The first of a series of three linked lectures on the Sustainable Mobility Paradigm given as part of the Benelux Interuniversity Association of Transport Researchers (BIVEC-GIBET) programme.

Planetary Boundaries and Low Carbon Urban Mobility

David Banister

Transport Studies Unit

School of Geography and the Environment

University of Oxford

1. Introduction

Planetary boundaries – pillars of sustainability – urban mobility

1. Three sets of planetary boundaries – environmental, economic and social
2. Interfaces between them
3. Urban Mobility and the Sustainable mobility paradigm
4. Availability and use of space in cities
5. City structure and urban form
6. Conclusions

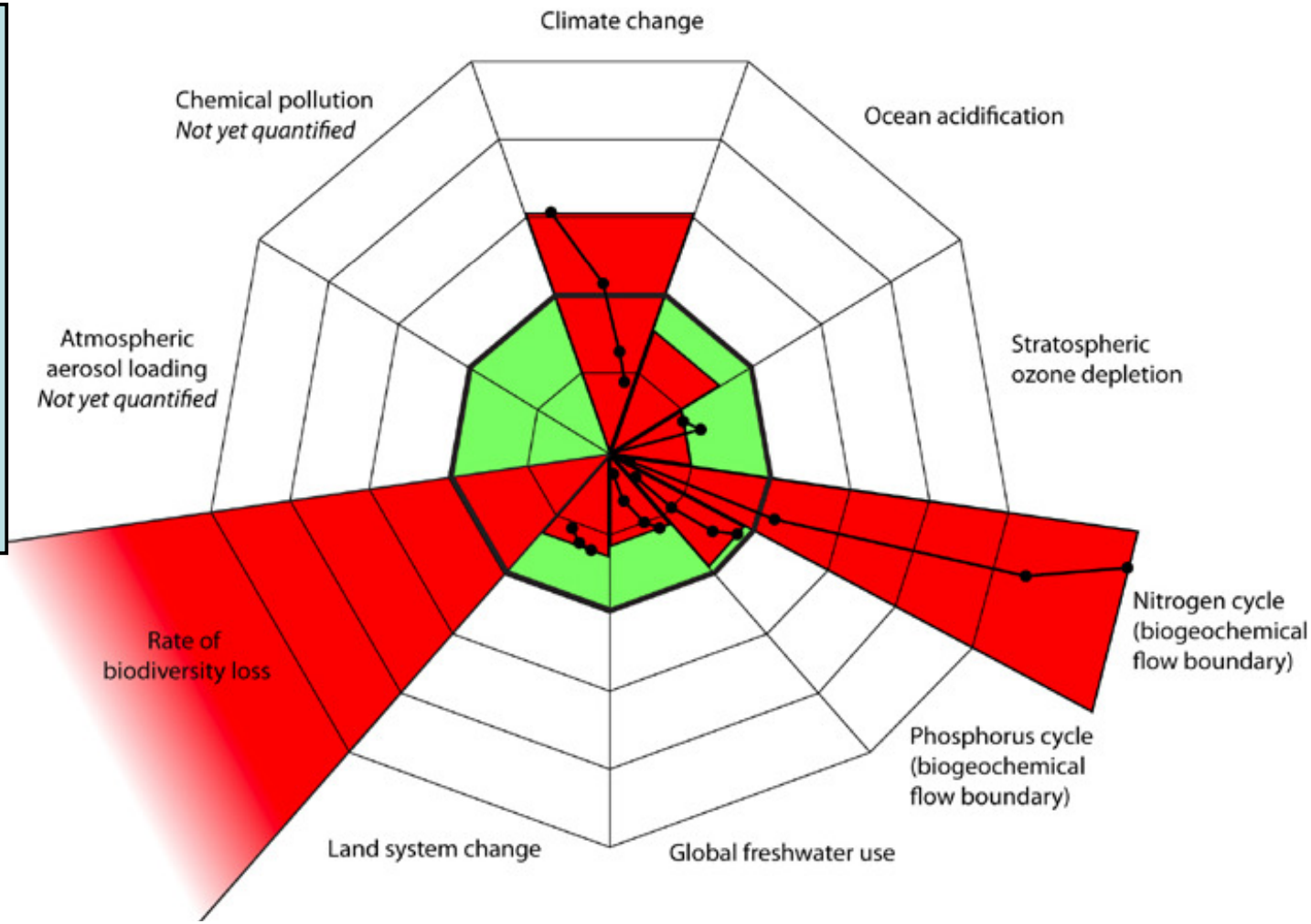
Planetary Boundaries: Environmental

Ten systems and ‘safe’ limits – exceeded in 3: Biodiversity loss, Climate change and the Nitrogen cycle – Johan Rockström et al (2009)

Complexity, non linearities, thresholds

Tipping points and transitions from one state to another

CO2 – 450 ppmv stabilisation target for 2050



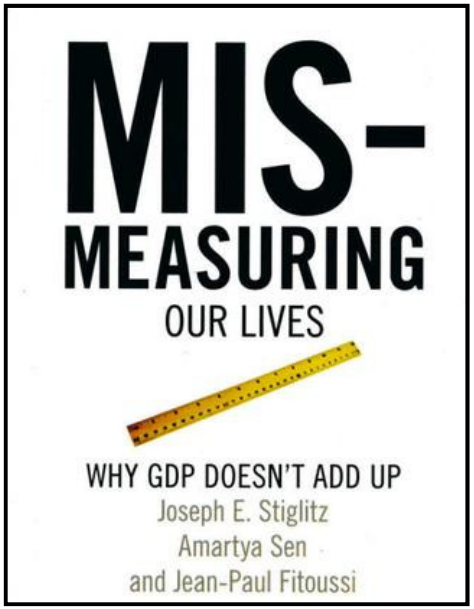
Planetary Boundaries: Economic

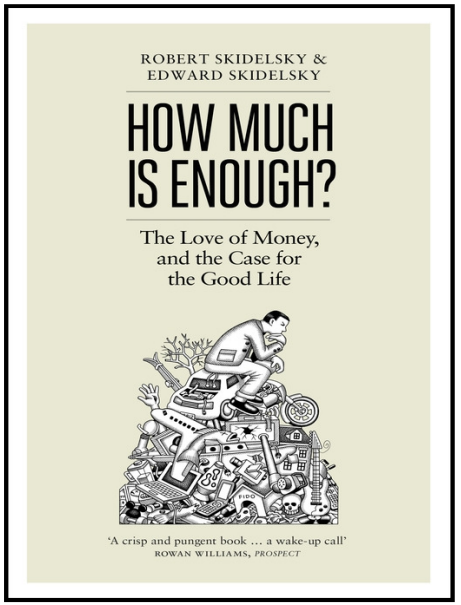
Stagnation in Growth in Western Economies

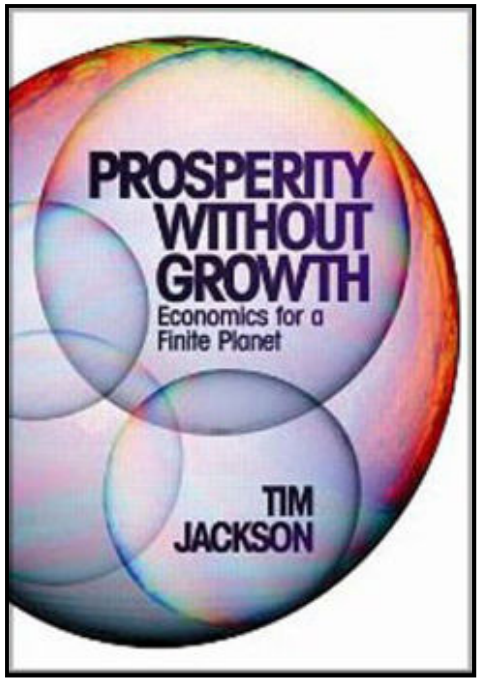
- High levels of unemployment
- Levels of sovereign debt
- Meltdown of banking system

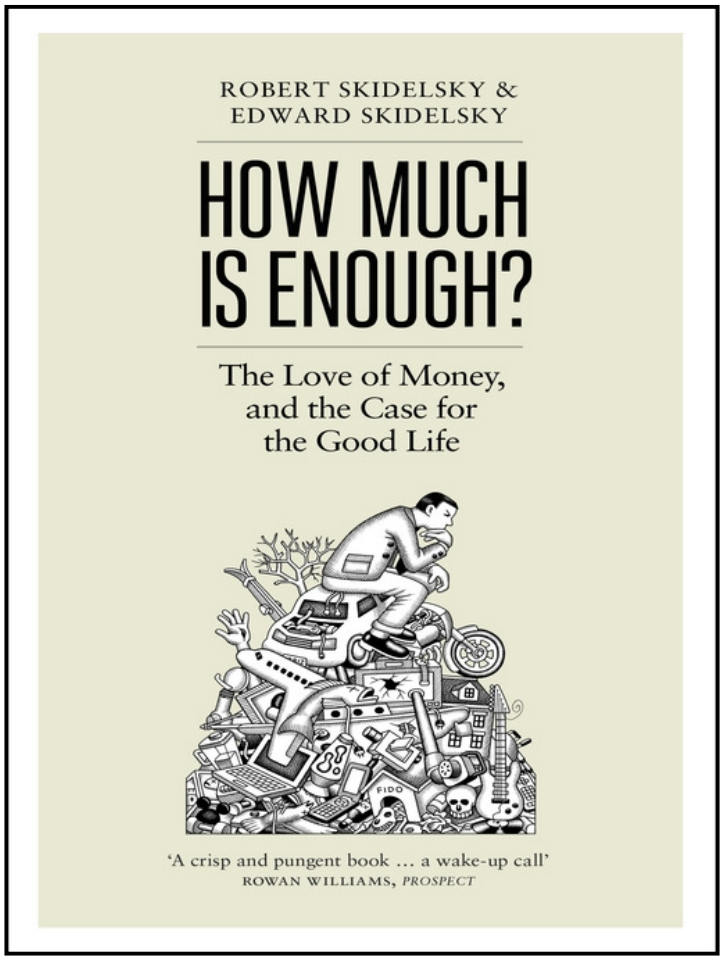
Inclusion of metrics to measure sustainability – economic balance sheets to cover assets, debts and liabilities

Measurement of Well-being – legacy values to future generations and distributional fairness









Argue for a finite quantity of material needs that should be satisfied – that society has not differentiated between needs and wants

Talk about the quality of life through seven elements – health, security, respect, personality, harmony with nature, friendship and leisure

Use updated figure produced by Keynes in the 1930s - €50,000 in 2012 prices

Planetary Boundaries: Social

Growth in global population

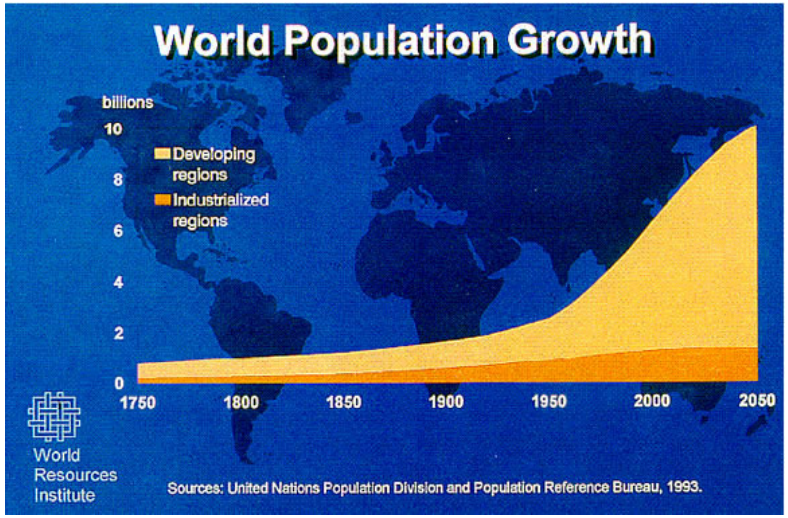
7 billion (March 2012) and 50% in urban areas

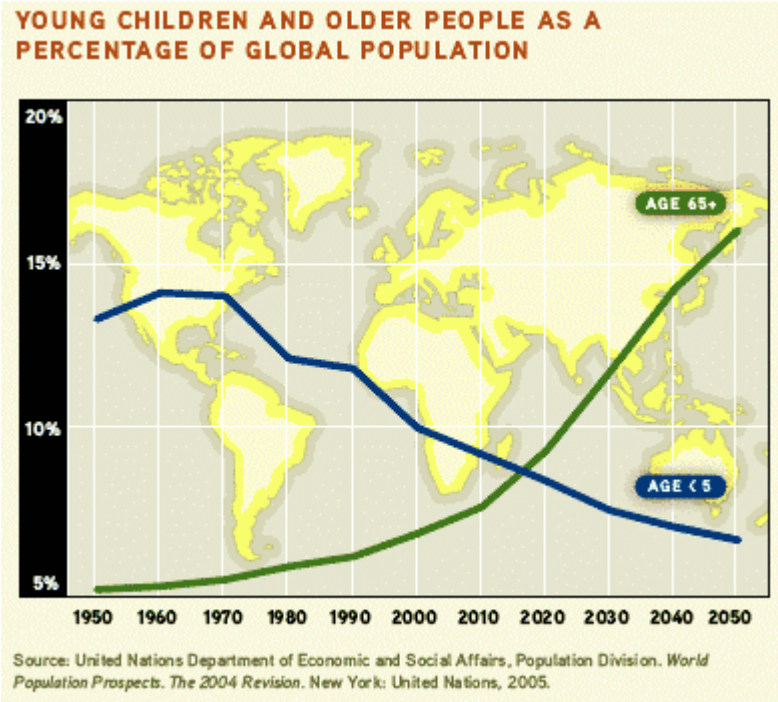
9 billion (2050) and 70% in urban areas

• Ageing: 1 billion >60 in 2050

• The older population is itself ageing, as the fastest growing age group is those over 80 years (3.8% per annum)

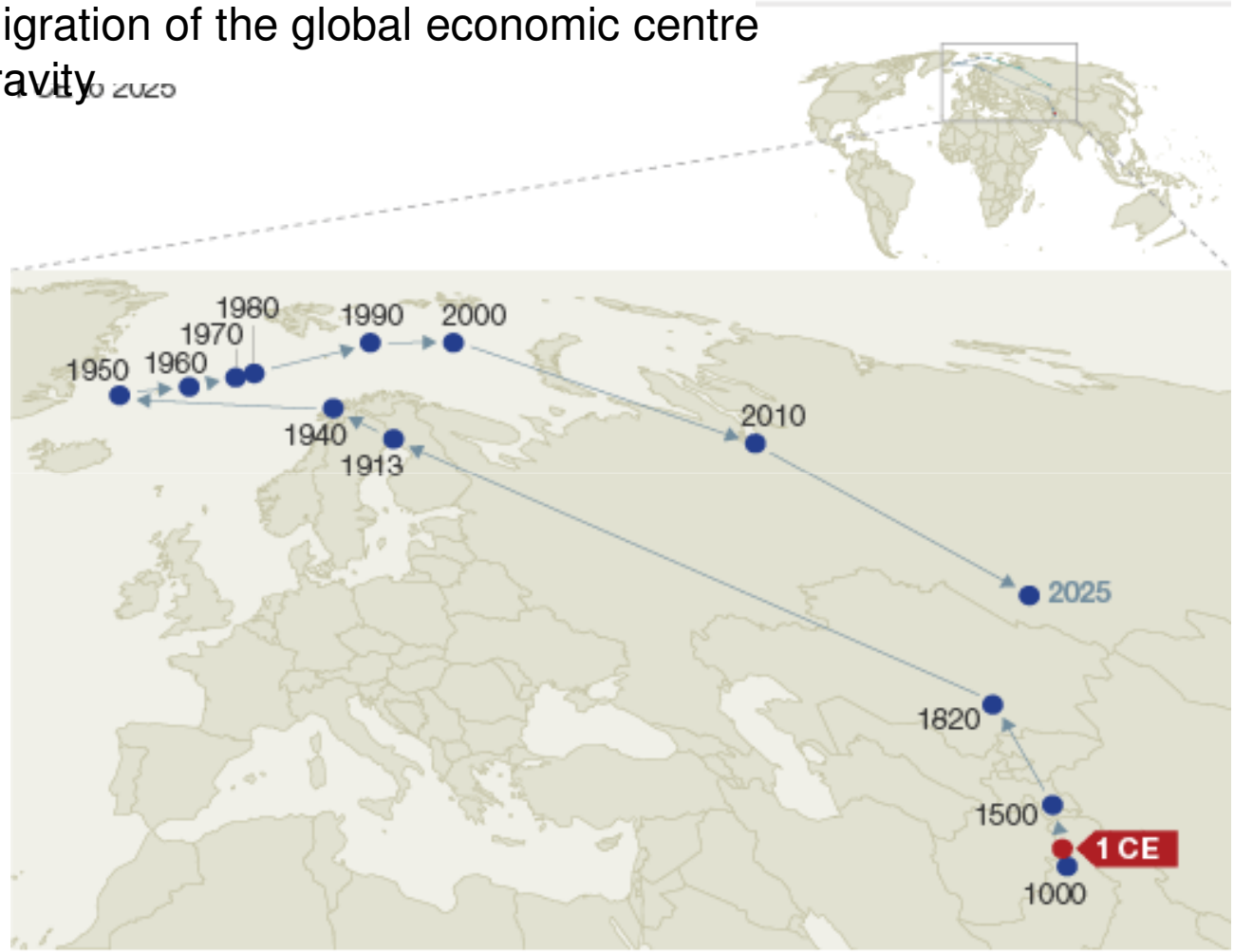
• Migration: 5 million cross boundaries in developed countries – plus impact of natural disasters – 20 million (2008)





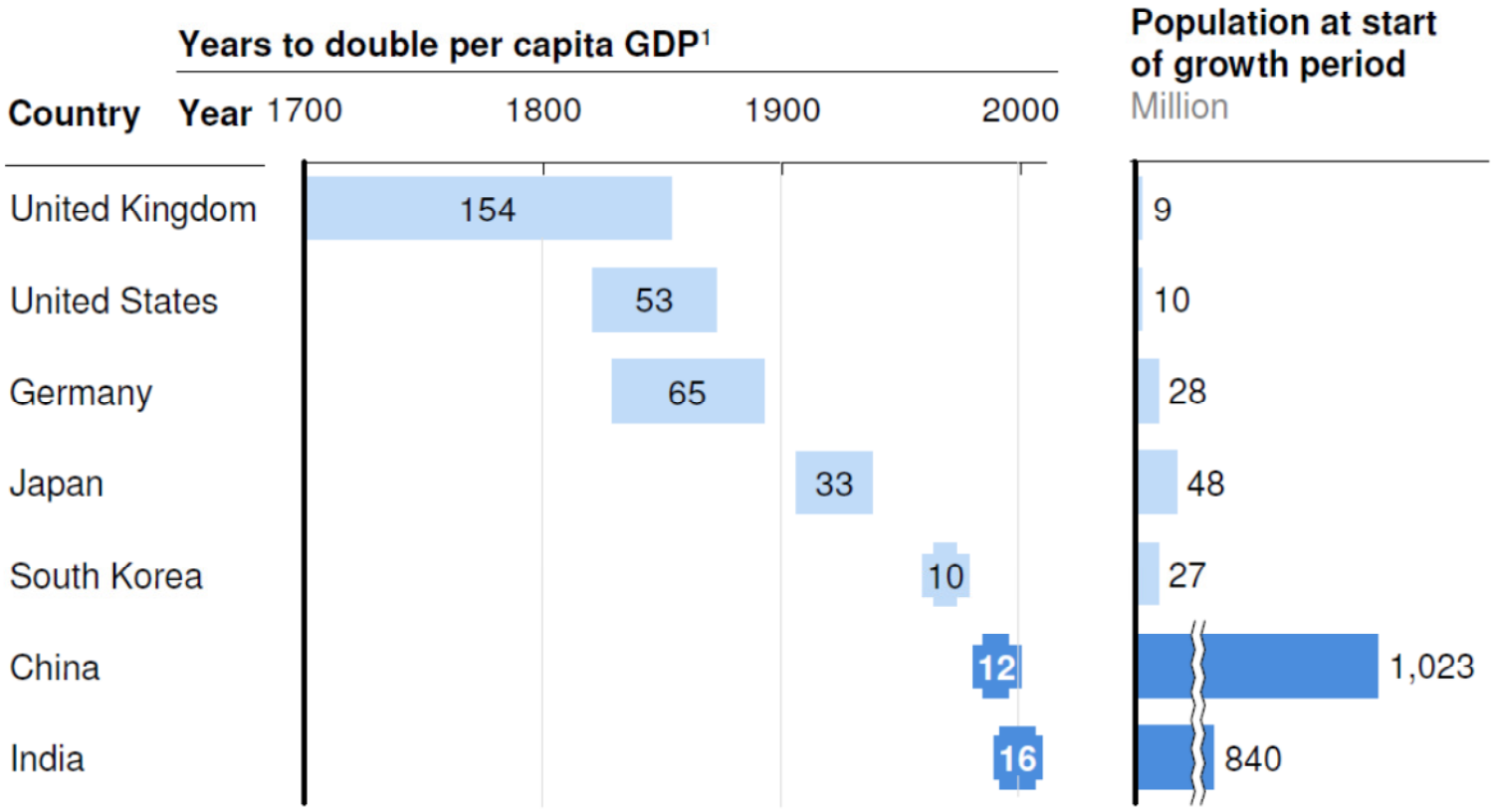
2. Interfaces between PBs

a) Migration of the global economic centre of gravity



[1]Calculated by weighting national GDP by each nation's geographic center of gravity; a line drawn from the center of the earth through the economic center of gravity locates it on the earth's surface. For detailed analysis, see the appendix in the McKinsey Global Institute (MGI) report *Urban world: Cities and the rise of the consuming class*.
Source: MGI analysis using data from Angus Maddison, University of Groningen; MGI Cityscope v2.0

b) Speed of change

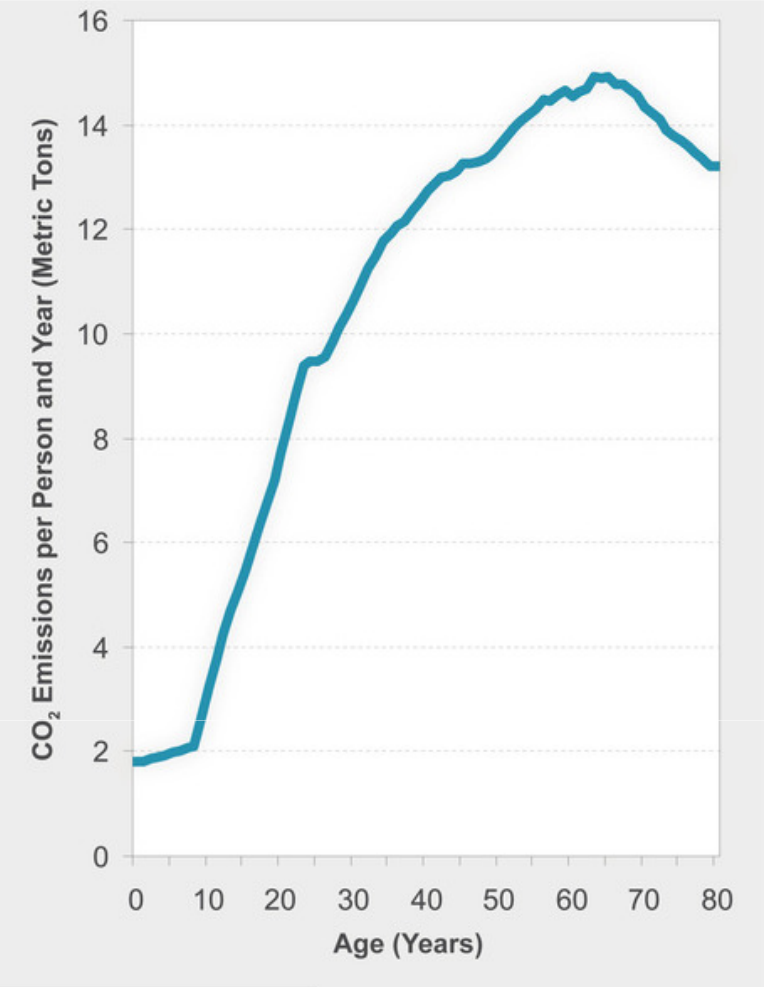


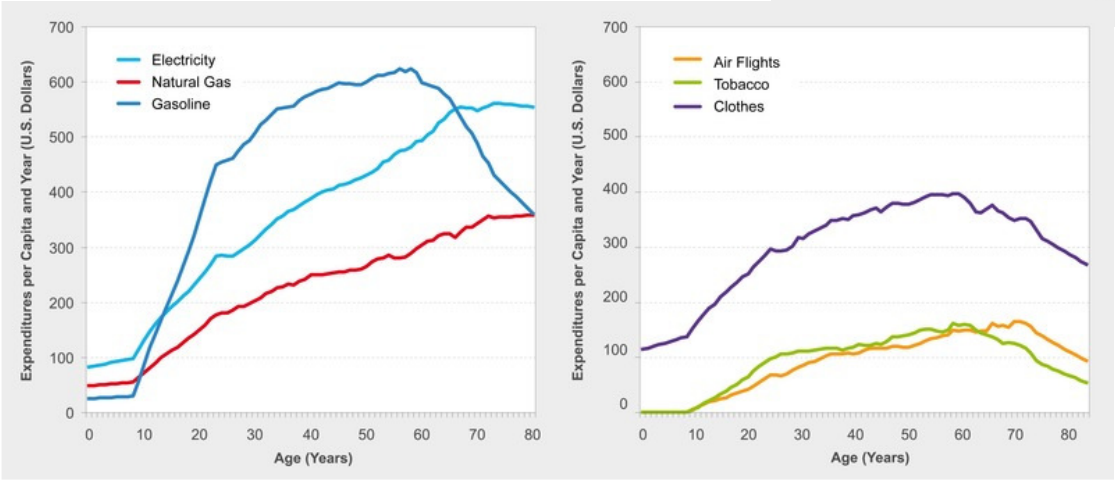
1 Time to increase per capita GDP in PPP terms from $1,300 to $2,600.

SOURCE: Angus Maddison; University of Groningen; *Resource Revolution: Meeting the world's energy, materials, food, and water needs*, McKinsey Global Institute, 2011.

c) Age related CO_2 emissions in the US (2007): based on the consumption of nine goods, including transport fuel, air flights and car purchases

Emilio Zagheni (2011)





d) Urban density and transport CO_2 emissions

Atlanta and Barcelona have about the same population – but Atlanta's urban area is 26 times larger than that of Barcelona – and its CO_2 emissions levels are over 4x as high – but Barcelona's figures are higher than those of other cities with the same densities

3. Urban Mobility and the Sustainable Mobility Paradigm

World's Largest 30 Cities in 2020

By GDP (PPP)

Source: Jones Lang LaSalle, World Winning Cities, 2012

Meta City Regions >40 million

Pearl River Delta 60m: Yangtze River Delta 105m

Tokaido Corridor 83m: Sao Paulo Rio Corridor 40m

Mega Agglomerations and Axial City Regions

The Sustainable Mobility Paradigm – Banister (2008)

1. TRIPS	2. DISTANCE	3. MODE	4. EFFICIENCY
Substitute or not make trips	Shorten trip lengths Land use planning	Use of public transport Walk and cycle	Load factors Fuels Efficiency Design

Sustainable Urban Transport Paradigm – ADB (2009), p4

1.Transport policy is defined by what works — including end users — participate in the policy-making process to ensure that plans and projects reflect actual needs.
2.Land use planning is part of the solution. To facilitate the provision of public transport and reduce the need for travel.
3.Transport demand is managed to supply and projects are centered on traffic restraint and the greater use of public transport.
4.Transport plans and projects reflect a wider city vision or spatial strategy. They are also affordable, adaptable, and implementable.
5.Policy effectiveness is demonstrated to a skeptical stakeholder community.

4. Availability and Use of Space in Cities

Efficiency – in use of space. Energy used and people carried

Typical travel space requirements by mode – Litman (2012), Table 5

	Speed mph (and km/hr)	Standing/Parked sq ft (and sq m)	Travelling sq ft (and sq m)
Pedestrian	3 (5)	10 (0.95)	30 (2.85)
Bicycle	10 (16)	20 (1.86)	100 (9.29)
Bus passenger	15 (24)	20 (1.86)	20 (1.86)
Car - slow	20 (30)	100 (9.29)	300 (27.87)
Car – fast	60 (90)	100 (9.29)	3000 (278.7)

Road supply as a percentage of urbanised area – Vasconcellos (2001), Table 2.1

Developing countries	% land used for roads	Developing countries	% land used for roads	Developed countries	% land used for roads
Kolkata	6.4	Delhi	21.0	New York	22.0
Shanghai	7.4	Sao Paulo	21.0	London	23.0
Bangkok	11.4			Tokyo	24.0
Seoul	20.0			Paris	25.0

The Shared Transport City

Reinterpretation of the principles of transport analysis – time and speed

The Vision: Low carbon mobility in cities focuses on shorter distances, slower transport and the creative sue of time in travel

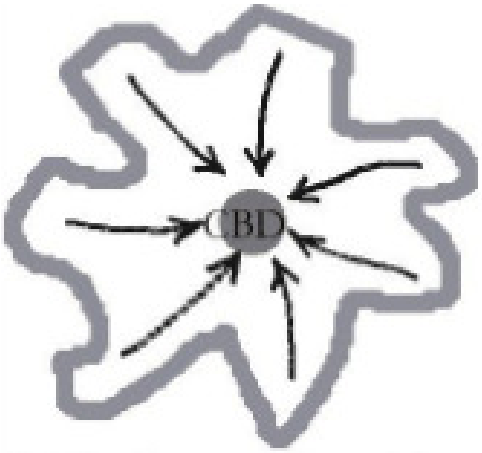
1. Efficient and modern public transport systems
2. New forms of ownership – cycles and small slow EVs
3. Efficient use of space in cities – engagement and ownership

5. City Structure and Urban Form: Macro level

a) Monocentric city: radial transport network

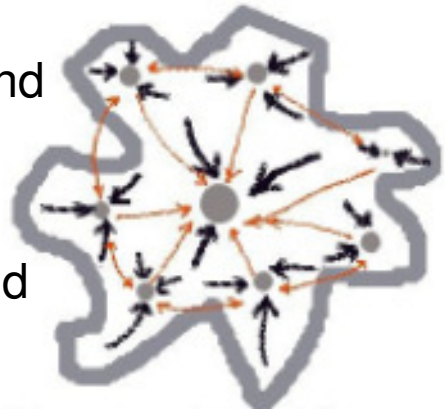
Greater complexity as cities grow

London and Jakarta



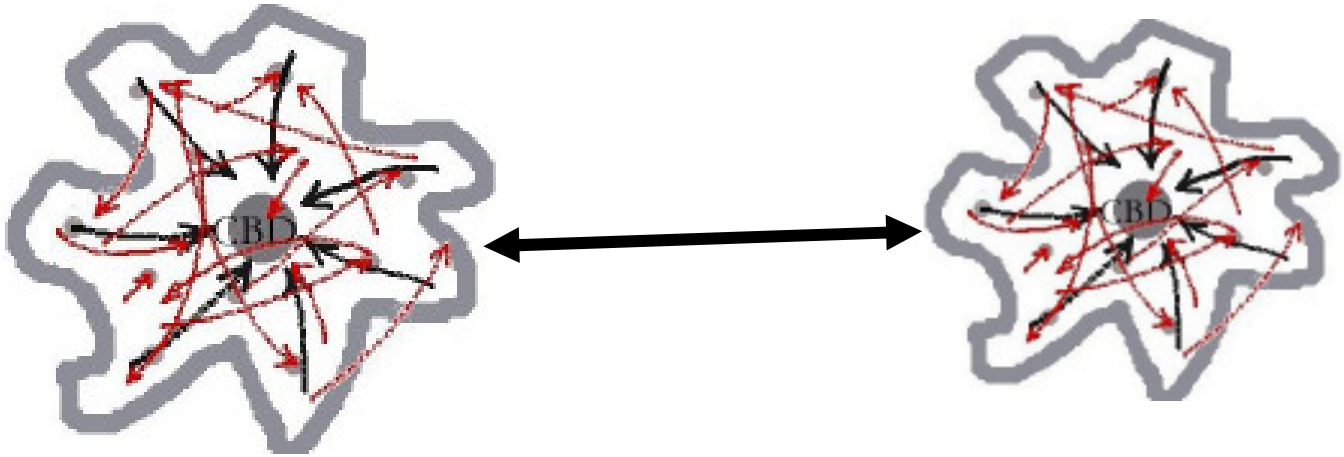
b)Polycentric city: several centres and hierarchy of functions

Rio de Janeiro and Mexico City



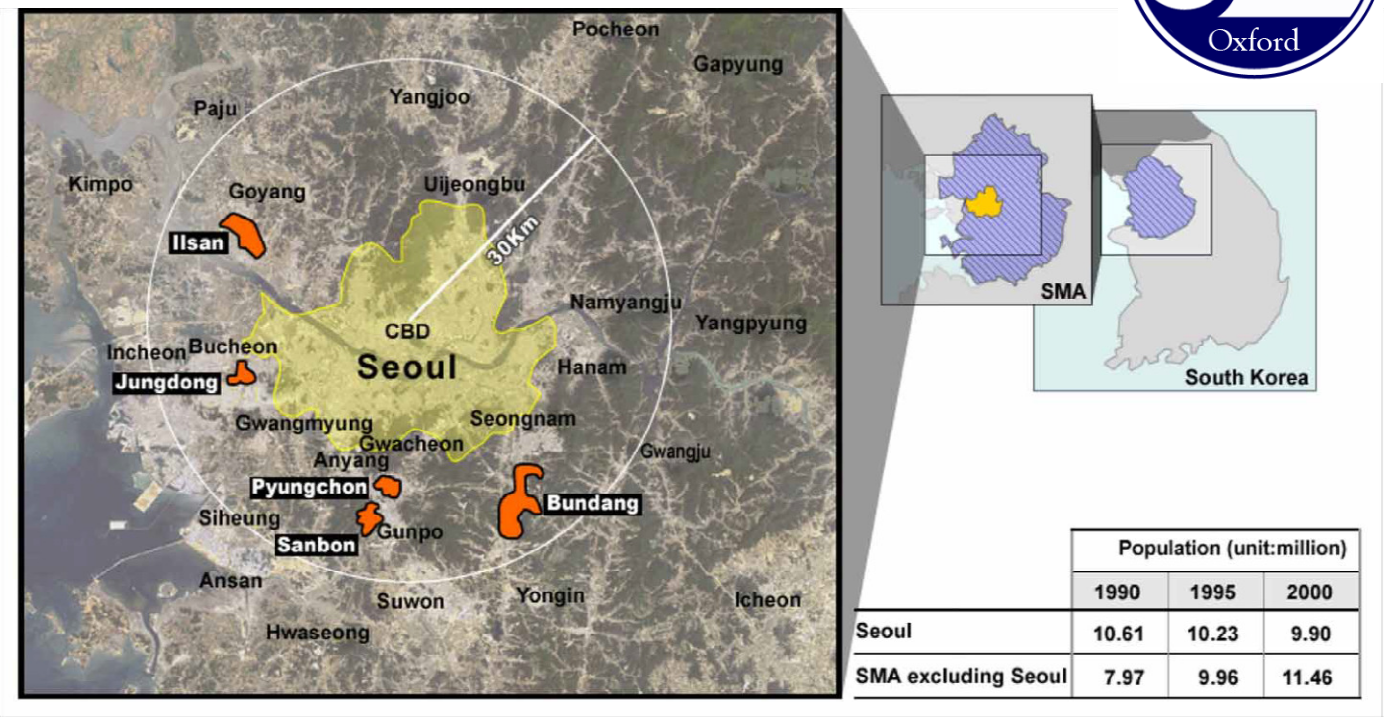
c) Axial city: two major cities about 200km apart and linked by HSR

China: Jinan and Qingdao, with intermediate stops Zibo and Qingzhou



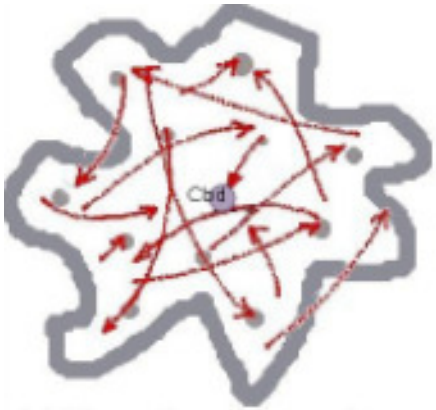
d) Satellite cities: New towns are located around a city centre

Seoul and Shanghai



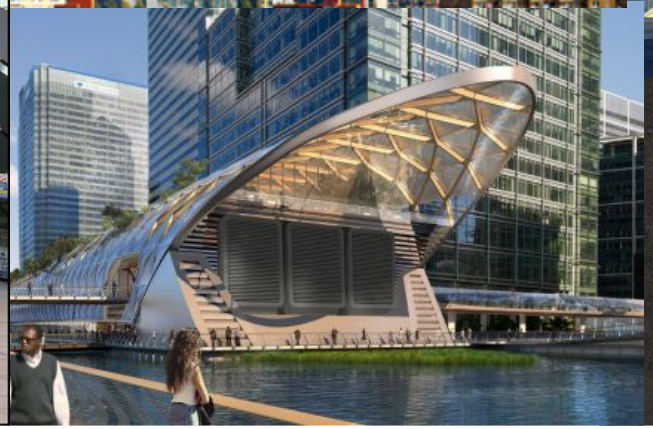
	Population (unit:million)		
	1990	1995	2000
Seoul	10.61	10.23	9.90
SMA excluding Seoul	7.97	9.96	11.46

e) Dispersed city: With many smaller centres, each with specialisations that may form an agglomeration



City Structure and Urban Form:
Meso level

Transit oriented development – Canary Wharf London



6. Conclusions – Living within the Planetary Boundaries

1. Increasing levels of urban density and reducing levels of urban sprawl so that journey lengths and the levels of car dependence can be reduced;
2. Complementary distribution of services and facilities to minimise trip lengths and increase accessibility;
3. Concentration of destinations, as this allows multi purpose trips and less travel, as well as providing the flows for efficient public transport;
4. Allocation of space to different uses to make it clear as to whose space it is - this has implications for pedestrian, residential and shopping areas, as well as providing networks for cyclists and walkers, and it relates to the ownership of urban space.