defensive

Tariffs, taxes, local content, etc.

Trade Access

Feedstocks: Steel-polymers-base metals, etc.

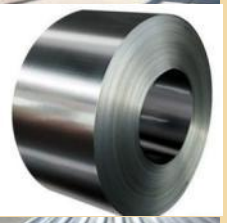
- Associations: SEIFSA, ECSA, etc

Inputs industries: Capital goods, consumables, services










Mining Inputs Sub-Cluster: Policies & Implementation

Mining Inputs Cluster → MIC Sub-sector Strategies → MIC Policies

Laws → Regulations → MIC Instruments

Infrastructure

Finance

Skills/Tech

Prod-uction → >local content > exports








Thank You

paulj1952@gmail.com