The role of macrologistics in industrial development: Infrastructure and policy

- Jan Havenga

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvennoot • your knowledge partner

Key messages

- Macrologistics enable systemic choices for infrastructure and policy
- The premise is the same as for micrologistics – without cost data we are blind
- South Africa has macrologistics challenges
- We now have the instrumentation/experiments to assist with these challenges
- This work has been used widely, although sadly so, not much by the DoT
- We've exported to India, are working in Vietnam and possibly China soon
- We have illustrative case studies
- Future challenges will require more of macrologistics

Discussion points

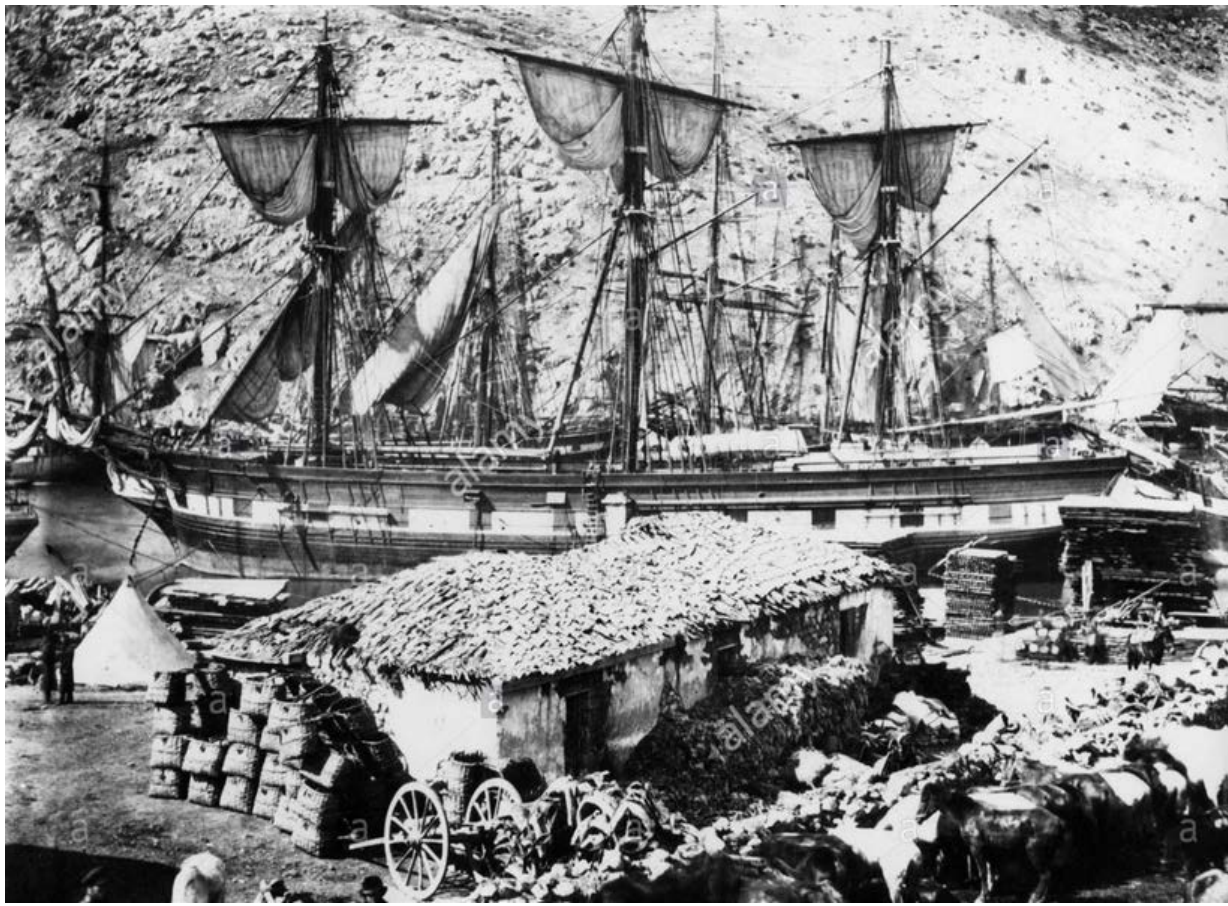
The rise of Macrologistics

South Africa's Macrologistics status

South Africa's Macrologistics improvement opportunities

Examples of Macrologistics in practice

The future of logistics




VESTA

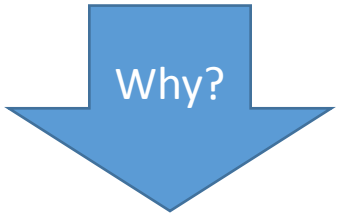

Shell


10c


10c
10c
10c
10c
10c
10c

The lower level definition of logistics

- Transport
- Storage
- Management and administration
- Opportunity cost of holding inventory



- Because the fuel is not available where and when needed
- We also talk about a time and place discrepancy

Logistics provide time and place utility

The strategic or firm level view of logistics

	Ocean delivery	Road delivery
Transport	R 3 600 000	R 18 000 000

The transport cost for road delivery is 5 times more, but the total logistics costs only half

Logistics is an input into a system that produces value

Inputs
Flour
Yeast
Sugar
Salt
Water

By the time that the average product in South Africa is consumed 50% of the cost is logistics

Like all inputs the objective is to minimize

We want to keep the cost of the ingredients as low as possible

We want to keep the cost of the other production factors as low as possible

Minimising the cost of each element is not enough. We need to understand costs

This can be done for an entire economy

Discussion points

The rise of Macrologistics

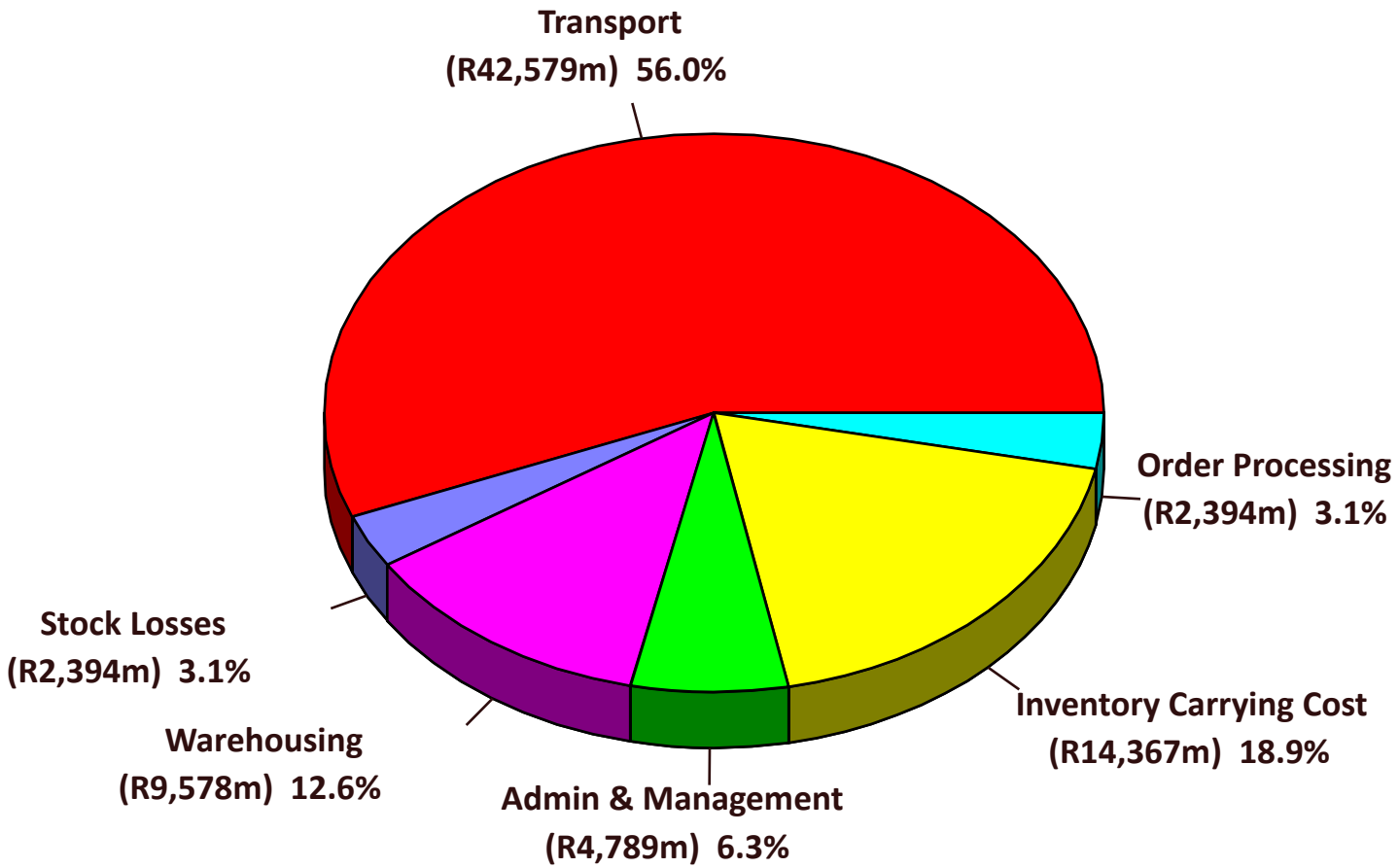
South Africa's Macrologistics status

South Africa's Macrologistics improvement opportunities

Examples of Macrologistics in practice

The future of logistics

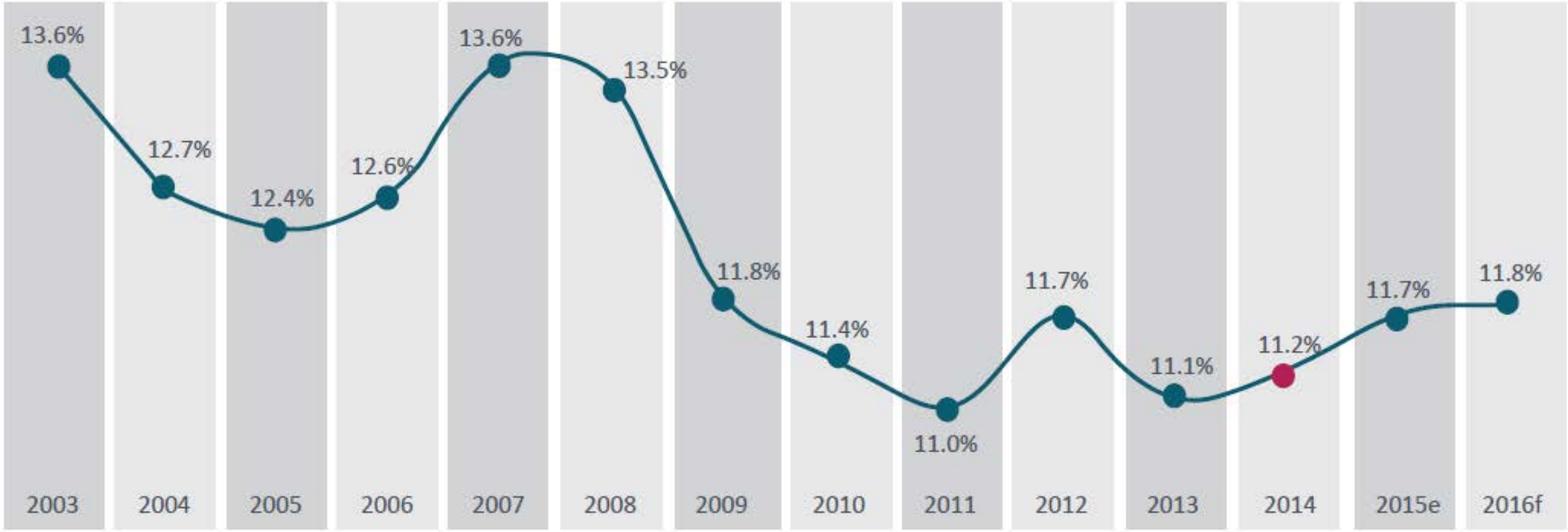
Logistics costs for South Africa in 1996



Total logistical cost = R76,101m (18% of GDP)

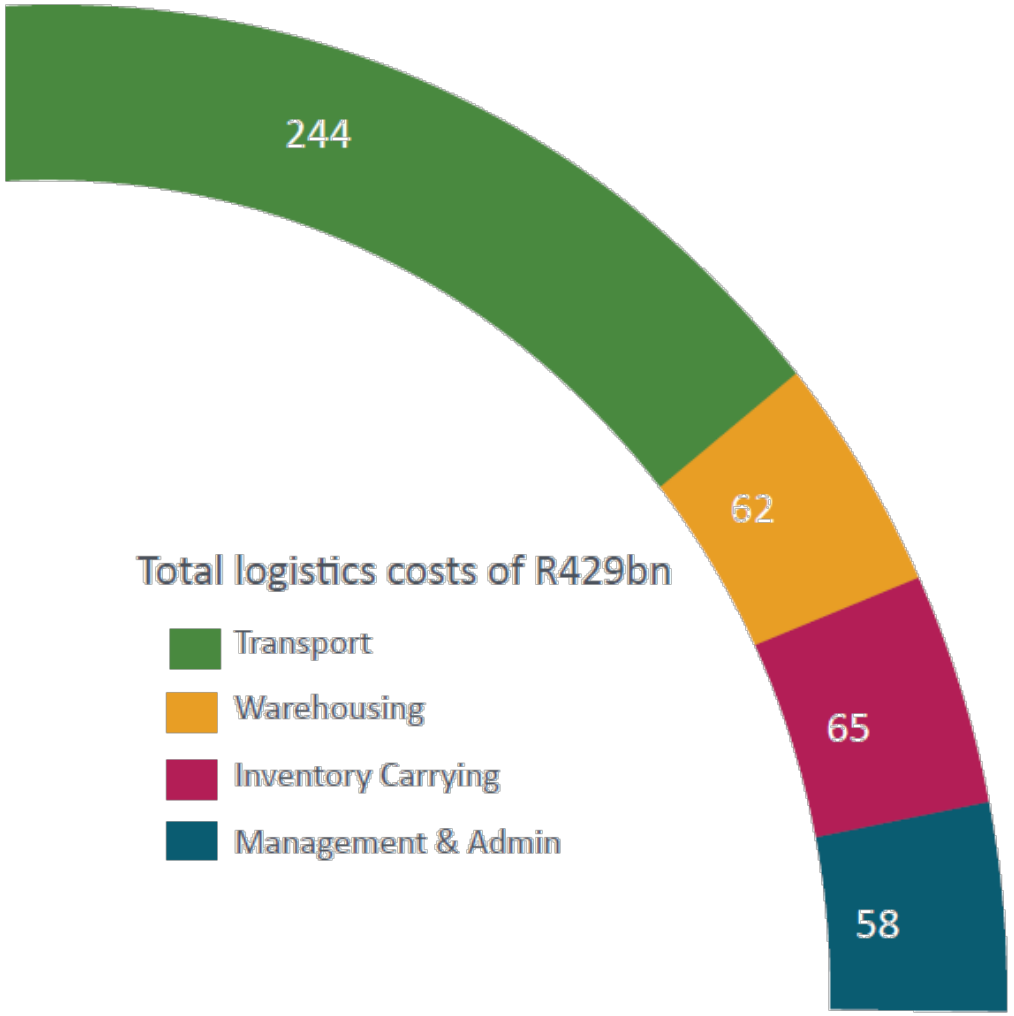
South Africa's input – output relationship over the last decade

- Logistics costs as a percentage of GDP

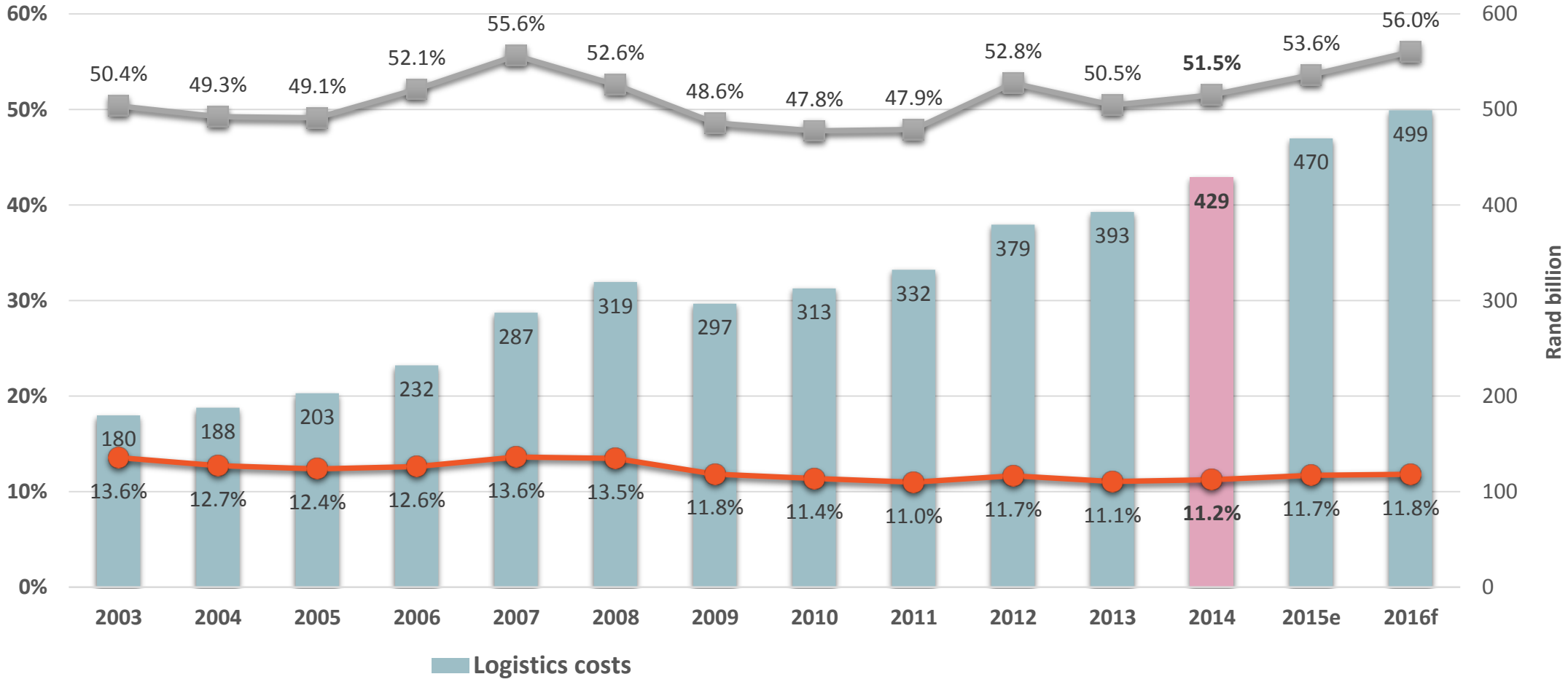


Our macrologistics position improved up to 2011, but has since deteriorated

Transport costs is still the biggest contributor



In 2016 costs will touch a half trillion Rand



But this relationship is still a functional view. Decision informing trade-offs are not possible

Discussion points

The rise of Macrologistics

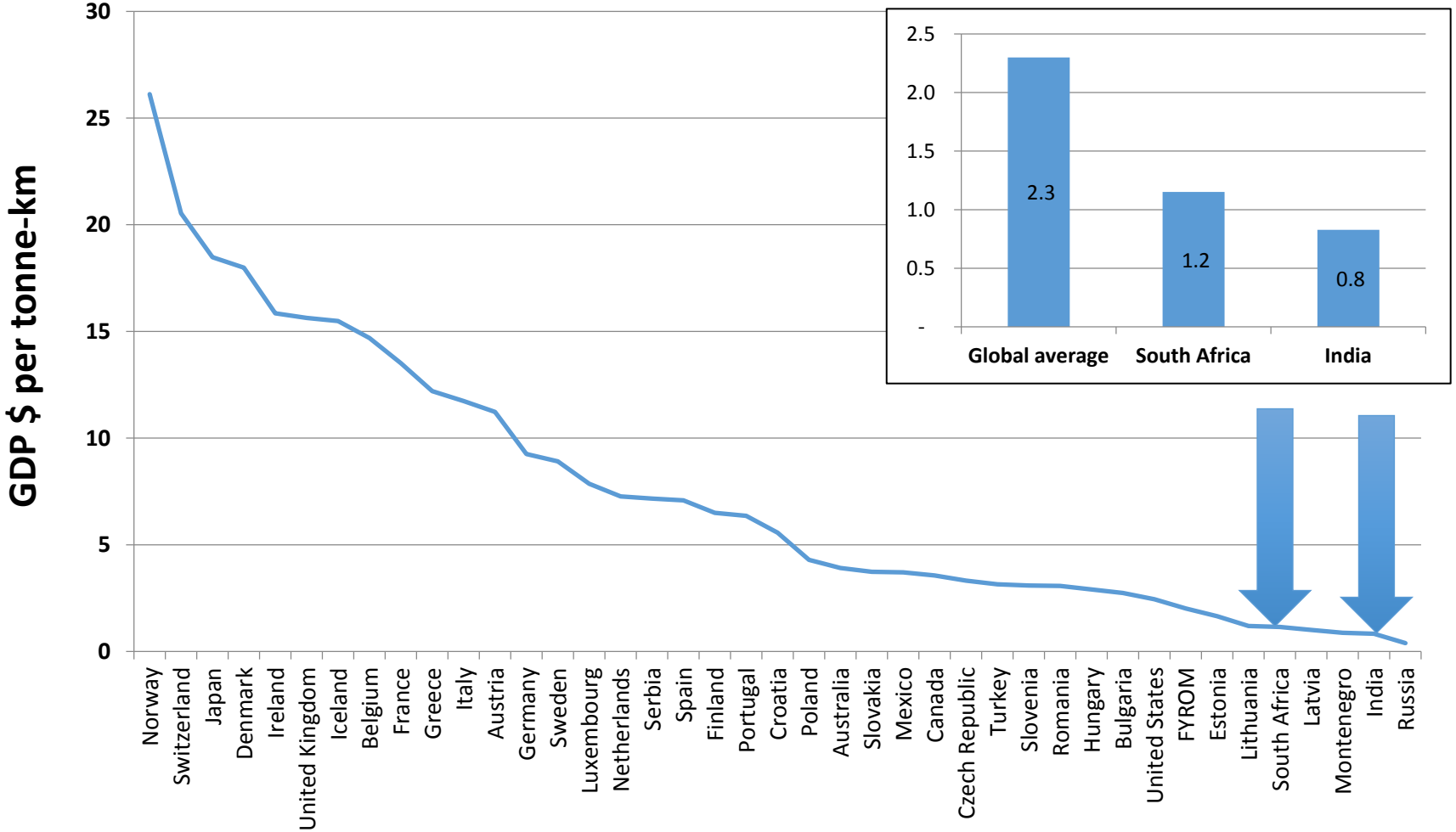
South Africa's Macrologistics status

South Africa's Macrologistics improvement opportunities

Examples of Macrologistics in practice

The future of logistics

Understanding demand and supply. Spatial challenges in all BRICS countries



What causes high logistics costs?

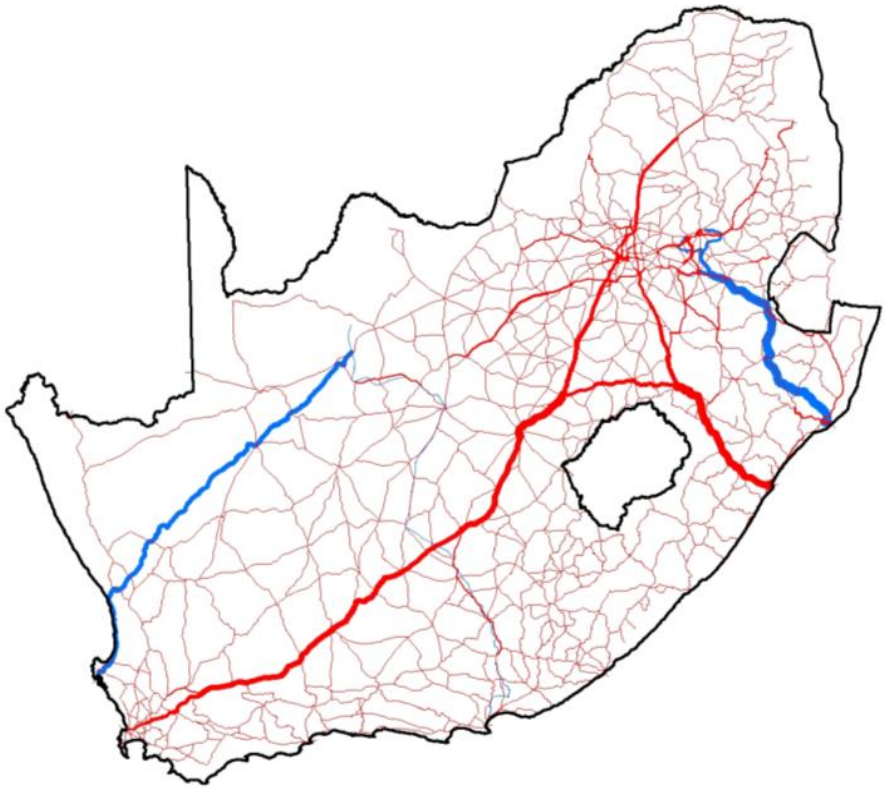
- High demand for logistics relative to value added
  - Spatial
  - Lack of beneficiation
  - Excessive choice

- Expensive or inefficient supply
  - Modal choice
  - Routing and scheduling
  - Double handling
  - Empty haul
  - Load factors
  - Driver behaviour
  - Inefficient drivetrains

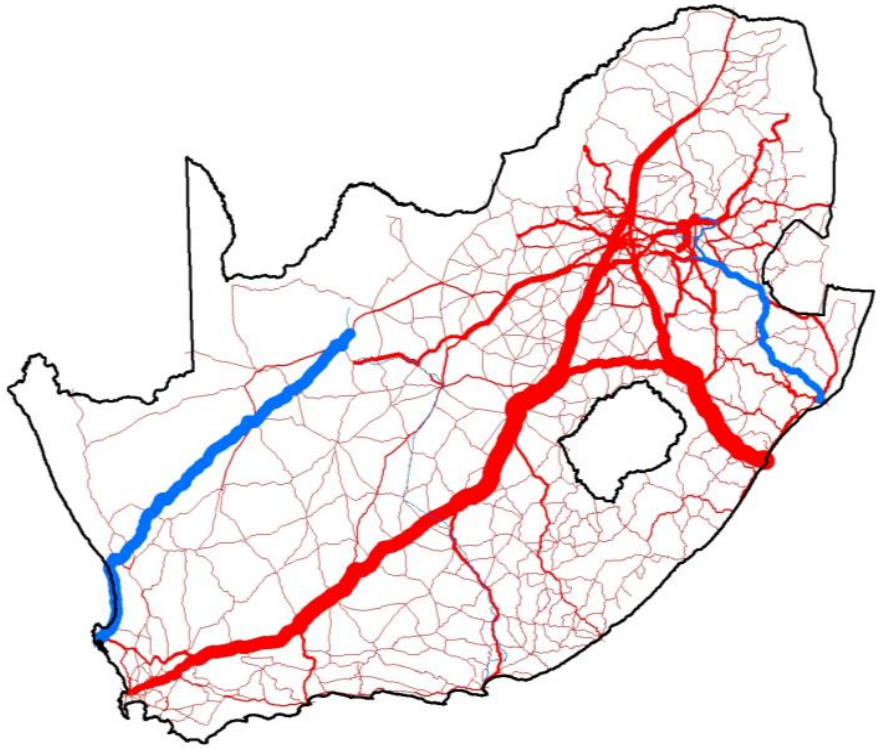
But overall to manage this the logistician needs macro ABC costing. The heart of logistics

To understand what can improve you need to understand demand

- **Today**



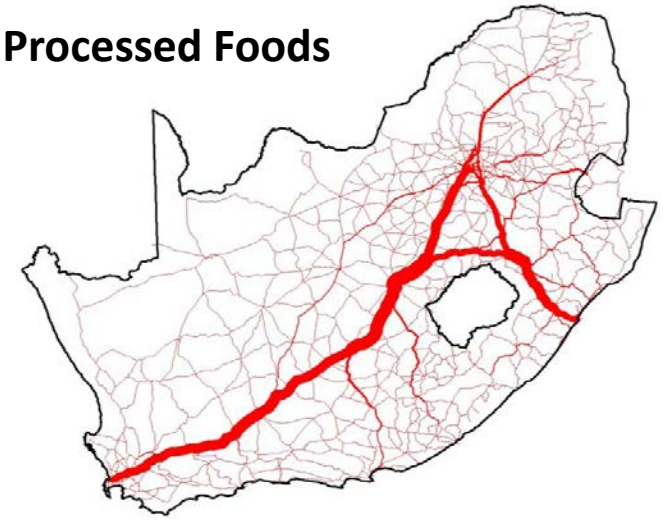
- **Forecast for 2040**



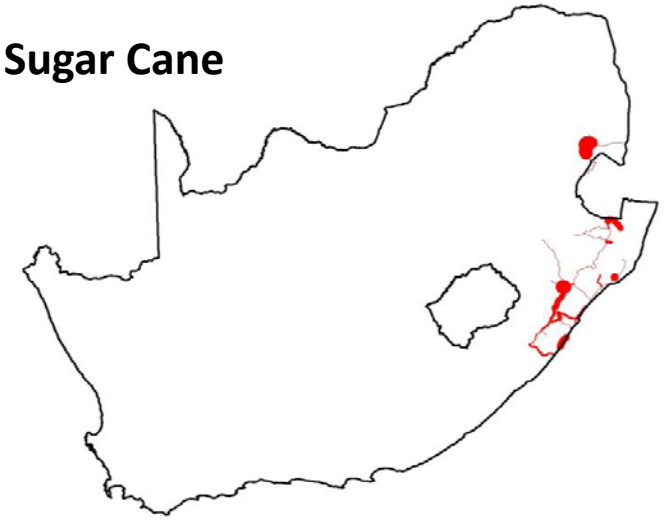
South Africa's extensive freight flow model – the start of instrumentation

The model includes 83 commodities

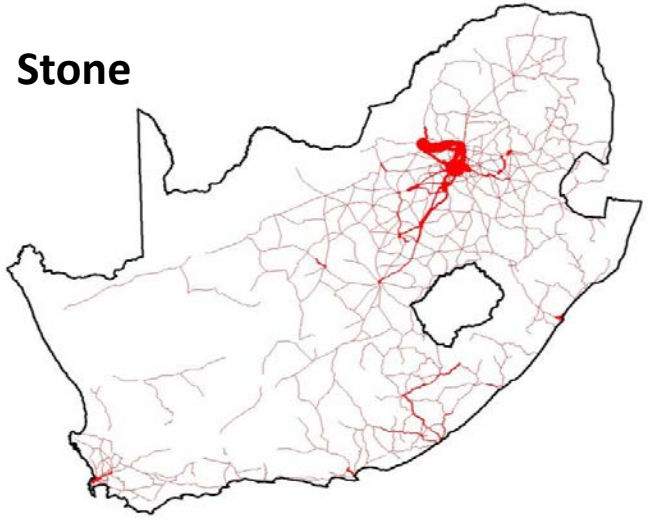
Processed Foods



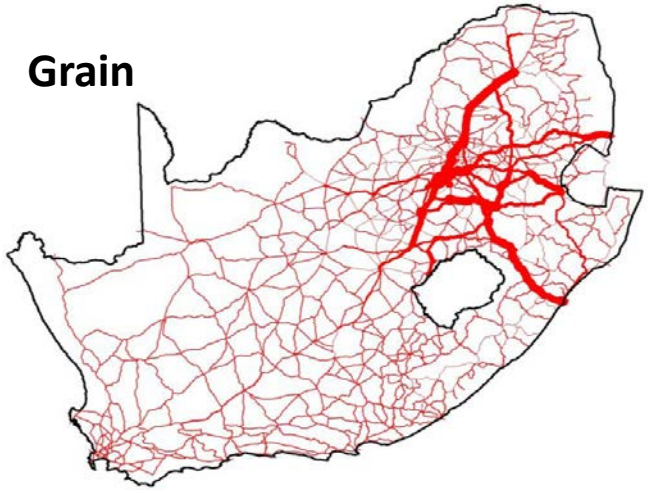
Sugar Cane



Stone



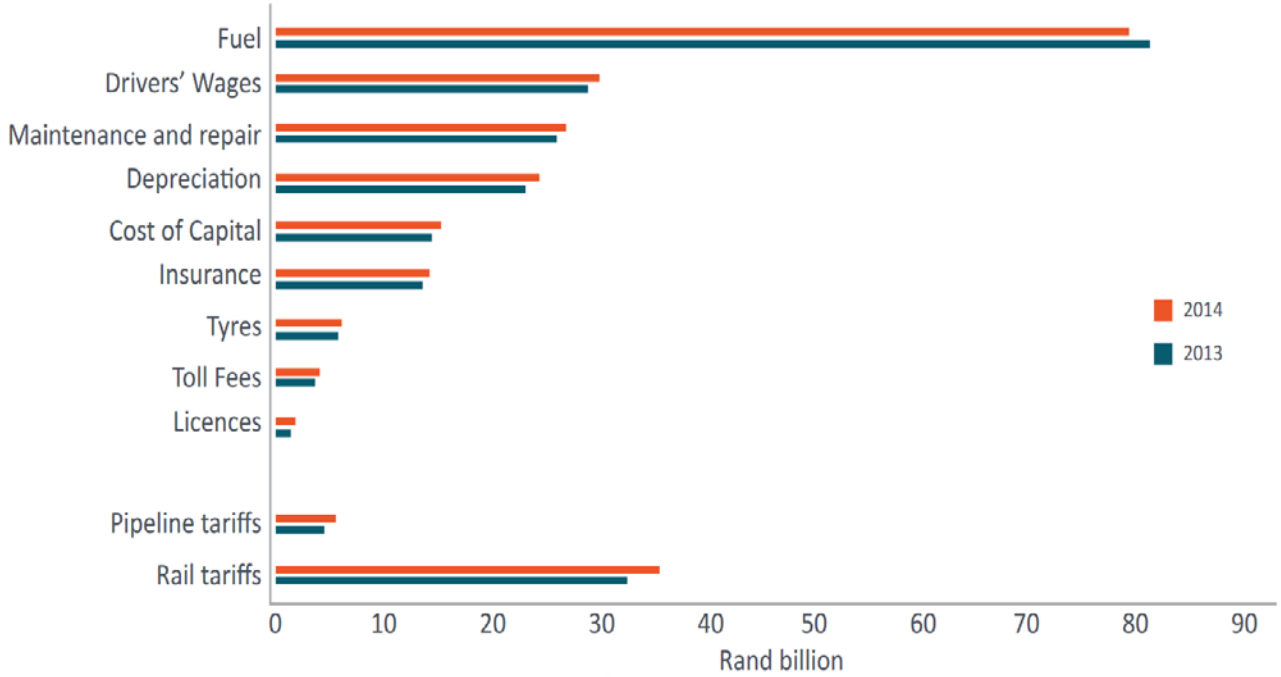
Grain



Between ~400 districts, tons, tonkilometres, all modes, costs

And for systemic calculations costs are disaggregated

- Into various segmentation regimes
- Including detailed cost elements



- And various cost drivers

Load factor
    Empty haul
    Load per trip
Distance per annum
Fuel consumption per vehicle
Driver habits or training
Vehicle maintenance and compliance

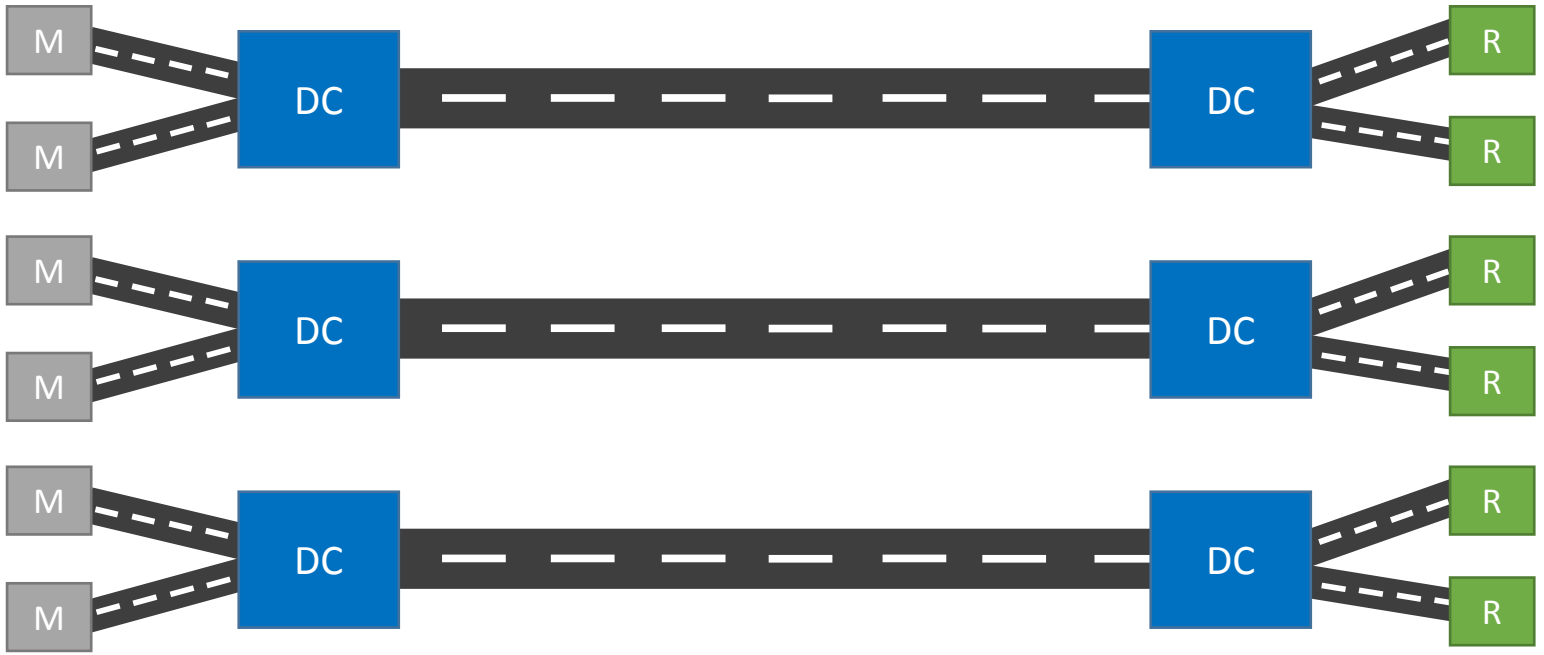
A combination of segmentation, elements and drivers enables systemic trade offs

It is at the heart of logistics. National level instrumentation

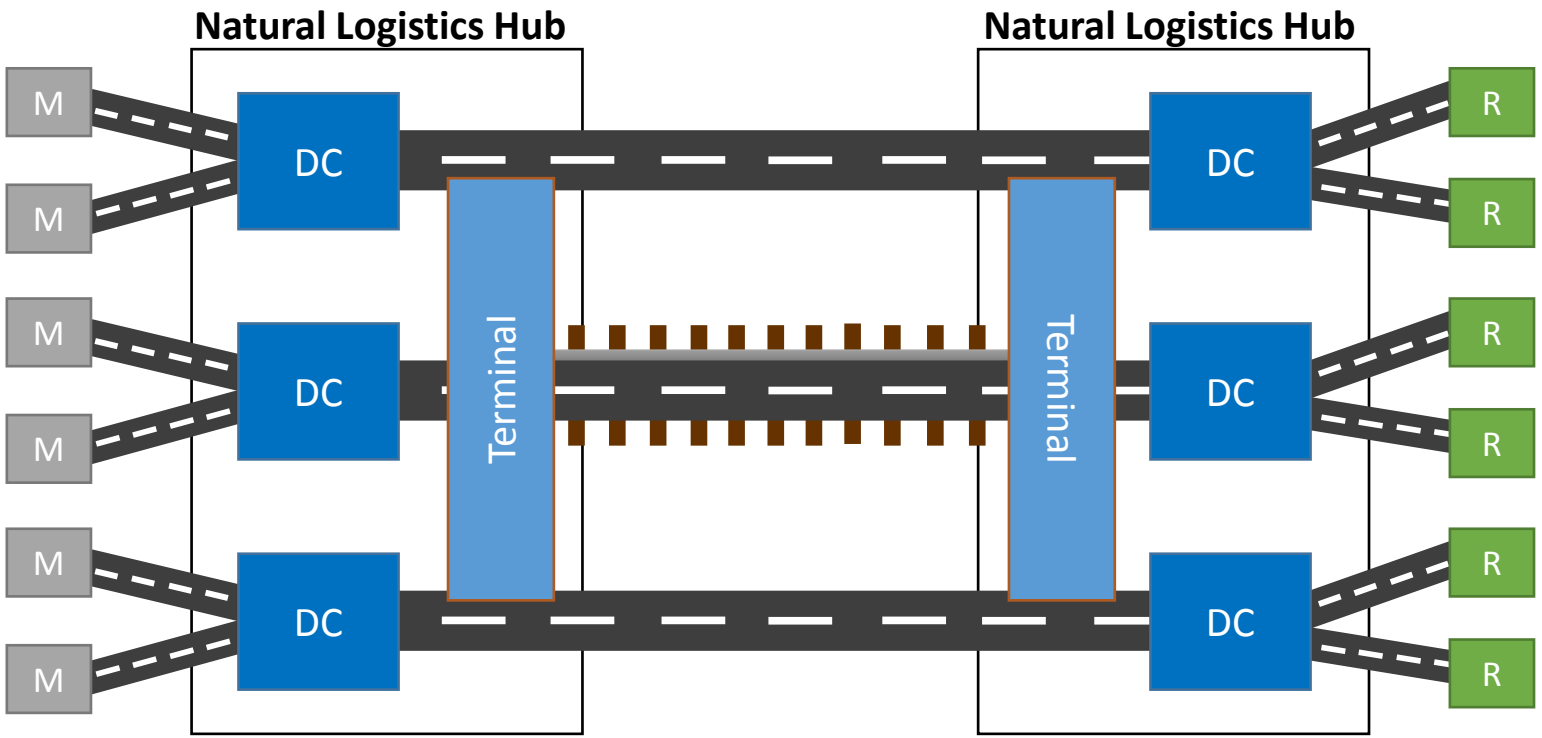
One supply side example – note this “train”

This is a tragedy

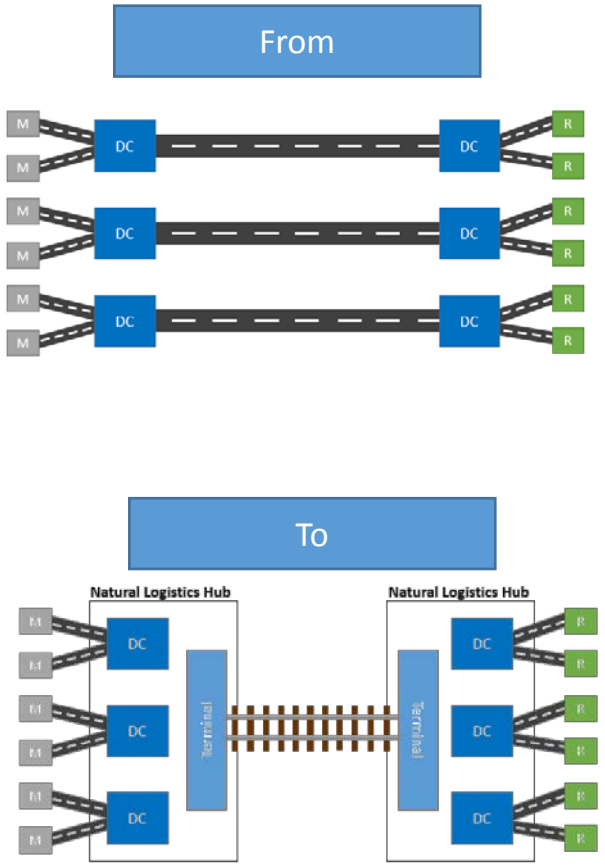
The typical FMCG long distance supply chain has natural “catchment” areas...



But can we do it differently?



And can we prove why?



Volumes and Savings

		South Africa	Corridors	2 corridors only
Volumes	Tons (million)	50	30	20
	Tonkilometers (billions)	30	16	13
Savings	Costs (Billion R)	7	6	4
	Emmissions ('000 tons)			400

Considering a vehicle fleet – for the Natal Corridor

	Current fleet	Trips per day (laden)
Current	3500	2 000
30 year scenario: Aggressive rail	8 000	4 500
30 year scenario: Current rail	11 000	6 500
30 year scenario: Stagnated rail	14 000	8 000

Why do we struggle to do it?

- Micrologistics approach to a macrologistics problem
  - Tragedy of the commons
- The failure of infrastructure – we don't know what we need and how to prioritise
  - On a micro level:
    - Capital projects prioritisation
    - CBA per project
- The failure of policy – we don't know why we regulate
  - On a micro level:
    - Specific positioning criteria
    - Measureable strategies
- The failure of logistics as a discipline
  - The absence of:
    - Instrumentation
    - Link with Macroeconomics

Effects of Industrialisation?

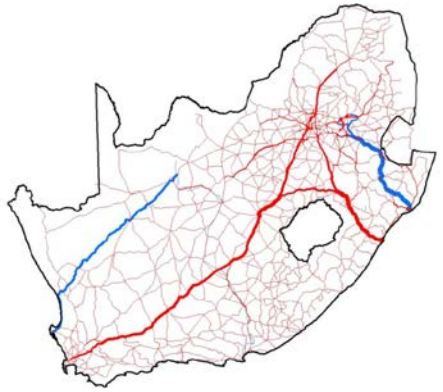
22 Scenarios already considered

- Ferromanganese smelter at Coega
- OEM vehicle plant in the Nelson Mandela Bay Metro
- Crude and gas refinery at Coega
- Copper and cobalt beneficiation in Limpopo
- Tshiame logistics hub in Harrismith
- Fracking in Karoo
- Nuclear power stations
- Deep Sea Ship repair facility at Mtunzini
- Titatium & zircon plant at Saldanha
- Biofuels refinery at Coega
- Ekurhuleni aerotropolis aviation facility at OR Tambo
- Dube Trade port outside Durban
- Tswane autotropolis vehicle hub at Pretoria
- Saldanha steel mill increased capacity
- Limpopo steel mill creation
- Saldanha liquid fuels
- Cement plant at Coega
- Blue metals steel mill at Germiston
- Soda Ash manufacturing at Durban
- Zirconium beneficiation at Mtunzini
- Titanium Oxide beneficiation at Mtunzini

Effects

- Freight flows
- Induced industries
- Transport costs
- Externality costs
- Logistics hubs
- Port system reconfiguration

As researchers in the absence of a SA appetite we've expanded our horizons



South Africa

Sub-Saharan Africa

India

Vietnam (in progress)

China (in discussion)

Turkey (possible)

Discussion points

The rise of Macrologistics

South Africa's Macrologistics status

South Africa's Macrologistics improvement opportunities

Examples of Macrologistics in practice

The future of logistics

Examples of macrologistics in practice

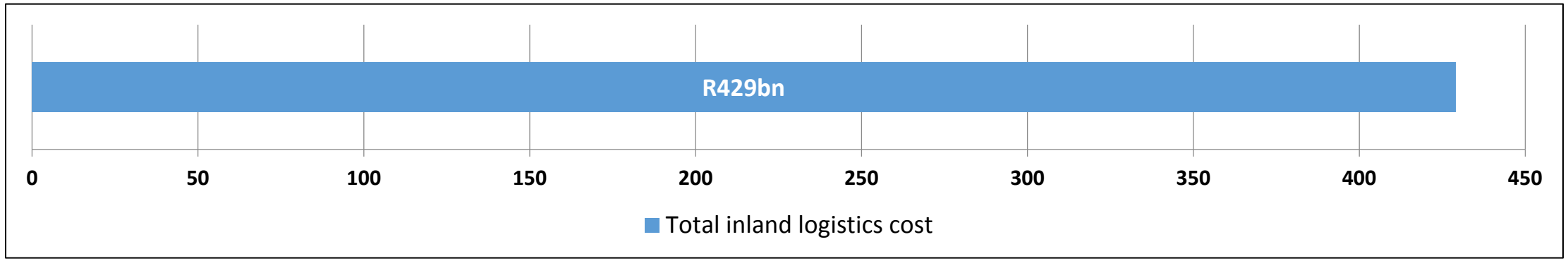
Trade and cluster example

Policy example

Infrastructure example – lessons from our work in India

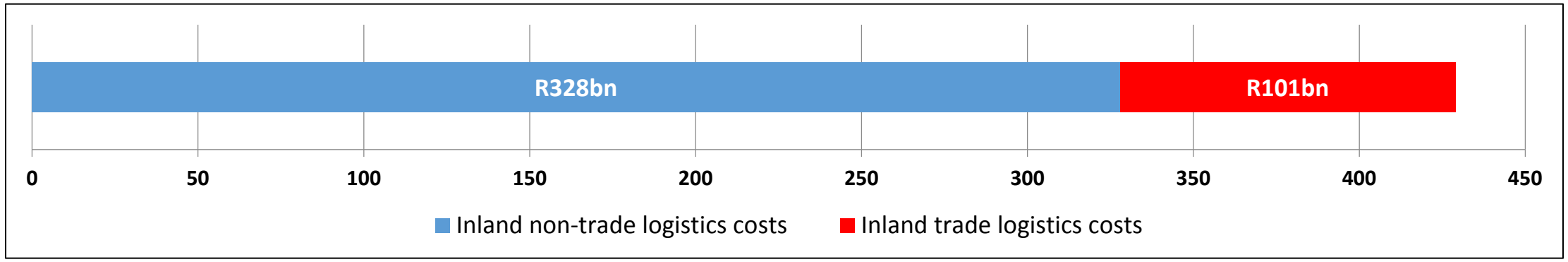
Humanitarian logistics question

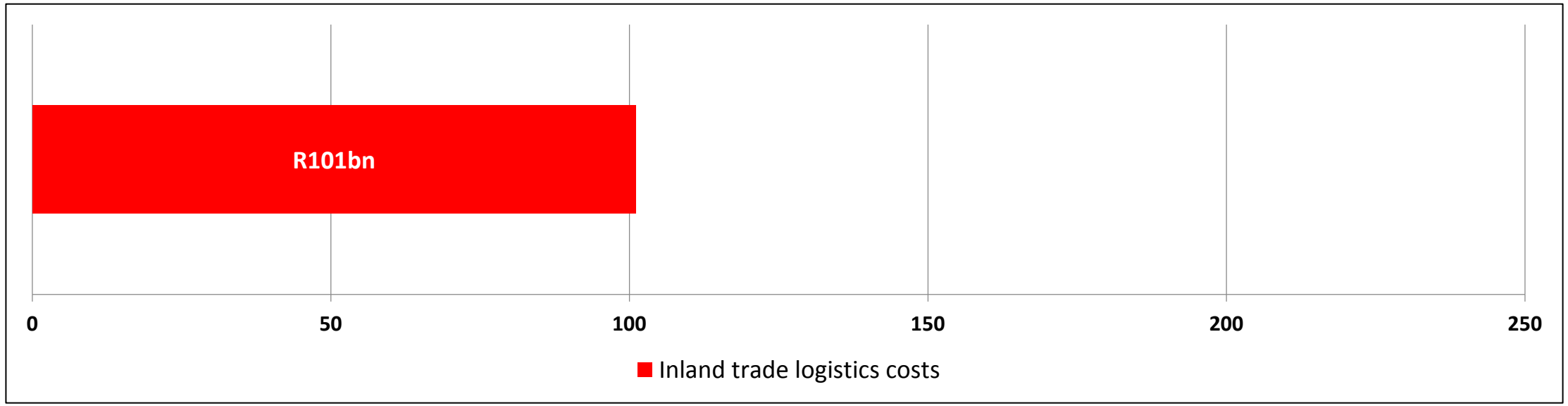
South Africa's logistics costs for 2014 were R429 billion



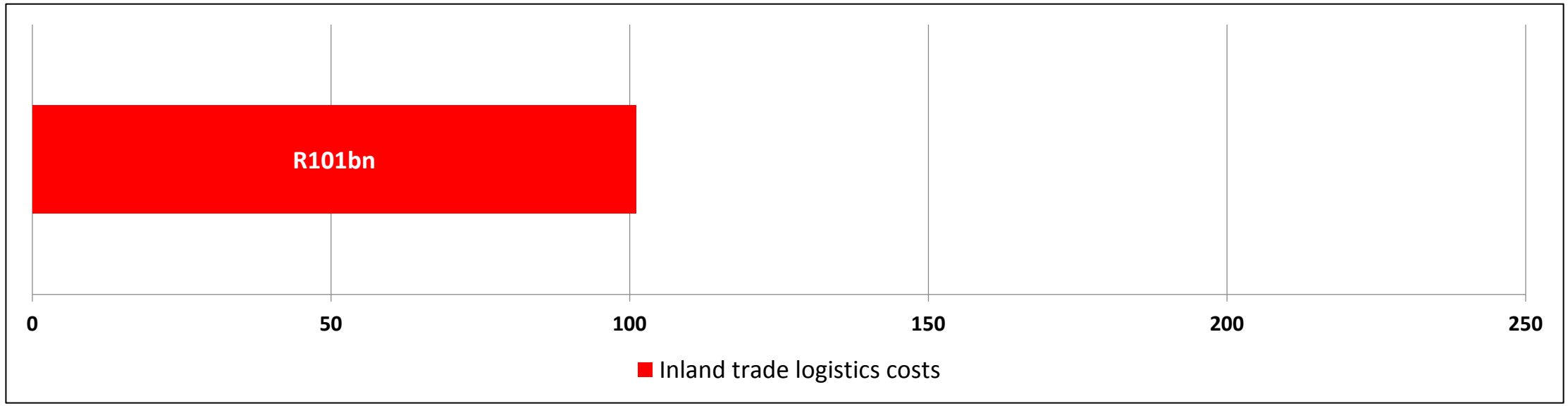
This includes costs up to the quay wall, but excludes the port and liner costs

Of the R429 billion, R101 billion were inland trade logistics costs

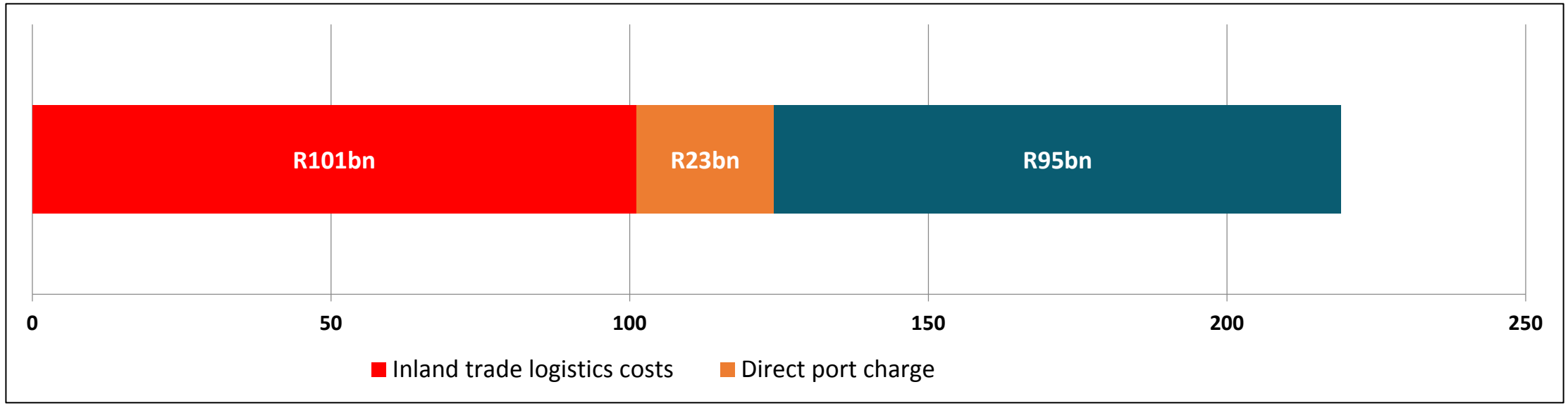




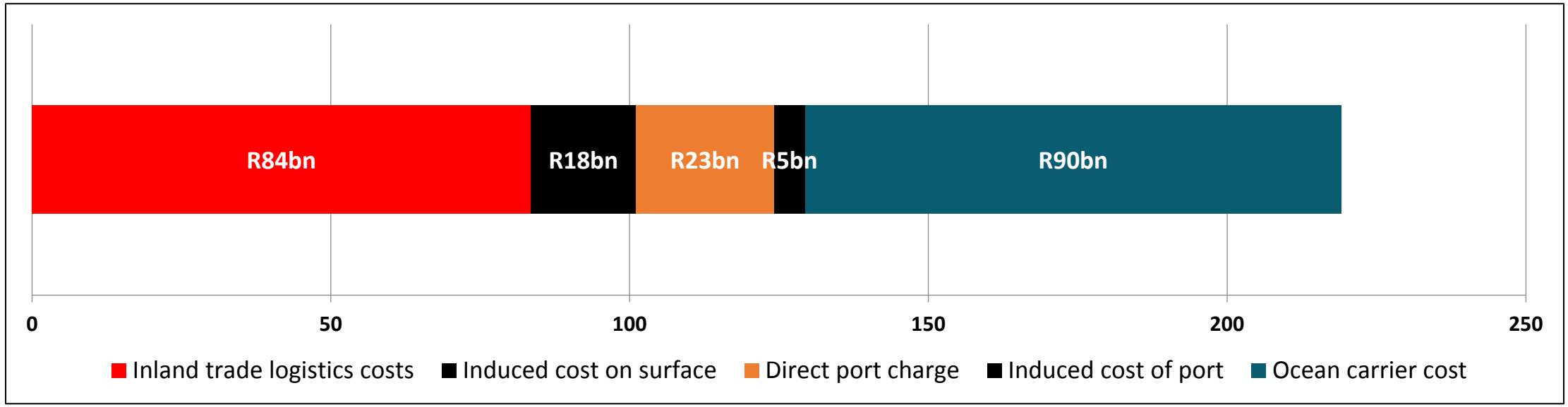
Of the R429 billion, R101 billion were inland trade logistics costs



Trade logistics costs

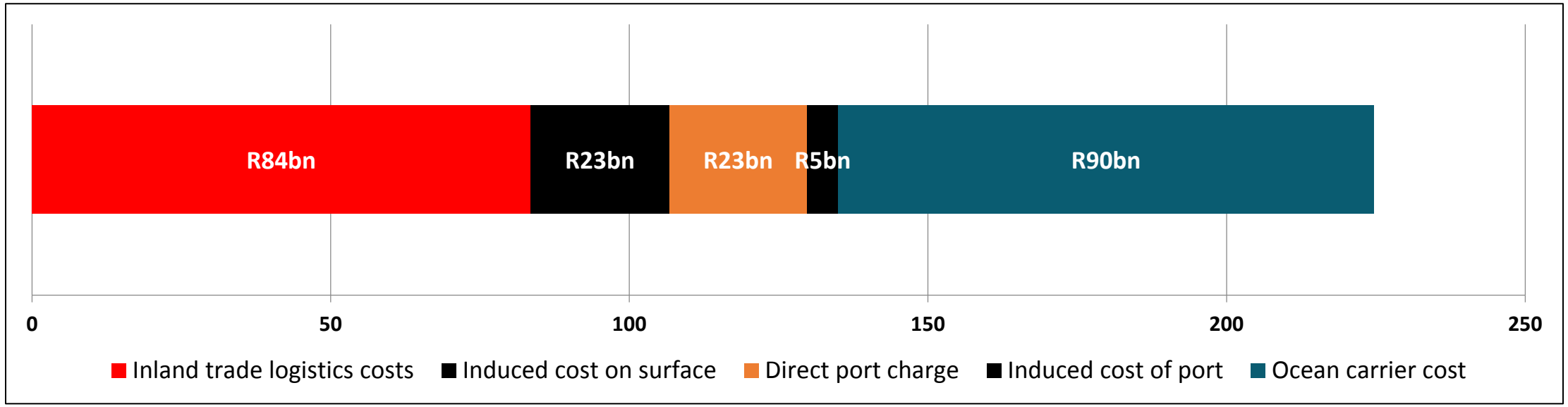


But R23 billion of this costs is “induced”. It is overspend or waste, due to the nature of trade supply chains



Induced costs total R23 billion

This figure could be as high as R28 billion



Examples of macrologistics in practice

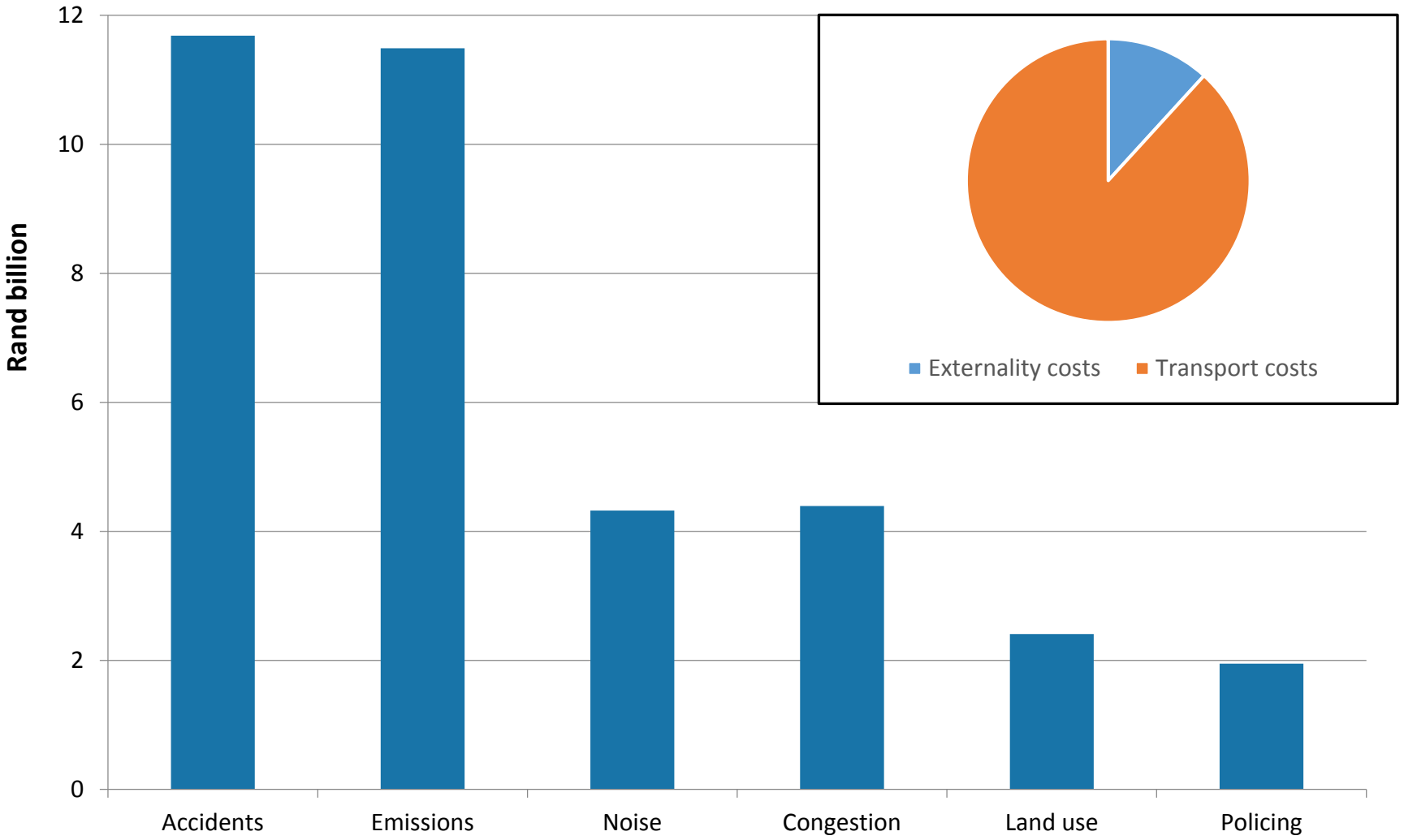
Trade and cluster example

Policy example

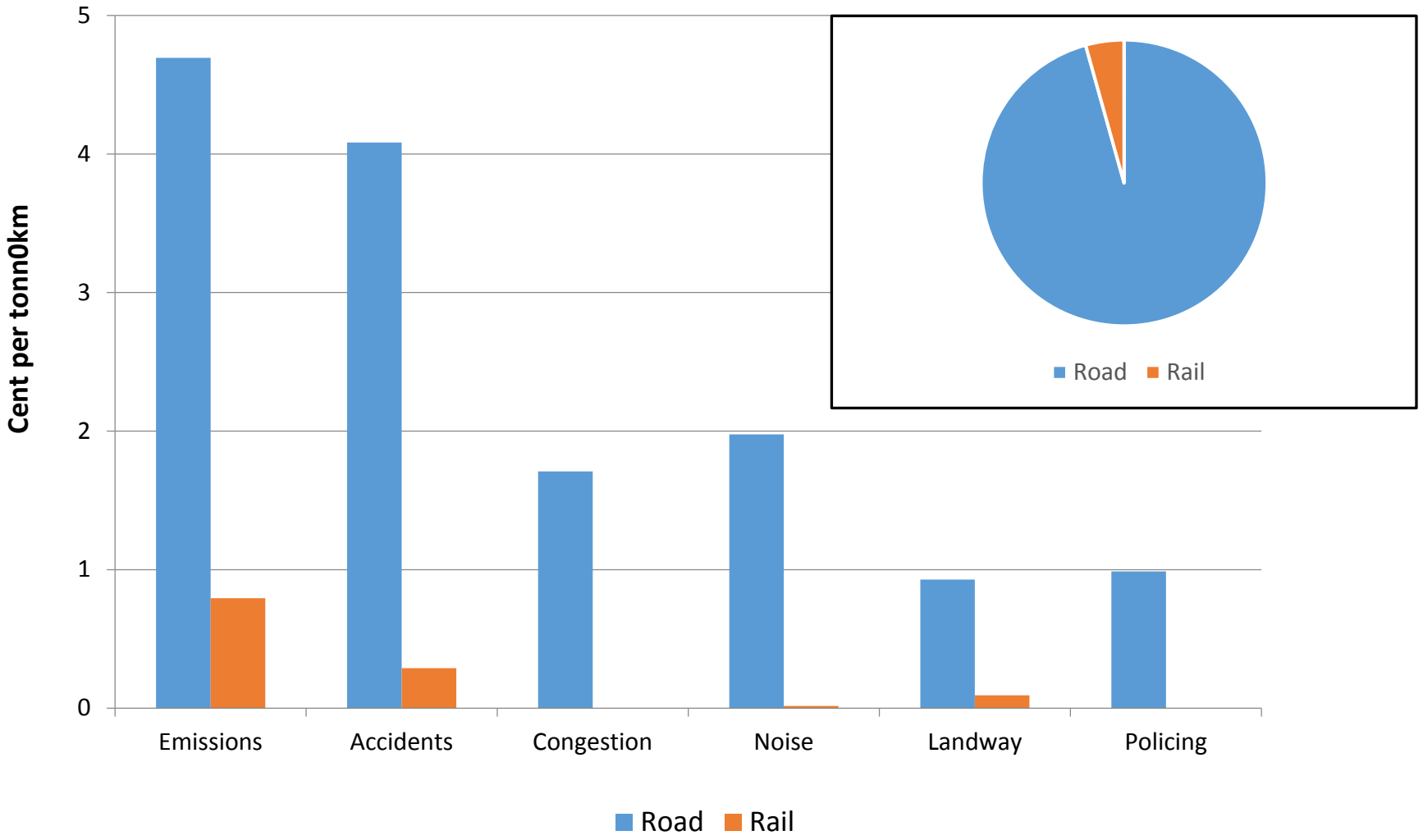
Infrastructure example – lessons from our work in India

Humanitarian logistics question

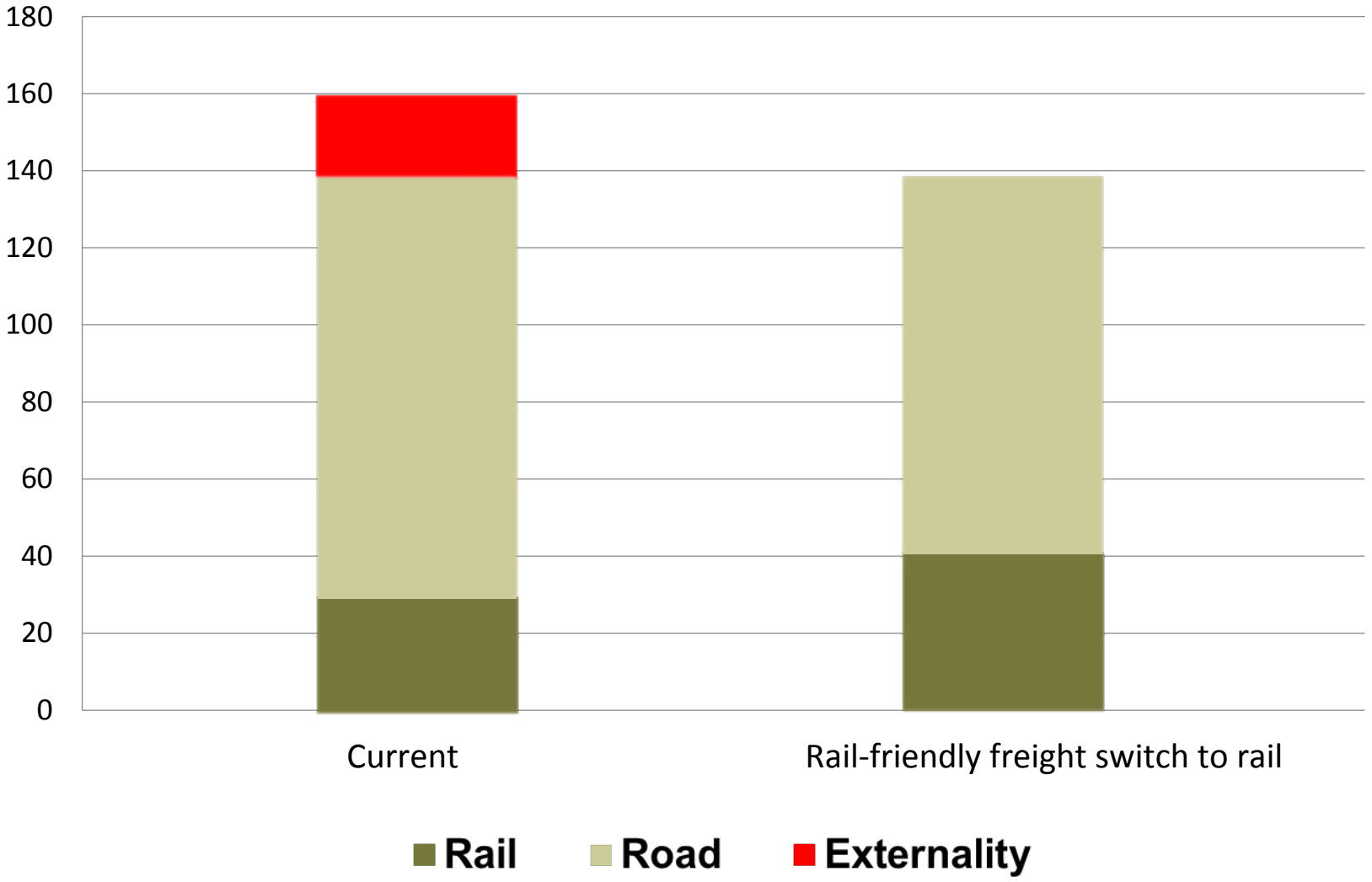
Externality costs in South Africa



Externality costs in South Africa – rates per mode



The full results of internalising South Africa's freight externalities



Examples of macrologistics in practice

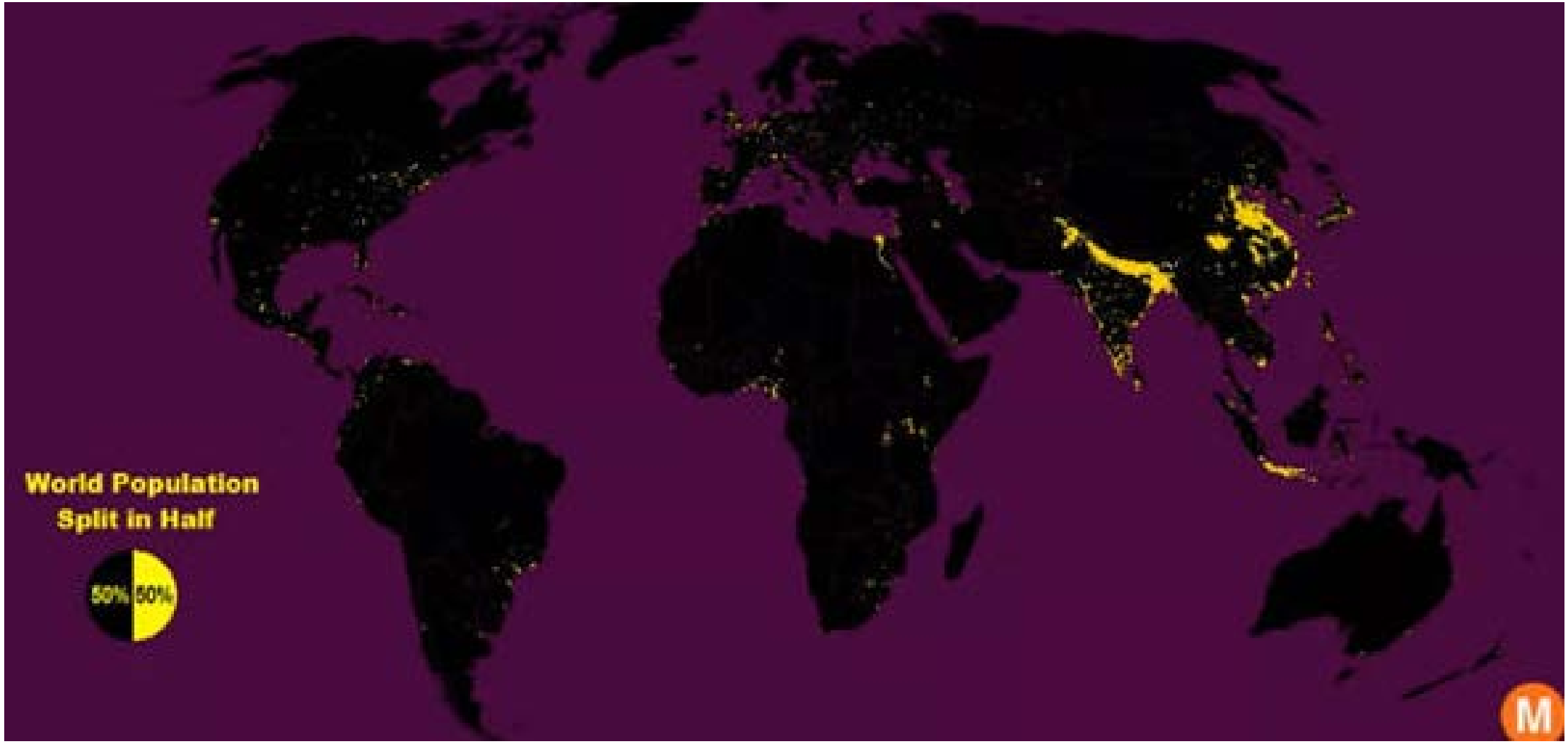
Trade and cluster example

Policy example

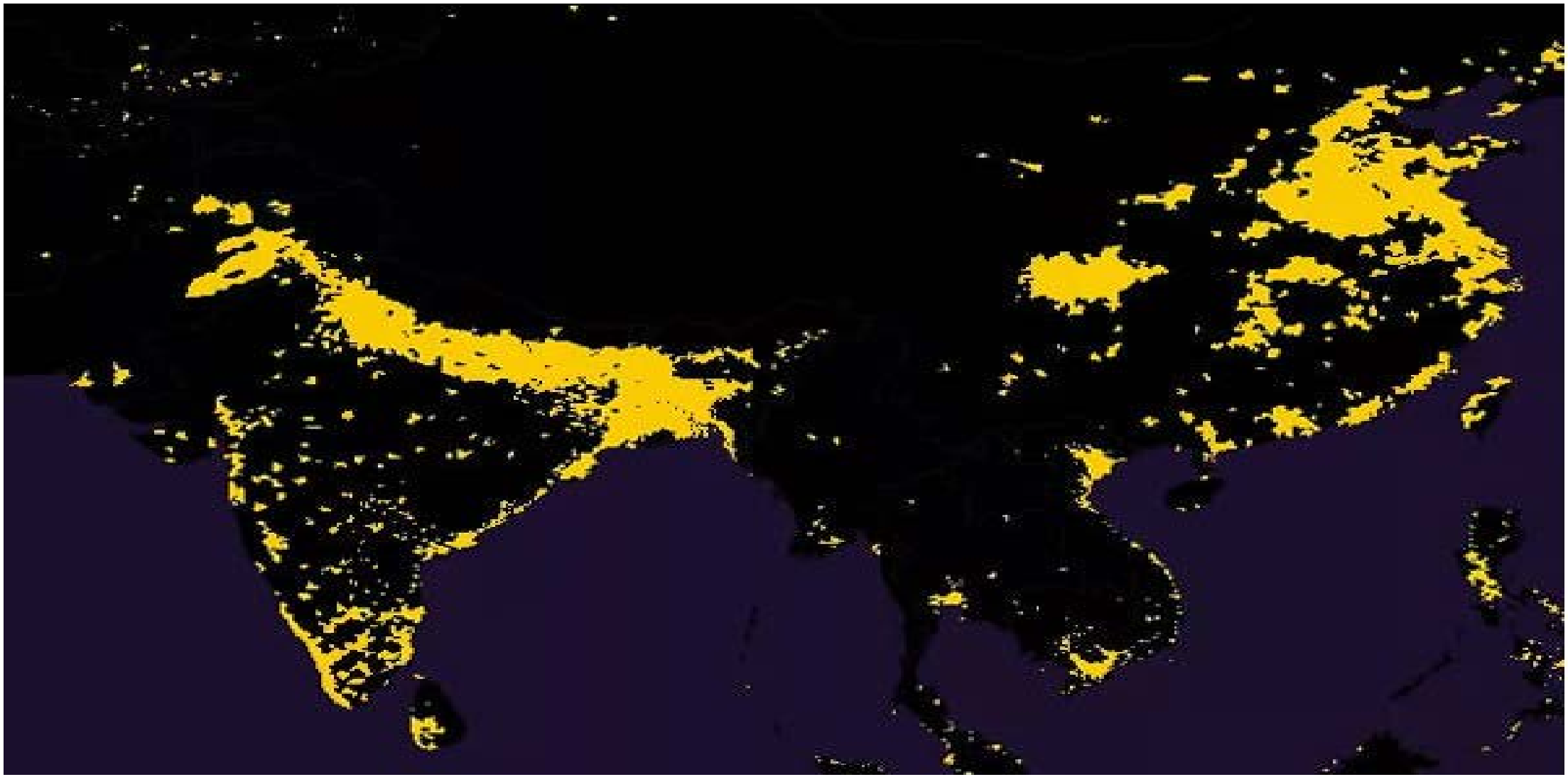
Infrastructure example – lessons from our work in India

Humanitarian logistics question

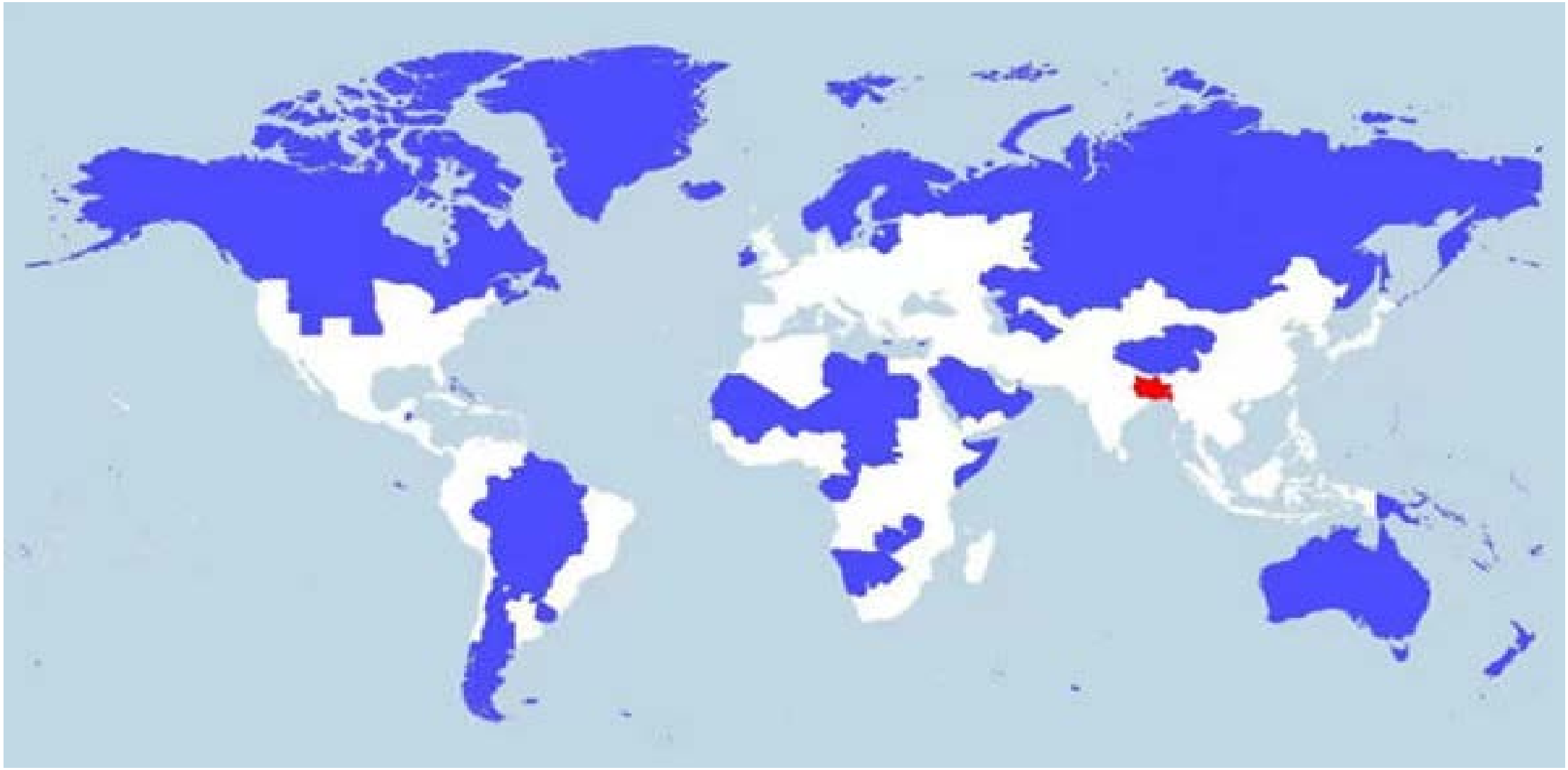
Why India? 50% of the world population lives on 1% of the surface

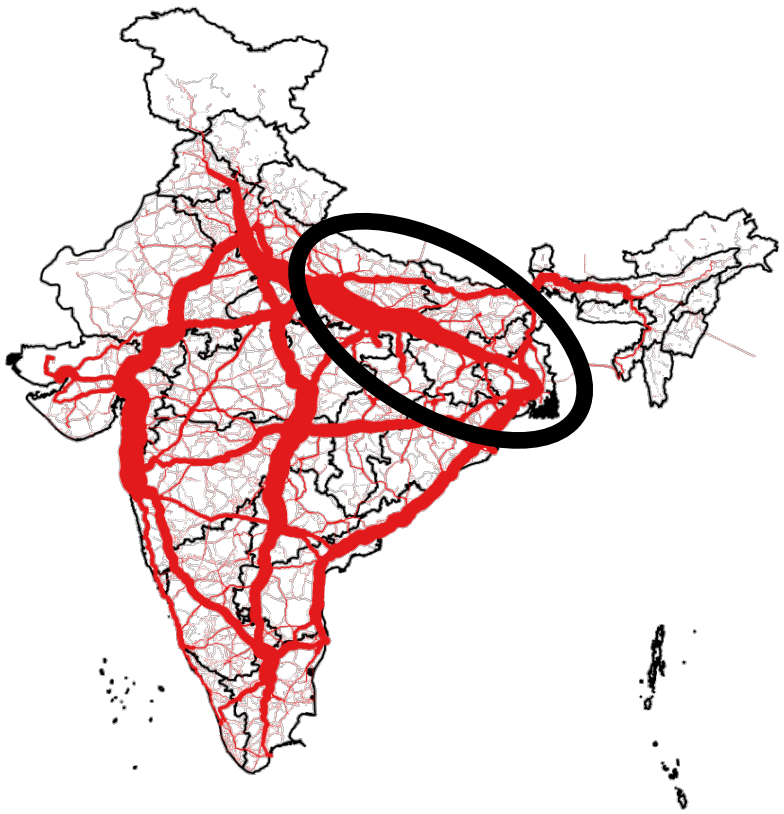


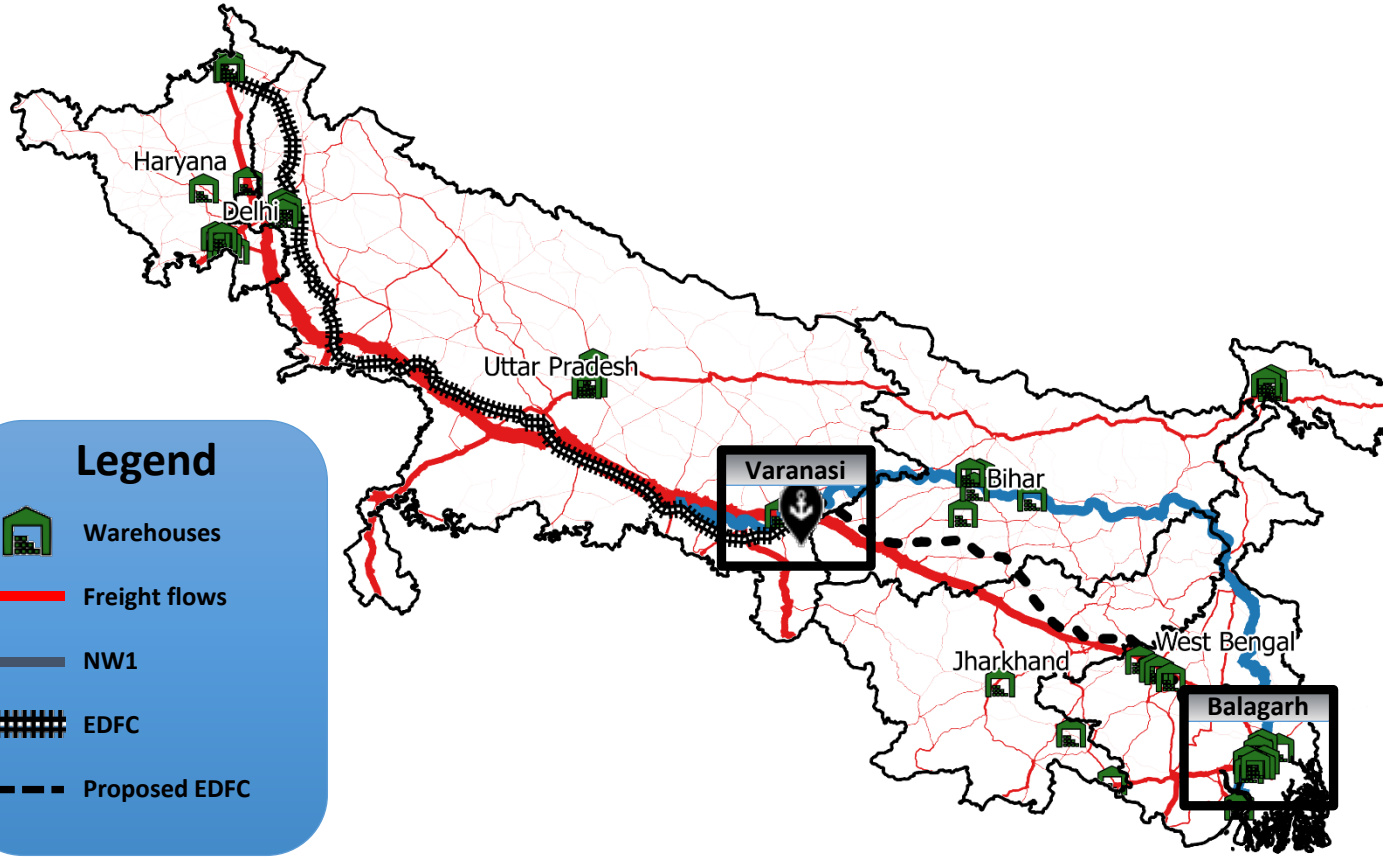
46% of the world population lives in the yellow area



The number of people living in the blue and red areas are the same






Haryana
Delhi
Uttar Pradesh
Varanasi
Bihar
Jharkhand
West Bengal
Balagarh
Legend
Warehouses
Freight flows
NW1
EDFC
Proposed EDFC

Two macrologistics business cases

Balagarh

Investment in DFC	Expected return to logistics savings per annum
$4 billion	$1 billion

Macrologistics issues
Connectrivity to the port/Kolkata city logistics/Congestion/Alternative port use

Investment in an extended gate/hub	Additional expected return to logistics savings per annum
$0.5 billion	$2 billion

Varanasi

- Design of a 0.5 million ton facility

- Varanasi at the confluence of the Ganga and all modes
- To maximize logistics savings a 39 million ton design is needed

Examples of macrologistics in practice

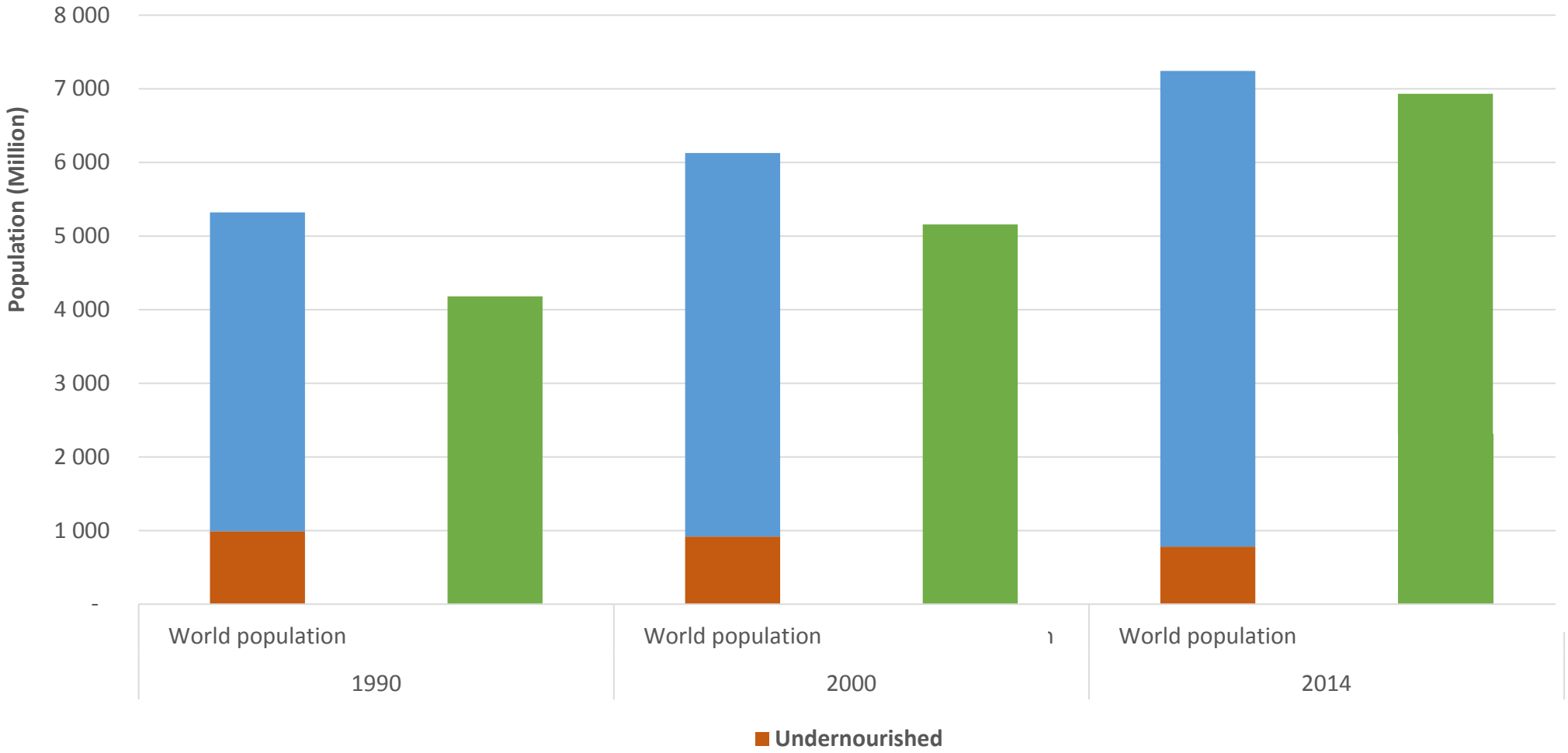
Trade and cluster example

Policy example

Infrastructure example – lessons from our work in India

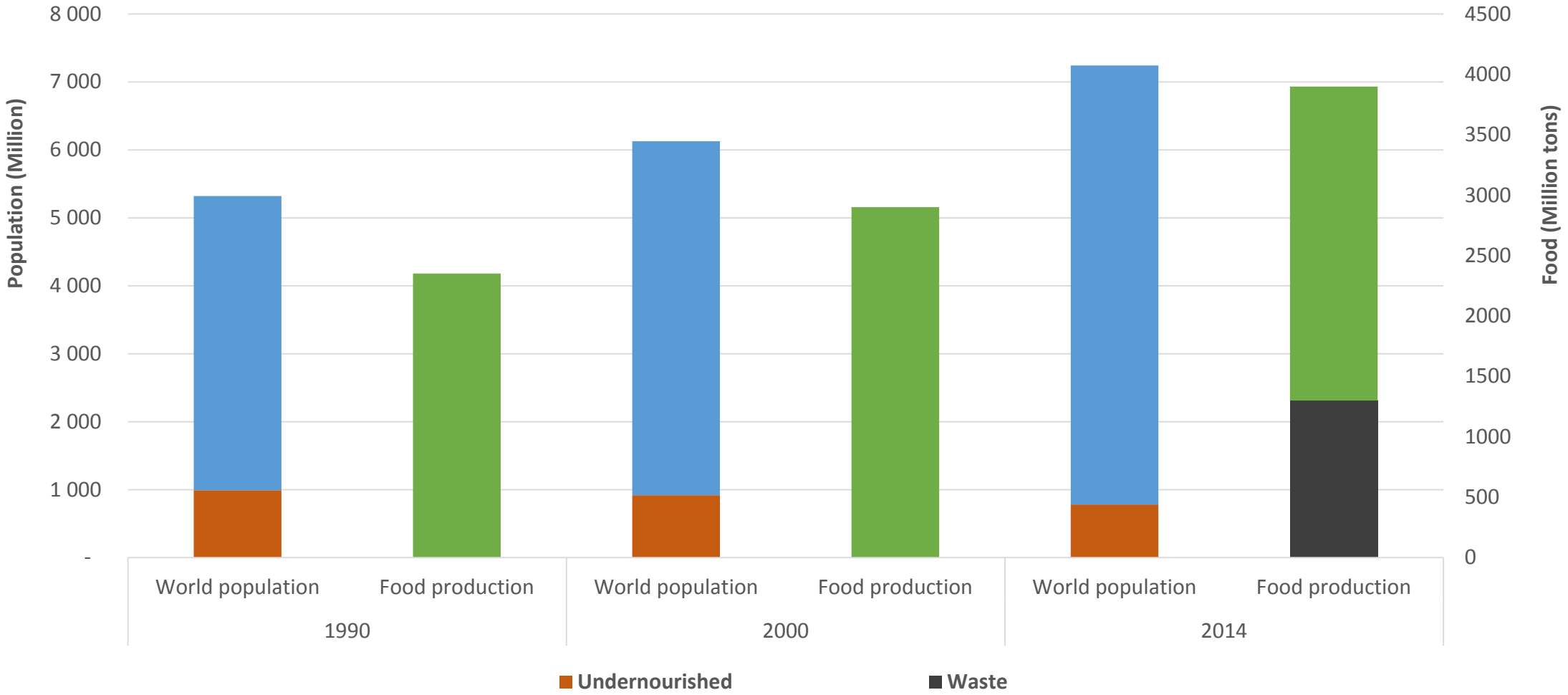
Humanitarian logistics question

World population and food production



Source: Hunger Notes - http://www.worldhunger.org/
Food and Agriculture Organisation of United States - http://www.fao.org
World Meters - http://www.worldometers.info/world-population/

World population and food production



Source: Hunger Notes - http://www.worldhunger.org/
Food and Agriculture Organisation of United States - http://www.fao.org
World Meters - http://www.worldometers.info/world-population/

Discussion points

The rise of Macrologistics

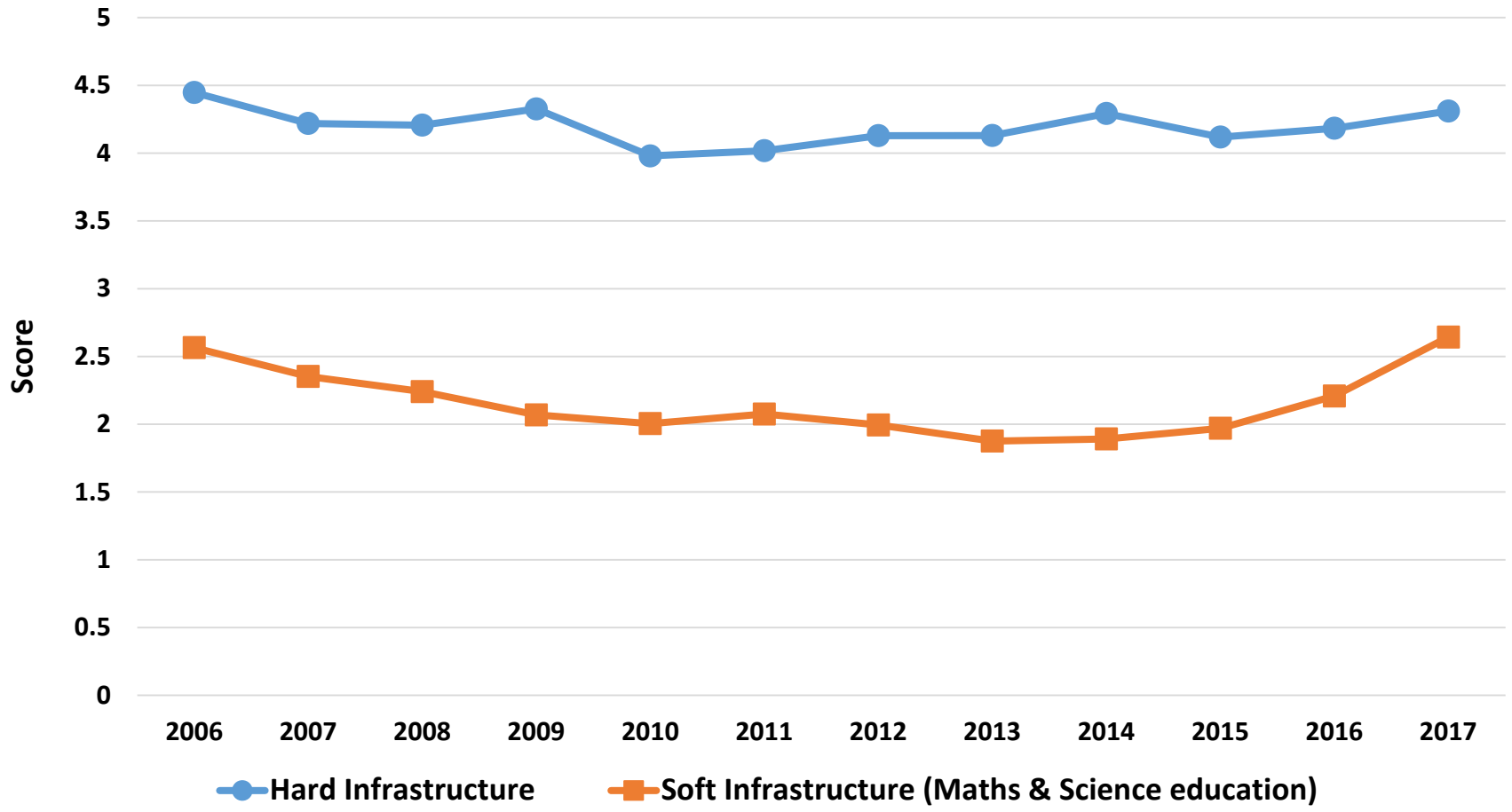
South Africa's Macrologistics status

South Africa's Macrologistics improvement opportunities

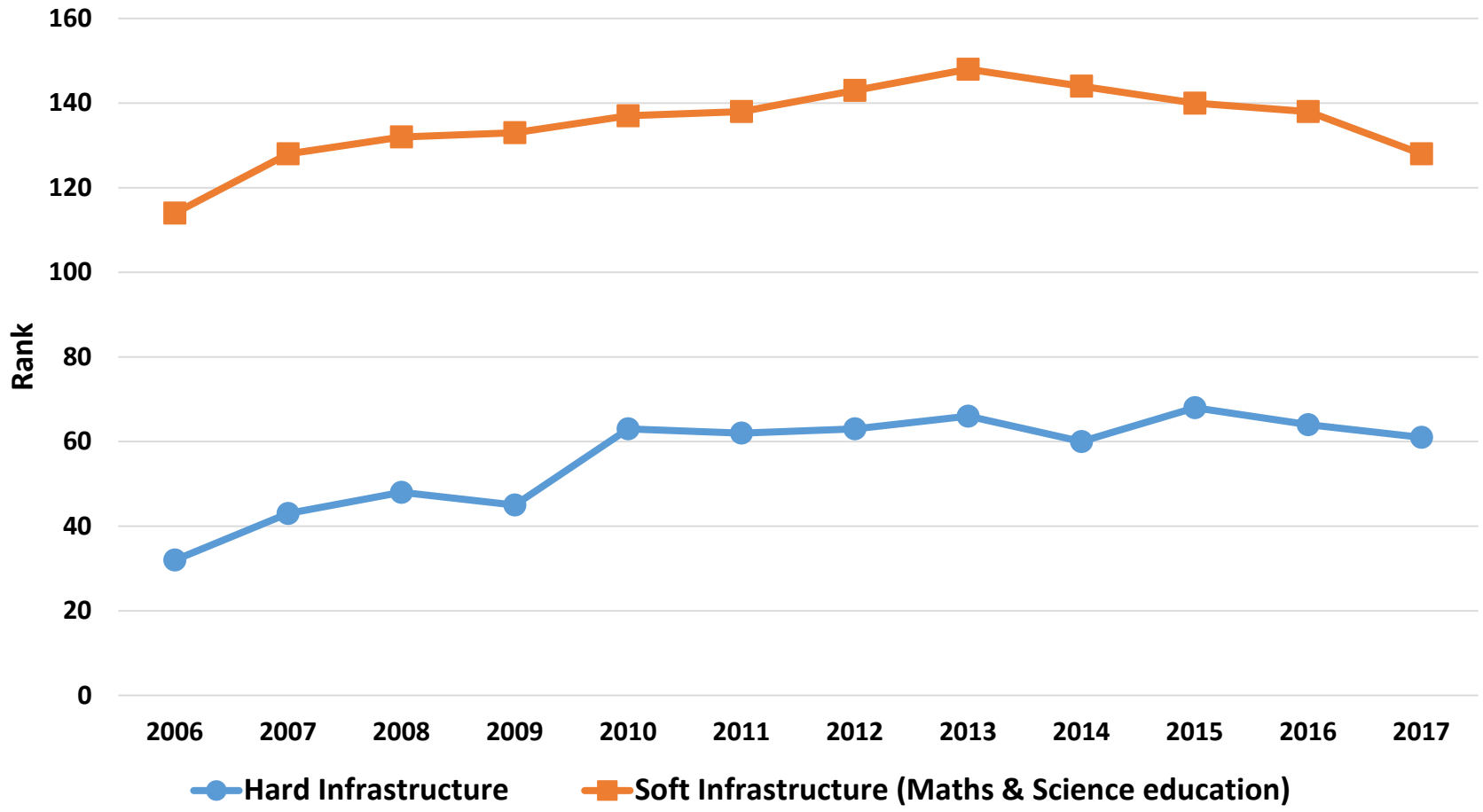
Examples of Macrologistics in practice

The future of logistics

So is infrastructure a problem? Consider hard and soft infrastructure



So is infrastructure a problem? Consider hard and soft infrastructure



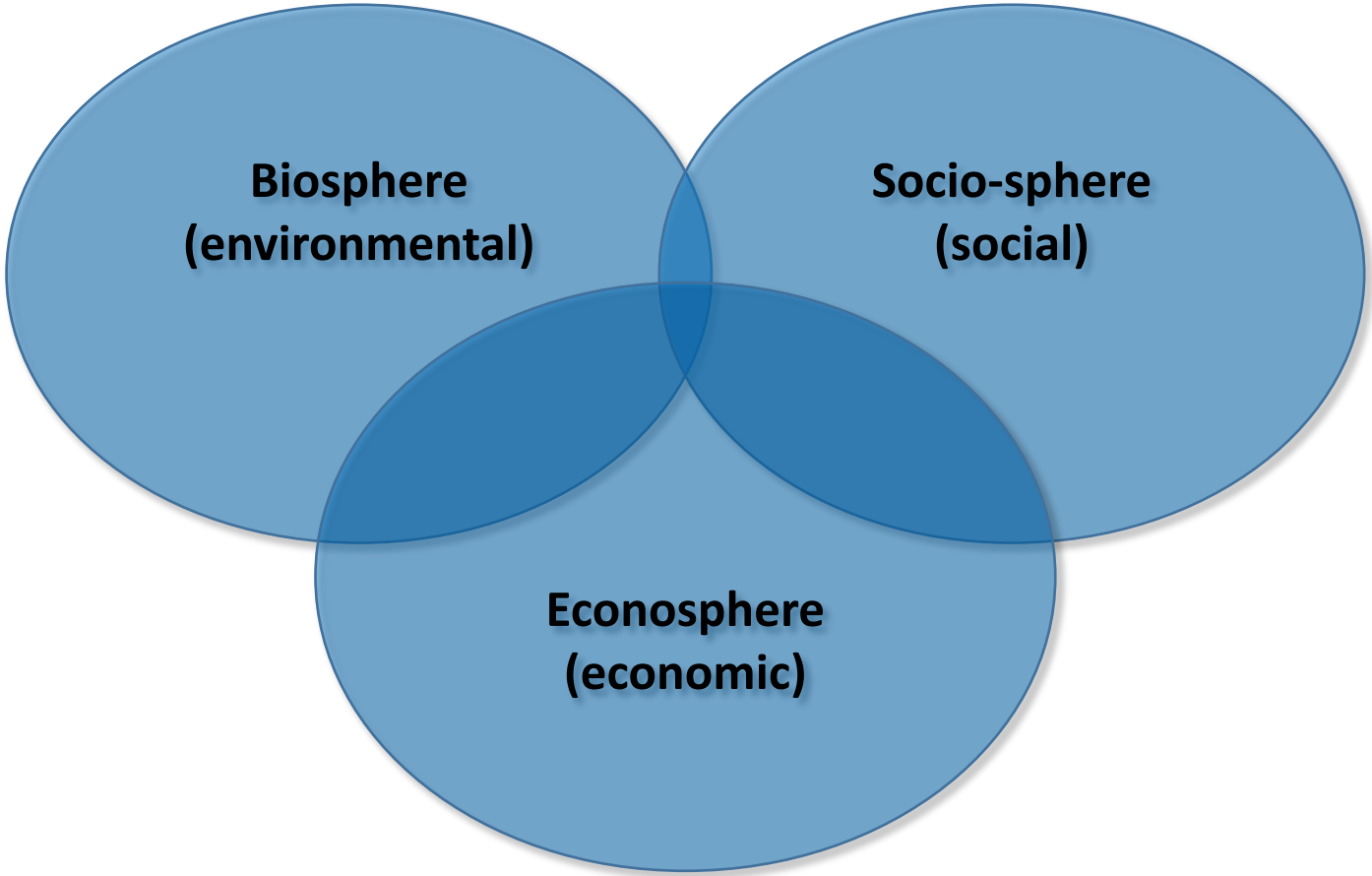
A lot of hype on supply side

- Physical internet
- 3 D printing
- Driverless trucks
- Electric road trains
- Drones
- Catenary supported highways

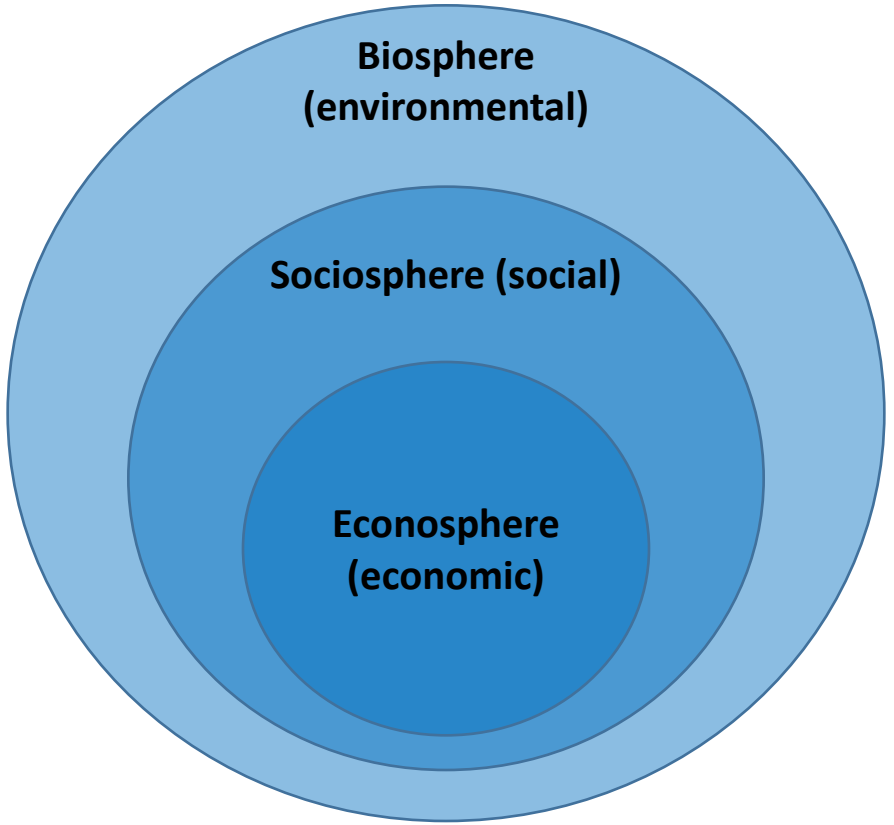
This is all micro logistics technology. The biggest change will be the rise of macrologistics

We need changes on the macro level

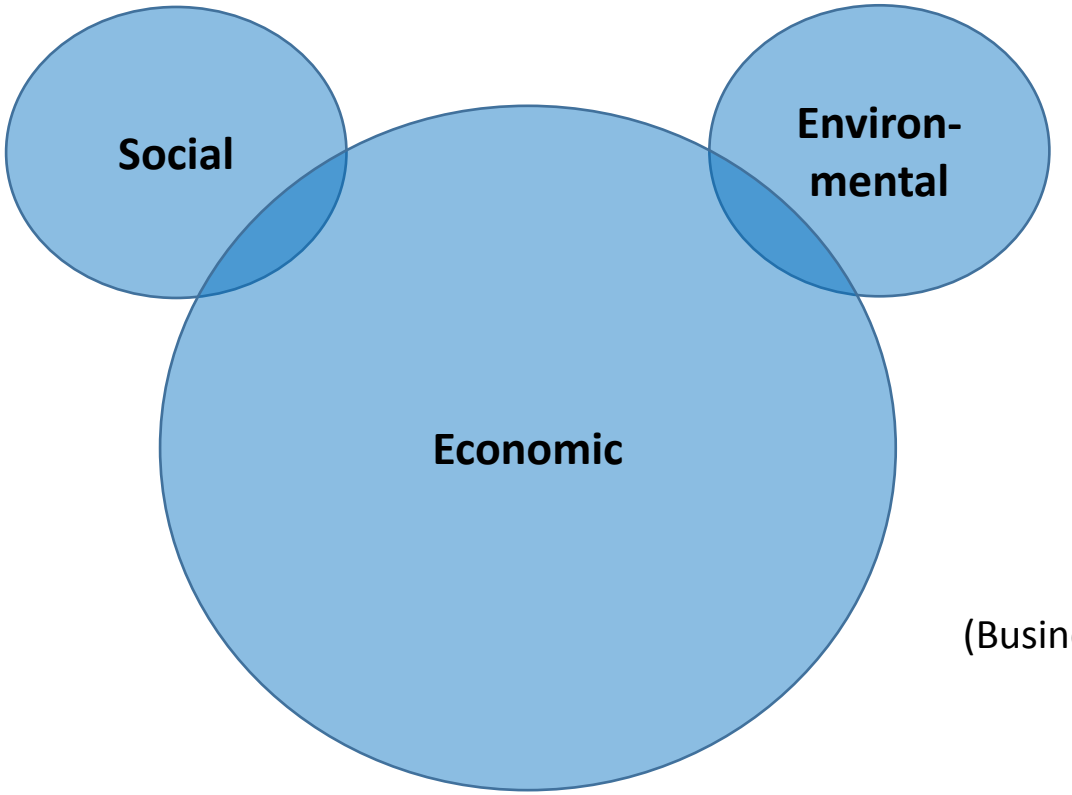
The new world order – the biosphere will drive logistics' future



Emerging – the bulls-eye model



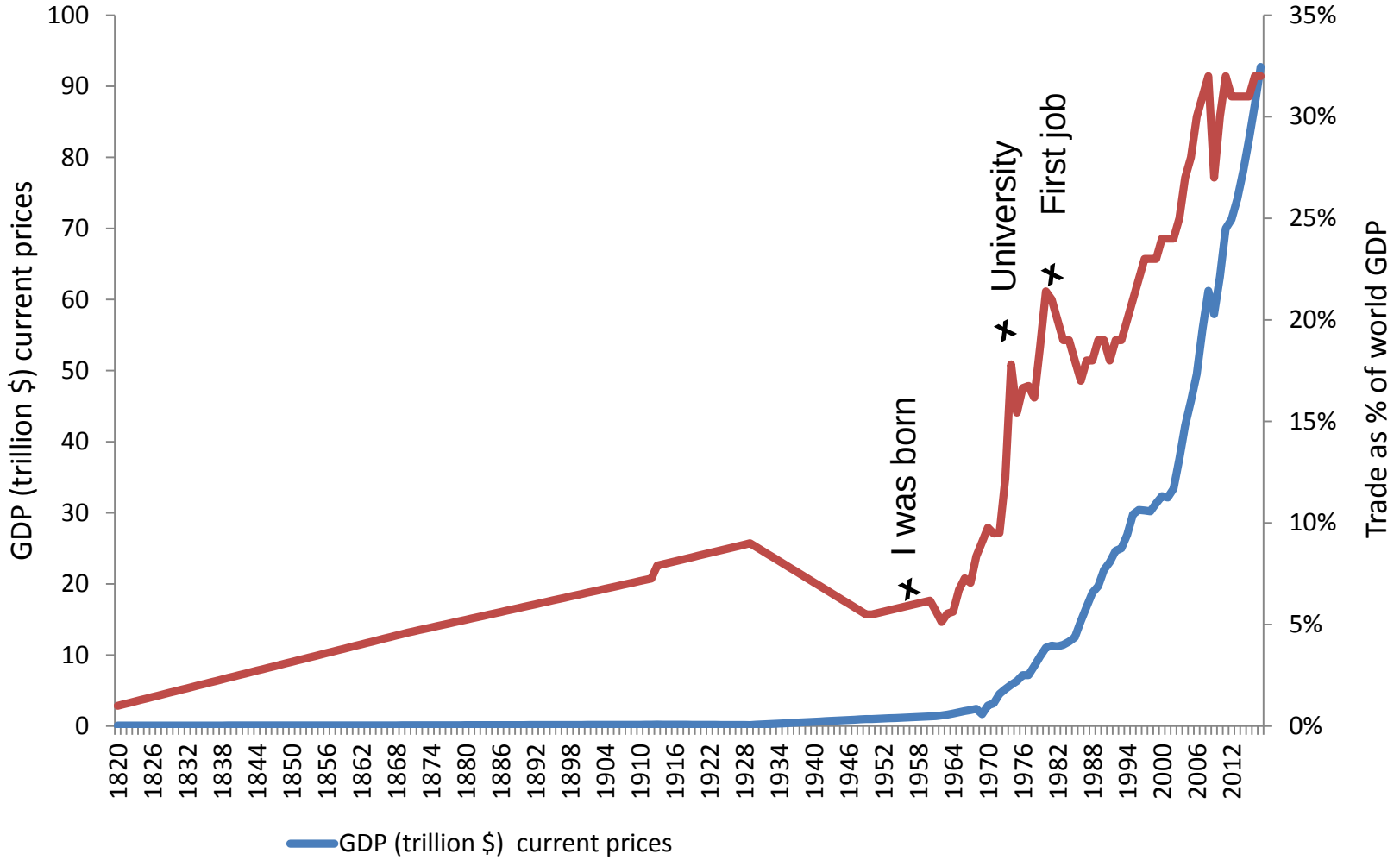
The current problem – The Mickey Mouse Model



(Business as usual)

Strong sustainability for New Zealand: Principles and Scenarios (2009) Sustainable Aotearoa New Zealand inc (SANZ)

A thought on demand side – from the engine of growth to degrowth



Relocalisation is real – the speed and disaggregation is still unsure

If logistics as an input needs to maximise output. How do we measure output? The emerging role of macrologistics

Econo-sphere	Socio-sphere	Bio-sphere
Does not distinguish between speculation and real growth	Growth at household level is not measured	Wellness of the environment ignored
Does not measure non-market activities that contribute to growth	Measures Quantity and not Quality	Encourages natural resource depletion
	Effects of poverty, illiteracy and life expectancy ignored	

Thank You