**Multi-year Expert Meeting on Transport, Trade Logistics and Trade Facilitation**

Sustainable Freight Transport Systems: Opportunities for Developing Countries

14-16 October 2015

# TOWARDS AN ENVIRONMENTALLY-SUSTAINABLE FREIGHT TRANSPORT SYSTEM: SETTING THE SCENE

by

Mr. Alan McKinnon

Professor and Head of Logistics

Kühne Logistics University (KLU), Hamburg

14 October 2015

# Towards an Environmentally-Sustainable Freight Transport System: Setting the Scene

*Professor Alan McKinnon*

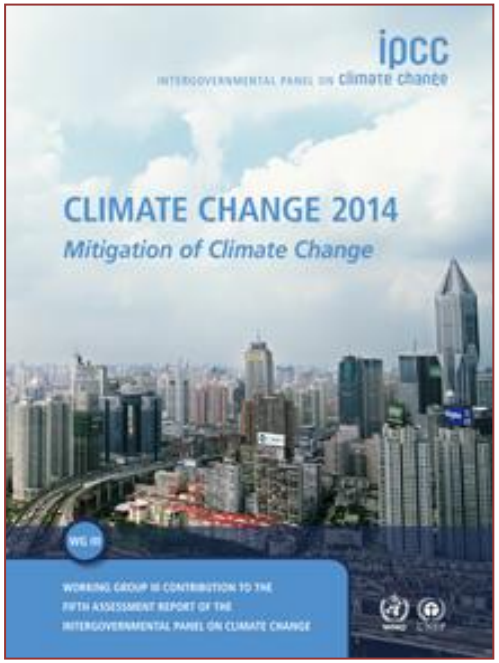
*Kuehne Logistics University*

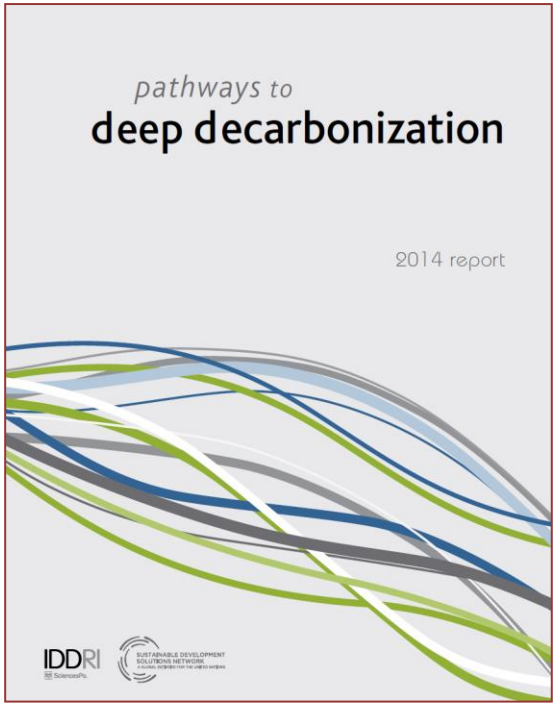
Sustainable Freight Transport Systems Meeting
UNCTAD

Geneva
October 2015

# Climate Challenge for the Freight Transport Sector

5th Assessment Report of the IPCC




Transport:

2010: 7 billion tonnes of $CO_2$
2050: 12 billion tonnes of $CO_2$

2050 limit on $CO_2$ emissions from all activity:
**20 billion tonnes**

To retain its 14% share transport must reduce $CO_2$ emissions to

**2.8 billion tonnes by 2050**

freight transport = one of the hardest sectors to decarbonise

On a BAU basis, freight share of total carbon emissions likely to rise from

7% (2010) to 16% (2050)

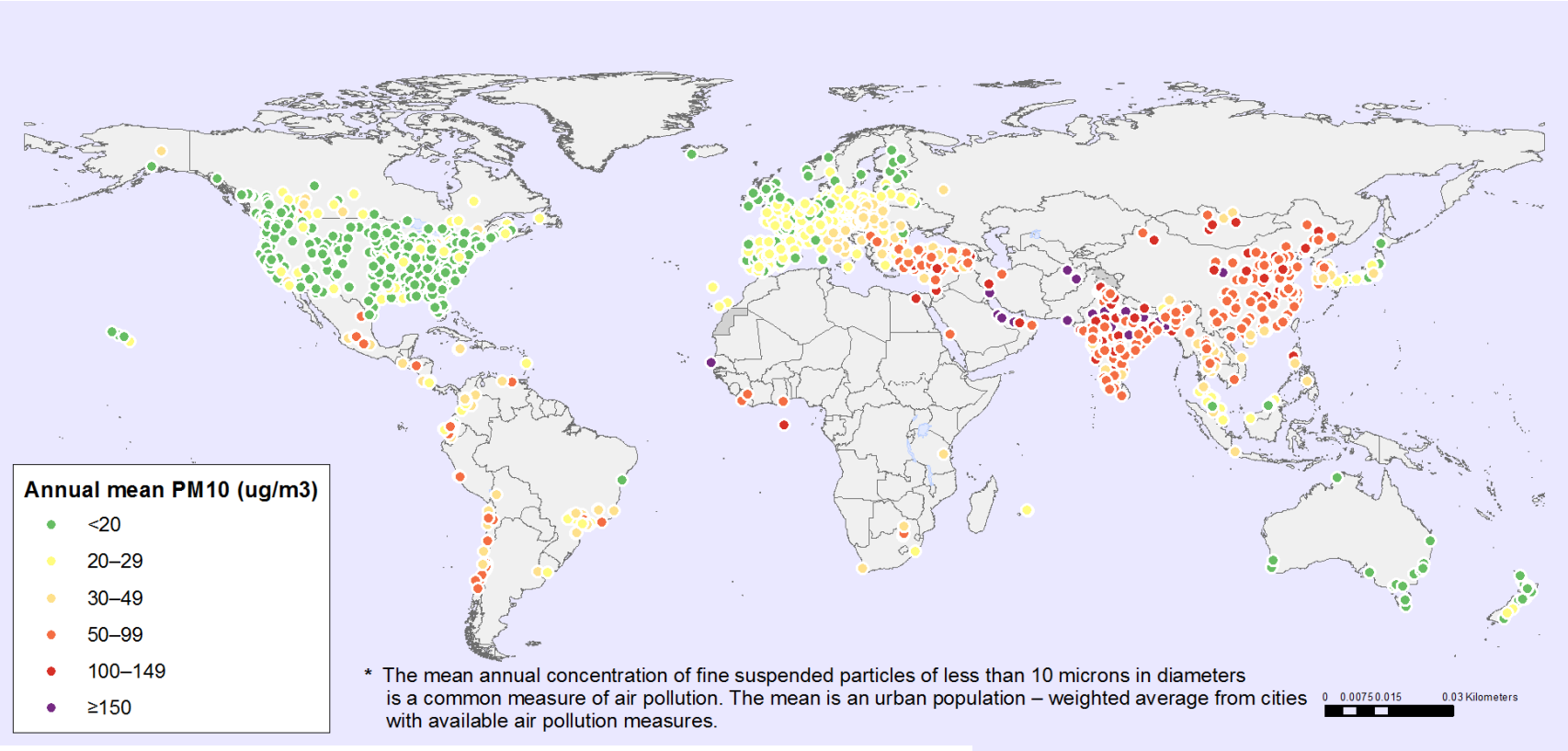
# Potential for Decarbonising Freight Transport in 15 Countries: *2010 - 2050*

| decoupling of freight tonne-km from GDP | Decoupling energy use from freight t-km | Decoupling freight energy use from related emissions |
|---|---|---|
| ↓ | ↓ | ↓ |
| freight transport intensity | energy intensity of freight transport | carbon intensity of freight energy |


Source: IDDRI / SDSN (2014) 'Pathways to Deep Decarbonisation

# Other Freight Transport Pollutants

## Average Exposure to PM10 in 1600 Urban Areas (2008-2013)



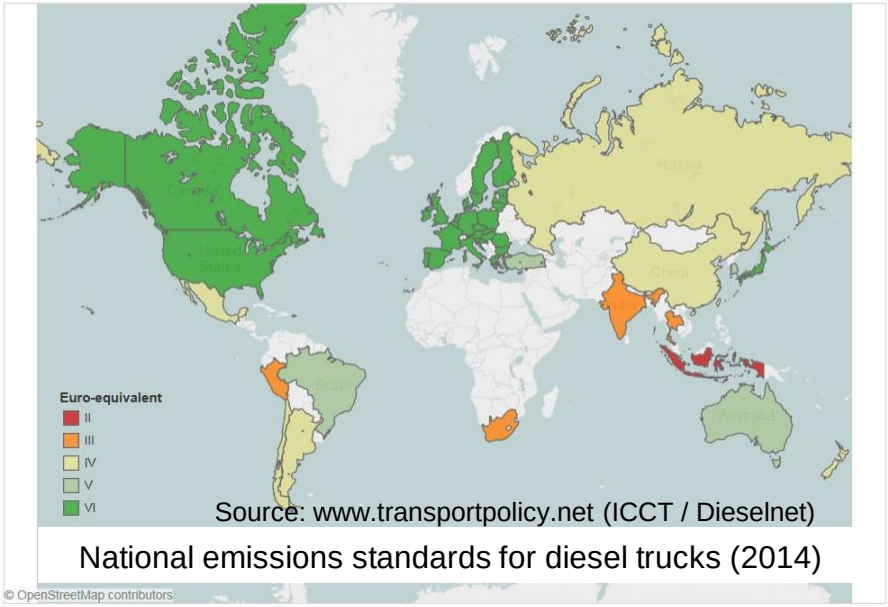

Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization

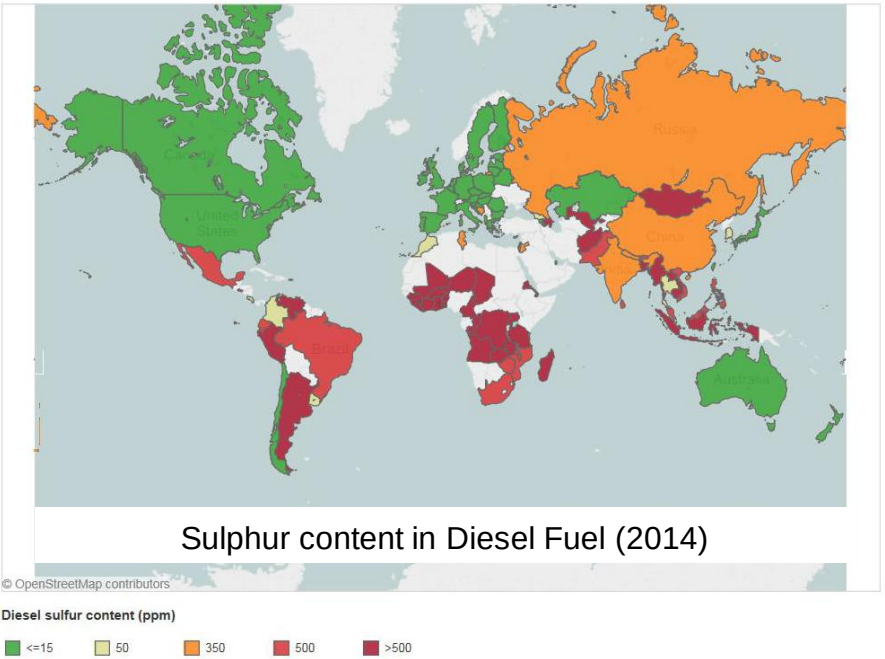


**Transfer of Green Freight best practice from developed to developing countries?**

# International Variations in Green Freight Parameters

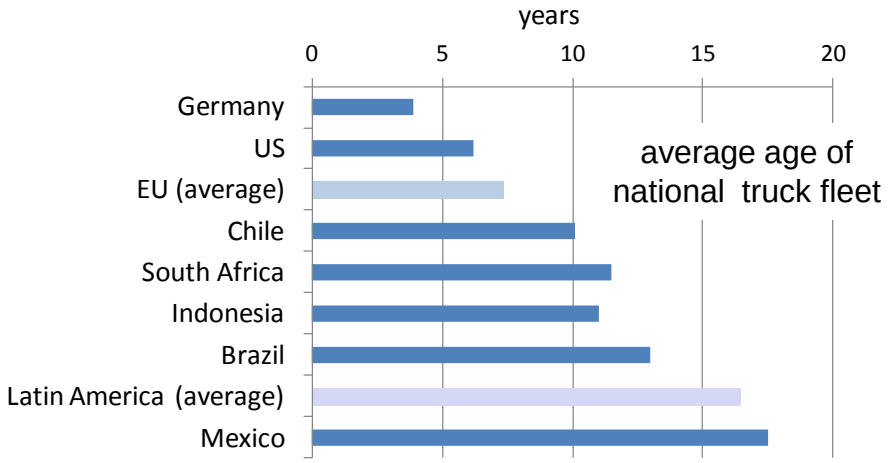


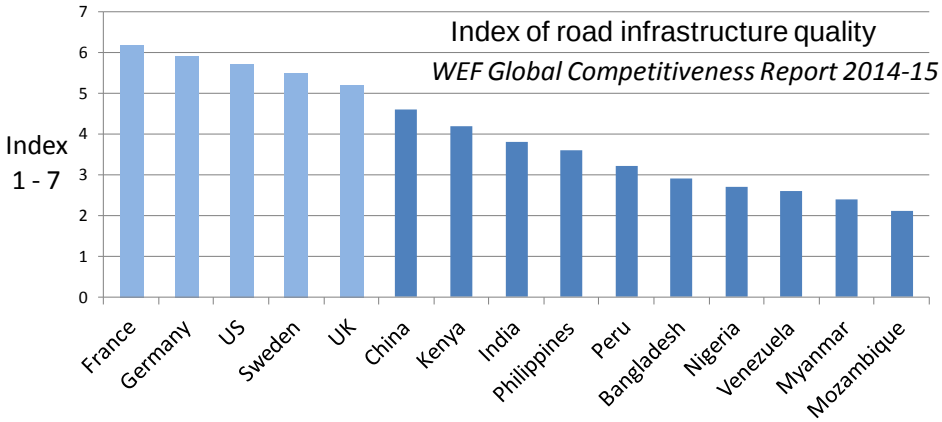

National emissions standards for diesel trucks (2014)




Sulphur content in Diesel Fuel (2014)

## subsidisation vs taxation of diesel fuel

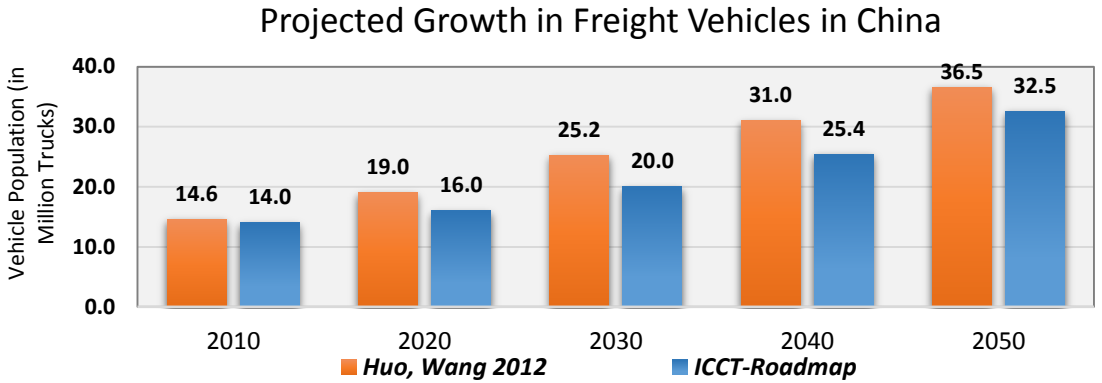


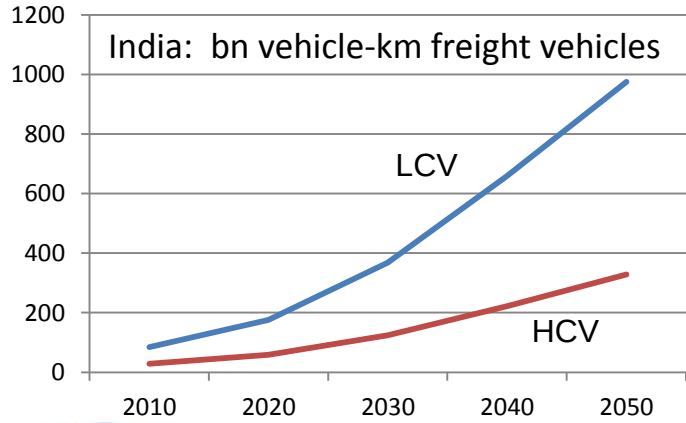




Truck design and capacity

Tyres

# Forecast growth of global truck market: 2014-2024



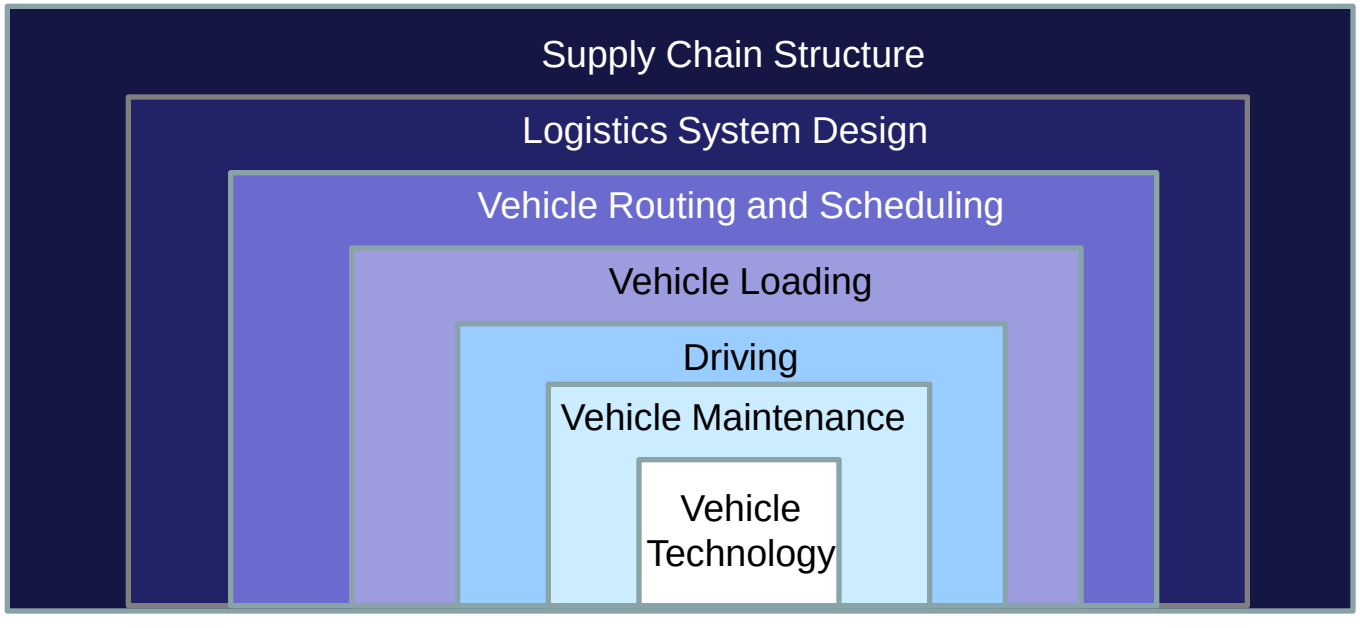



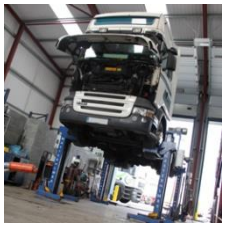


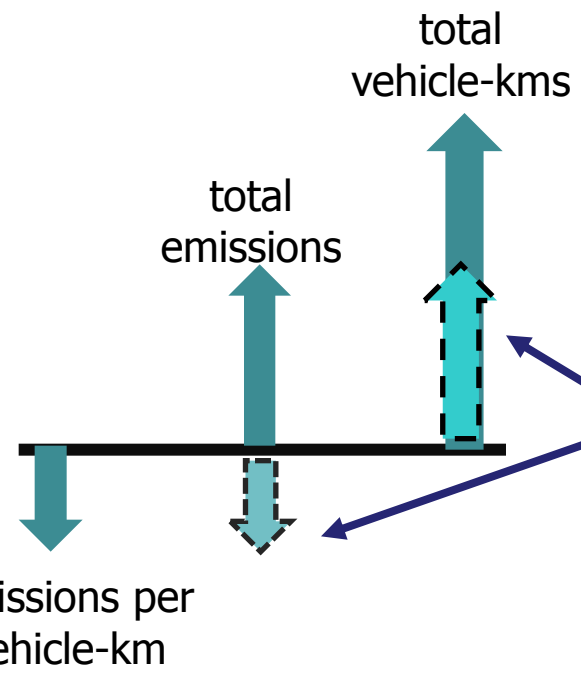


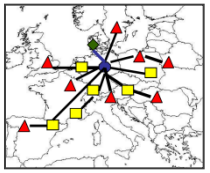
Source: Deloittes – '*Truck Market 2024*'

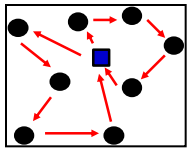
# Scope of a Green Logistics Programme



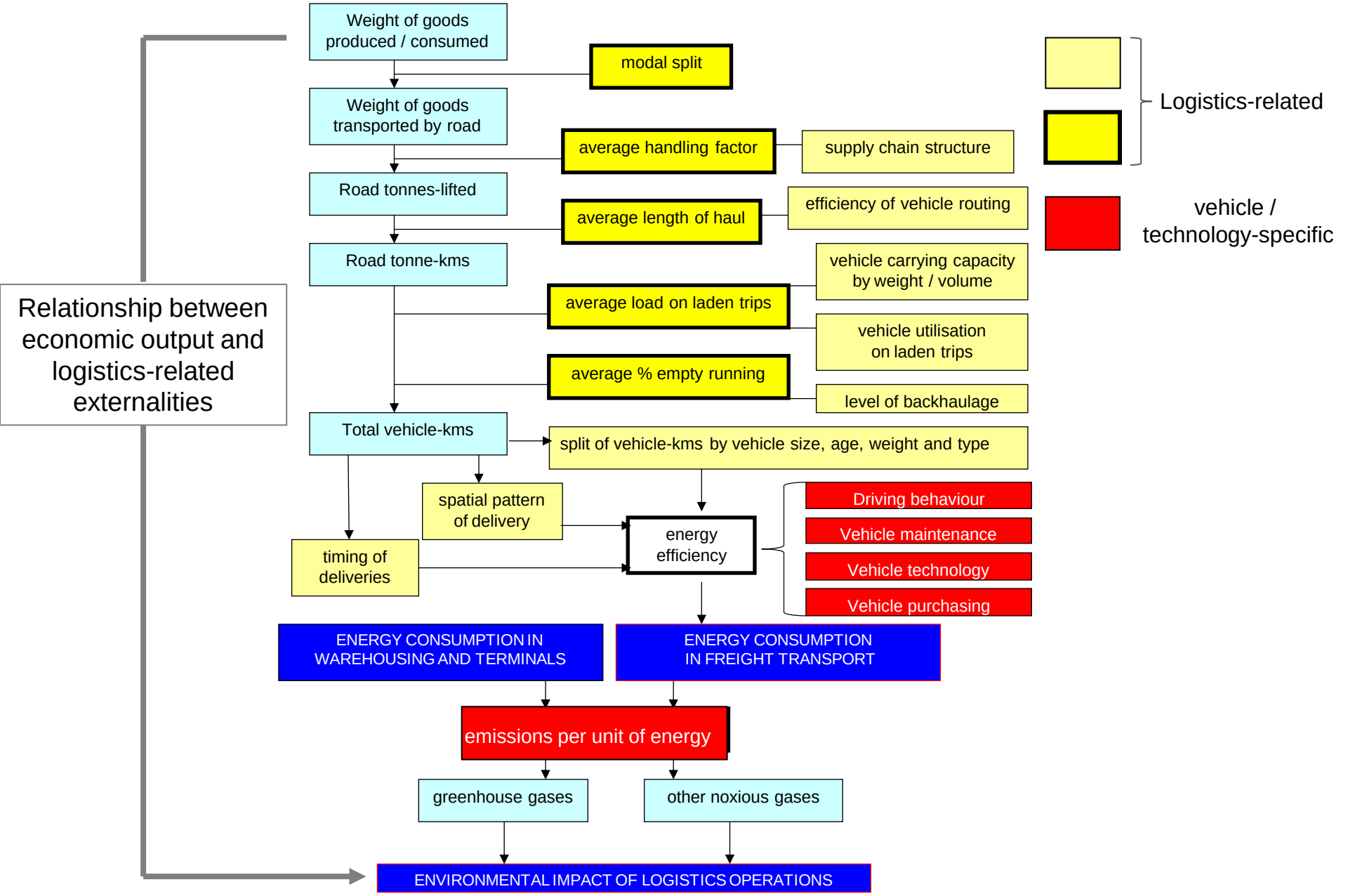







# Analytical Framework for Green Logistics



# Scoping of Logistics Interventions


logistics ≠ transport


delimiting the boundary around logistics initiatives

transport | logistics | related operations | business

fleet management
delivery scheduling
vehicle routeing
modal split
control tower
backloading
network design
cross-docking
port-centric logistics
primary consolidation
vertical collaboration
horizontal collaboration
recycling
order processing
materials handling
procurement
sourcing
vendor managed inventory
product design
packaging
sales and operations planning
outsourcing

single company

multi-business

# Plotting a greener logistics development pathway

opportunities for deviating from the conventional pathway

## conventional pathway

Economic development

Improvements to transport infrastructure – mainly road

Industrialisation

New patterns of consumption

Centralisation

Wider sourcing

New industrial / warehousing development not rail-connected

Change in commodity mix

Increased length of haul

Lower density / higher value products

Increased freight transport intensity: ratio of tonne-km to output

Decline in rail freight

Stronger just-in-time pressures

Growth in output

Poorer utilisation of vehicle capacity

Much more freight being moved

By less green mode

In less full vehicles

Greater environmental degradation

Higher externalities per unit of freight moved

internalise environmental cost – rebalance logistical cost trade-offs

land use planning policies for logistics

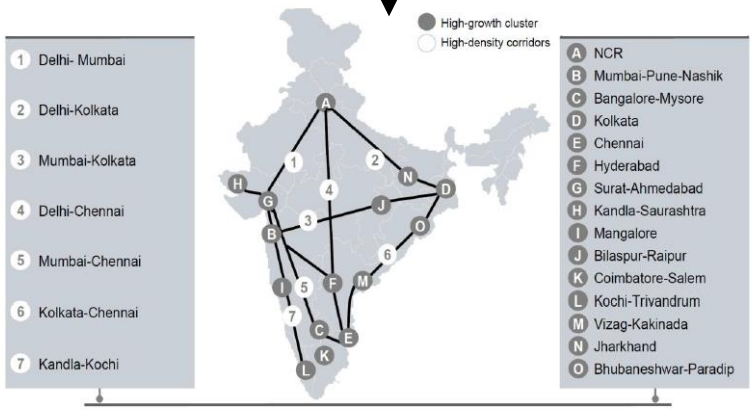
online freight exchanges to maximise backloading

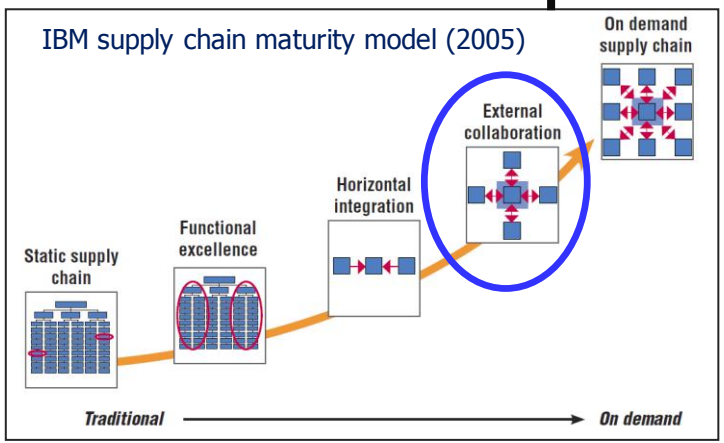
supply chain IT and analytics to optimise flows

promote supply chain collaboration

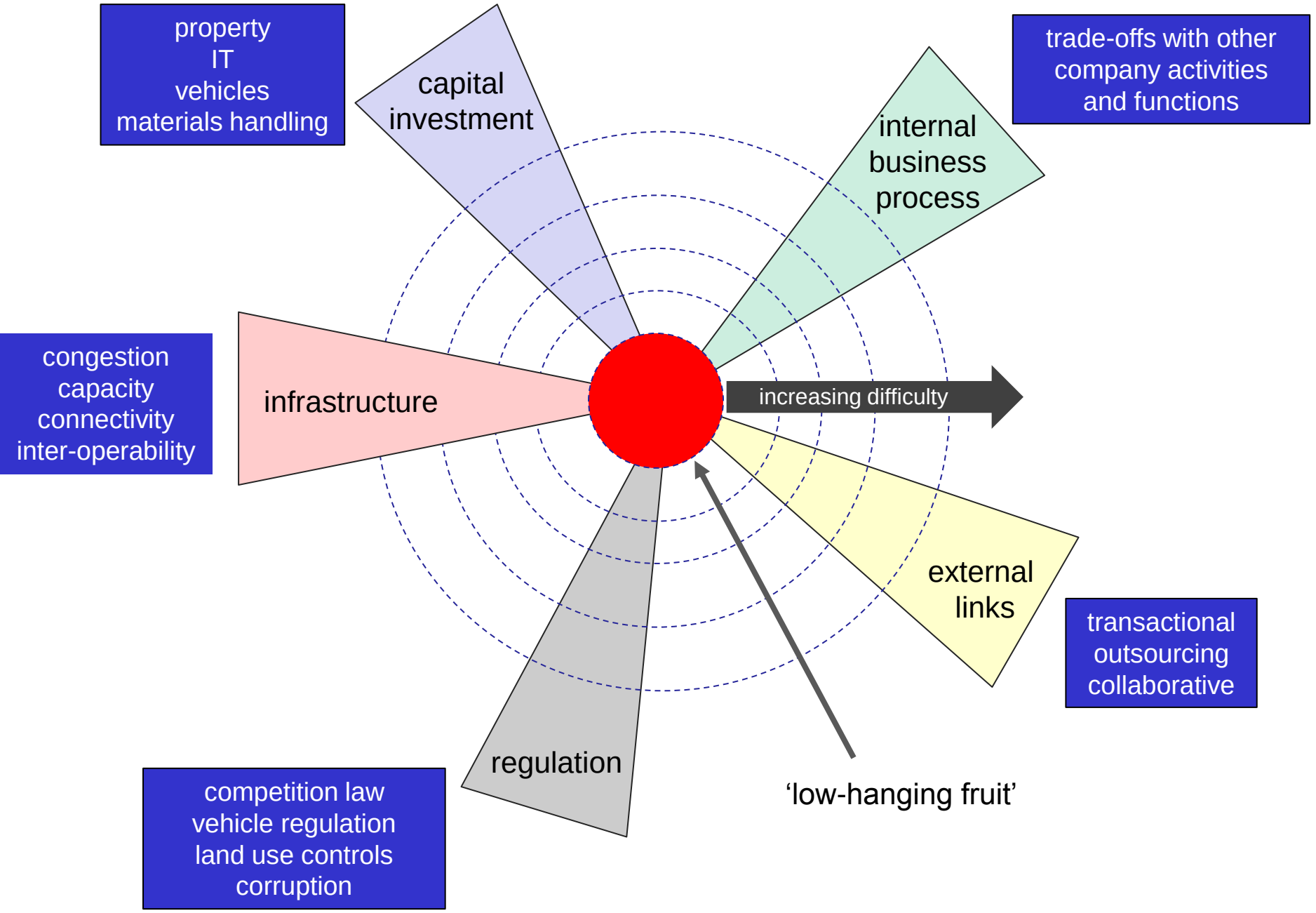
establish multi-modal logistics hubs

upgrade rail infrastructure and services

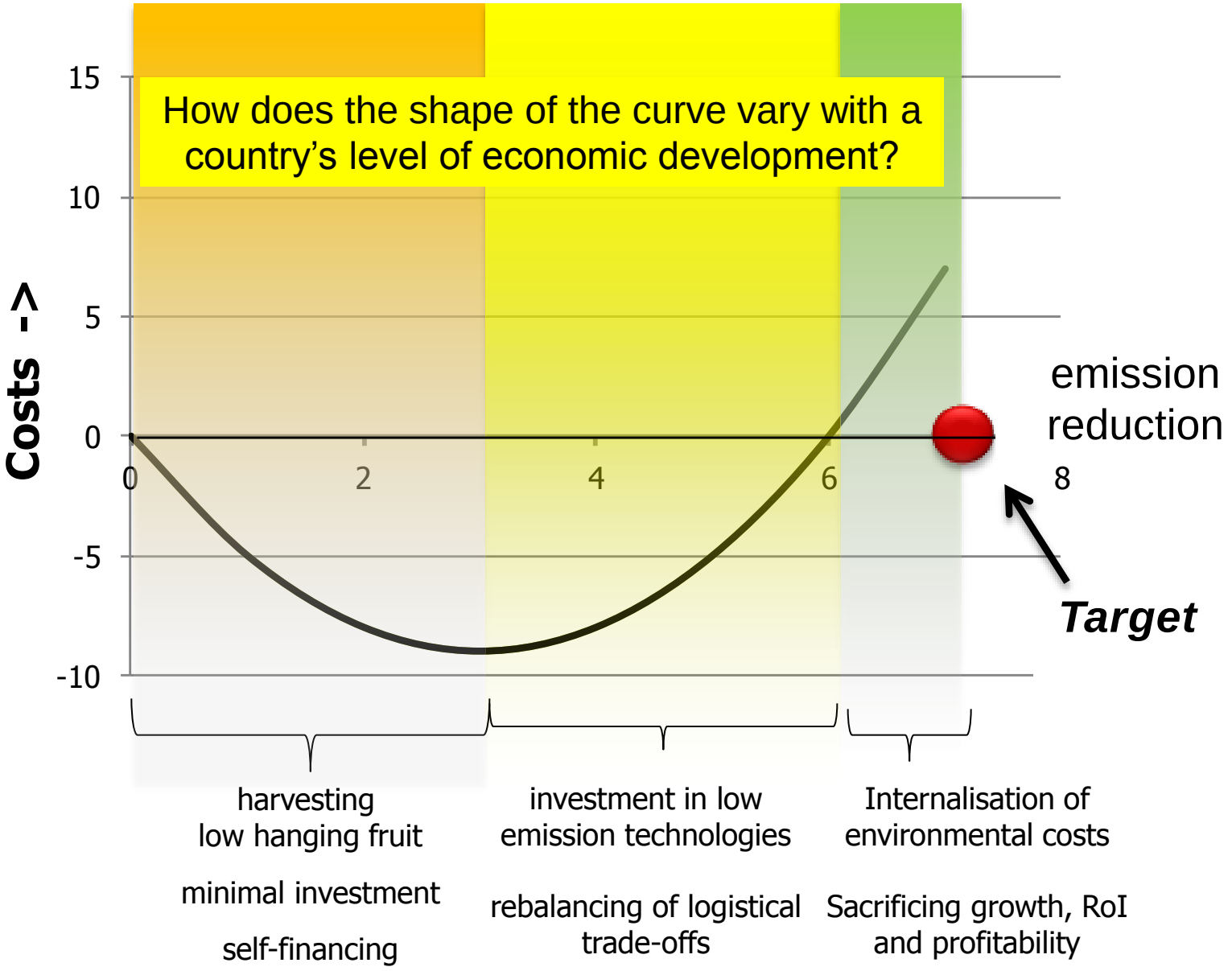


# Logistics interventions: *challenges and constraints*



# Future economics of greening logistics activities?




Adapted from Tavasszy (2014)

# Company targets to reduce the carbon intensity of logistics

| company | normaliser | time period | % carbon reduction target |
|---|---|---|---|
| Deutsche Post / DHL | *'every letter and parcel delivered, every tonne of cargo transported and every sq.m. of warehouse space'* | 2007-2020 | 30% |
| DB-Schenker | Tonne-km | 2006-2020 | At least 20% |
| UPS | UPS Transportation Index | 2010-2017 | 5% |
| UPS Airlines –Global | Pounds of $CO_2$ emitted for every ton of capacity transported on nautical mile | 2005-2020 | 20% |
| Fedex (aircraft) | available ton mile (ATM) | 2005-2020 | 20% |
| TNT (Mail and Express) | not specified | 2007-2020 | 45% |
| Maersk Line | not specified | 2007-2020 | 25% |
| NYK | 'unit of transportation from vessels' | 2006-2013 | 10% |

Source: McKinnon and Piecyk, 2012

40% improvement in carbon intensity of global logistics between 2010 and 2020

## Reconciling corporate carbon intensity targets with absolute targets of governments

EU 2011 Transport White Paper target: 60% reduction in **TOTAL** $CO_2$ from transport by 2050

# Assessing the effect of **external** factors on the decarbonisation of logistics

## TIMBER framework

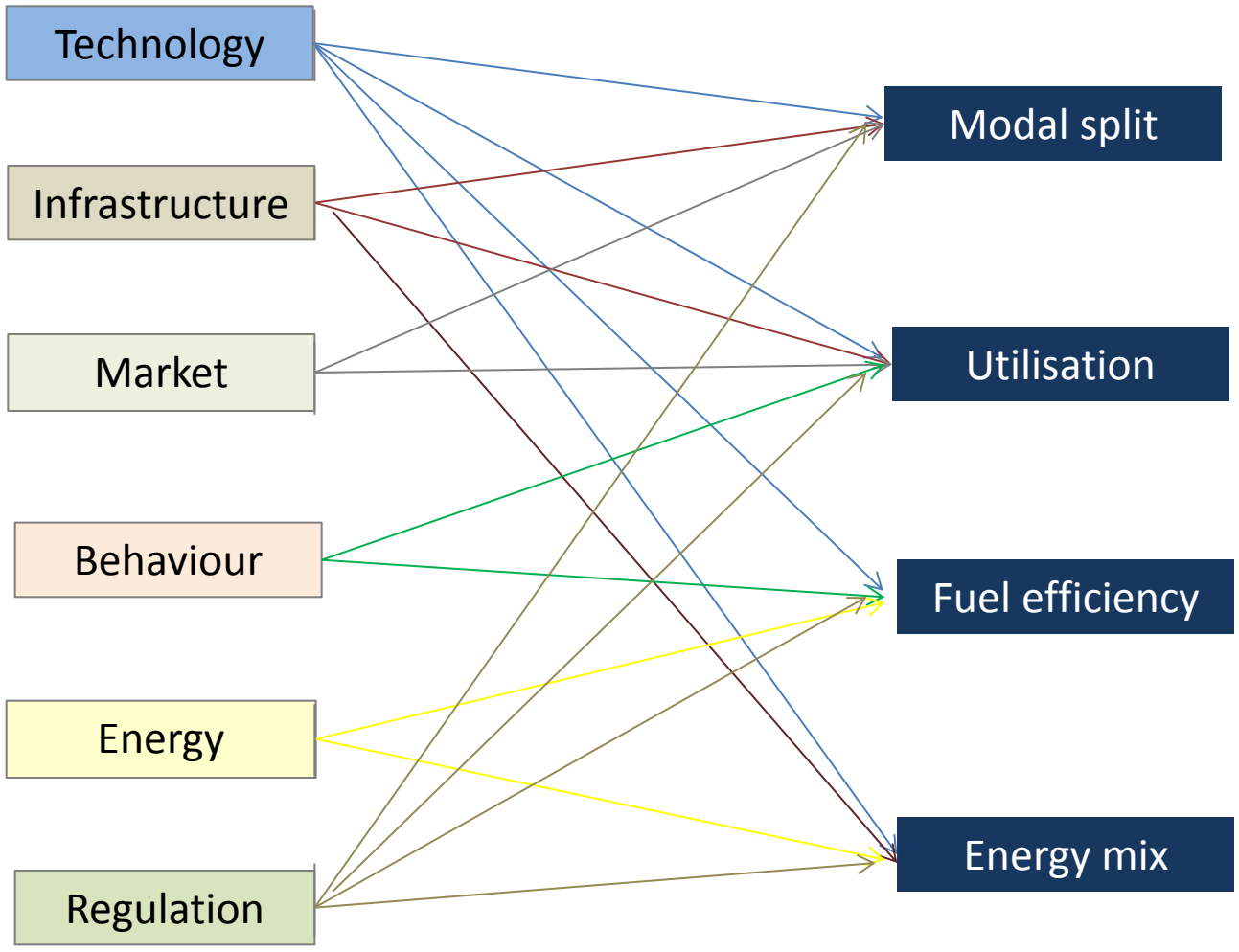
categories of external factor

- Technology
- Infrastructure
- Market
- Behaviour
- Energy
- Regulation

Assessing the effect of **external** factors on the decarbonisation of logistics

# TIMBER framework

categories of external factor



# Assessment of the Influence of **External** Factors on Logistics Decarbonisation

| | |
|---|---|
| Europe: | *Germany / Austria / Switzerland, UK, Netherlands, France, Italy* |
| North America: | *US, Mexico* |
| Asia: | *China, India, Indonesia* |
| Africa: | *South Africa* |

Professor Cees Ruijgrok
(Netherlands)

Dr Jacques Leonardi
(France)

Clean Air Asia
(China)

University of Stellenbosch
(South Africa)

Mr. Sudhir Gota
(India and Indonesia)

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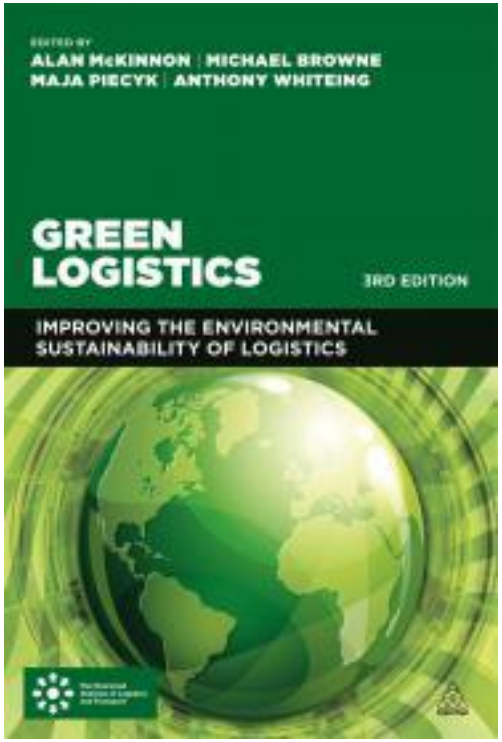
## Professor Alan McKinnon

Kühne Logistics University – the KLU
Wissenschaftliche Hochschule für Logistik und Unternehmensführung
Grosser Grasbrook 17
20457 Hamburg

tel.: +49 40 328707-271
fax: +49 40 328707-109

e-mail: Alan.McKinnon@the-klu.org
website: www.the-klu.org



# Examples of General Recommendations to Companies

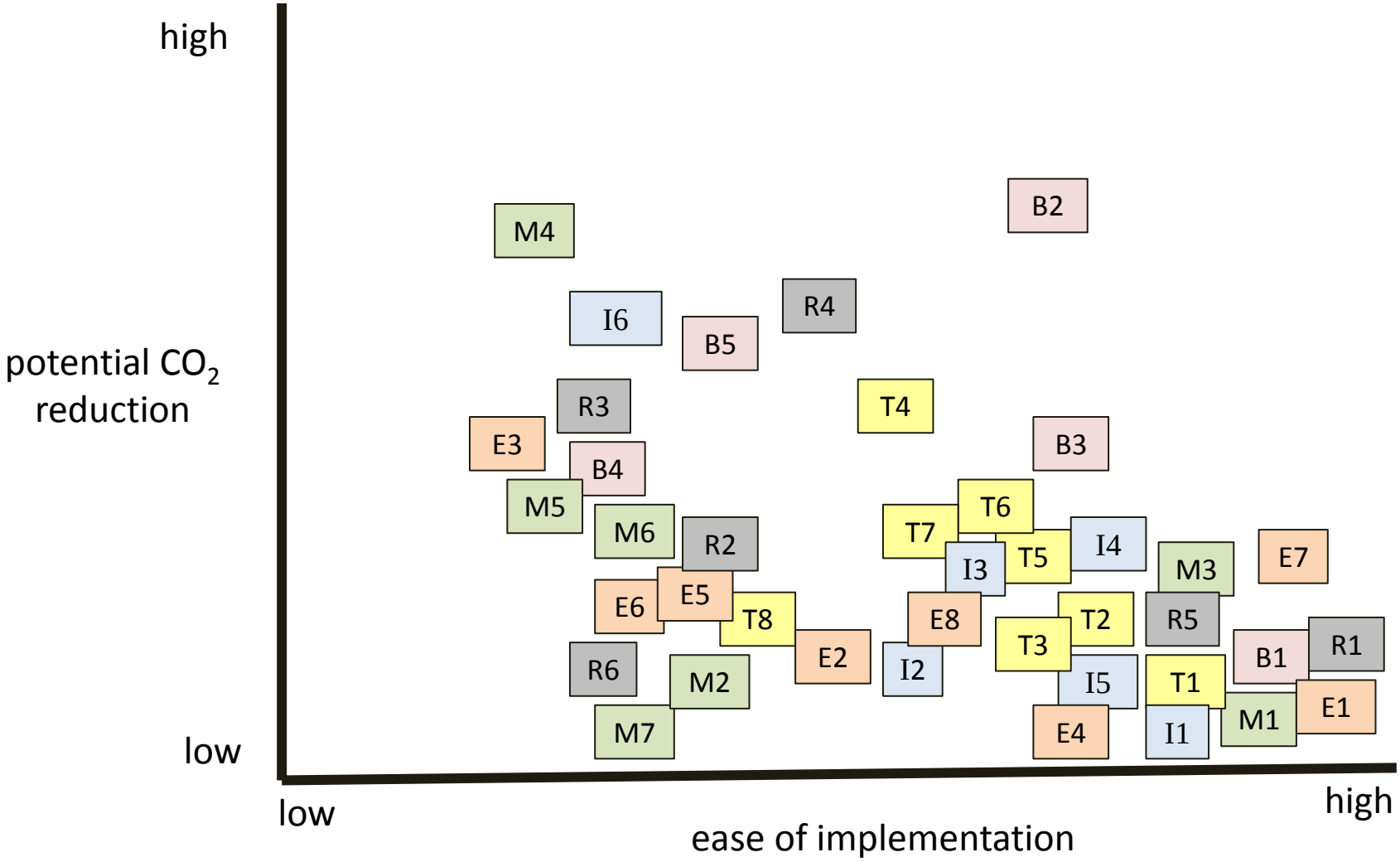
## TECHNOLOGY (T1-8)

1. Review available data (in main report) on potential carbon savings from truck technologies, future trajectories, uptake rates and cost effectiveness
2. Assess client expectations of future level of carbon emissions from their logistics operations and willingness to pay for low carbon technologies (LCTs)
3. Regularly recalibrate carbon modelling tools to reflect impact of LCTs, especially in countries with tightening fuel economy standards
4. Take advantage of any government schemes for vehicle scrappage and / or incentivising the purchase of lower $CO_2$ vehicles
5. Partner with vehicle and equipment manufacturers to pilot new LCTs in logistics
6. Exchange information with shippers / clients on new logistics-related LCTs , either directly or through green freight organisations
7. Establish joint initiatives with larger shippers / clients to develop / trial of new LCTs
8. Assess options for switching to alternative fuels: systematic reviews of the cost,quality, availability and carbon intensity of alternative fuels

## INFRASTRUCTURE ( I 1-6)

1. Review available data (in main report) on infrastructural trends and developments and their likely impact on carbon intensity
2. Take full account of planned road improvements in the planning of DC locations and delimitation of their service areas
3. Assess the effect of planned changes in rail / water-borne / intermodal infrastructures on the relative attractiveness of a shift to lower $CO_2$ modes
4. Ensure that vehicle routeing systems are sensitive to changes in the quality / reliability of road and rail networks
5. Take account of fuel consumption and $CO_2$ emissions when planning vehicle routes and schedules
6. Work with shippers / clients to find ways of rescheduling deliveries into off-peak periods to minimise impact of congestion on $CO_2$ emissions

Rating of TIMBER recommendations
by ease of implementation and potential $CO_2$ saving



# TIMBER Scenario 1: OPTIMISTIC

## Technology

- Rate of technology advance and uptake in the logistics sector at upper end of projections
- More rapid diffusion of low carbon technologies (LCTs) to developing countries / emerging markets
- IT advances (e.g. analytics, big data and cloud computing) translate into much greater $CO_2$ efficiency

## Energy

- Rate of decarbonisation of grid electricity at upper end of projections
- 2nd and 3rd generation biofuels shown to yield significant net GHG savings at affordable cost
- Extensive use of micro-generation at logistics facilities where climatic conditions are favourable

## Infrastructure

- Congestion minimised by capacity increases, improved infrastructure management and road pricing
- Prioritised investment in rail, inland waterways and ports promotes significant shift to these alternative modes
- Extensive gas refuelling and battery-recharging networks in place

## Behaviour

- Eco-driving is standardised by compulsory training
- Electronic monitoring of driver behaviour becomes universal
- In-cab guidance systems, smart cruise control and ultimately automation over-ride deficiencies in driver behaviour

## Market

- Large increase in horizontal and vertical collaboration in FMCG supply chains
- Full harmonization of carbon auditing and reporting by logistics providers and carriers
- Load fill and minimization of transport $CO_2$ prioritised over inventory reductions
- Competitiveness of rail-freight services enhanced by liberalization / privatization and corridor planning

## Regulation

- Truck size and weight limits are relaxed with measures to minimise adverse effect on rail's market share
- More governments introduce vehicle scrappage schemes to accelerate adoption of LCT across the truck fleet
- Proliferation and harmonization of national fuel economy standards for trucks

# TIMBER Scenario 2: PESSIMISTIC

## Technology

- Rate of technology advance and uptake in the logistics sector at the lower end of projections
- Diffusion of low carbon technologies (LCTs) to emerging markets restricted by cost factors, import controls etc
- Business practices and corporate governance prevent IT innovations from being fully exploited

## Energy

- Rate of decarbonisation of grid electricity at the lower end of projections
- Transport useage of biofuels remains low due to concerns about net GHG impacts, land use effects etc
- Low 'feed-in' tariffs and poor rates of return discourage micro-generation at logistics facilities

## Infrastructure

- Traffic growth exceeds additional infrastructural capacity increasing congestion and related $CO_2$ emissions
- Limited improvement to rail and water-borne infrastructures as investment in passenger rail, highways and aviation are prioritised
- Gas refuelling and battery-recharging networks are slow and expensive to develop

## Behaviour

- Eco-driving remains patchy, particularly in the developing world
- Adoption electronic monitoring of driver behaviour proceeds at a slow rate
- Use of technology to control vehicle operation is resisted by trade unions and owner drivers in many countries.

## Market

- Collaborative initiatives in the FMCG sector stabilise at a low level because of corporate inertia, managerial scepticism, legal constraints etc
- Comparing the carbon / environmental performance of carriers remains inconsistent and difficult
- JIT pressures intensify in the FMCG sector forcing reductions in load fill and transport-$CO_2$ increases
- Modal shift to rail continues to be inhibited by a lack of competitiveness in the rail / intermodal sectors

## Regulation

- Strong resistance from the railways and environmental organisations discourages governments and EU from relaxing truck size and weight limits
- Governments are reluctant to commit the large sums requires to rejuvenate national truck fleets
- National fuel economy standards for trucks remain confined to the US, China and Japan