



The Future of Cities

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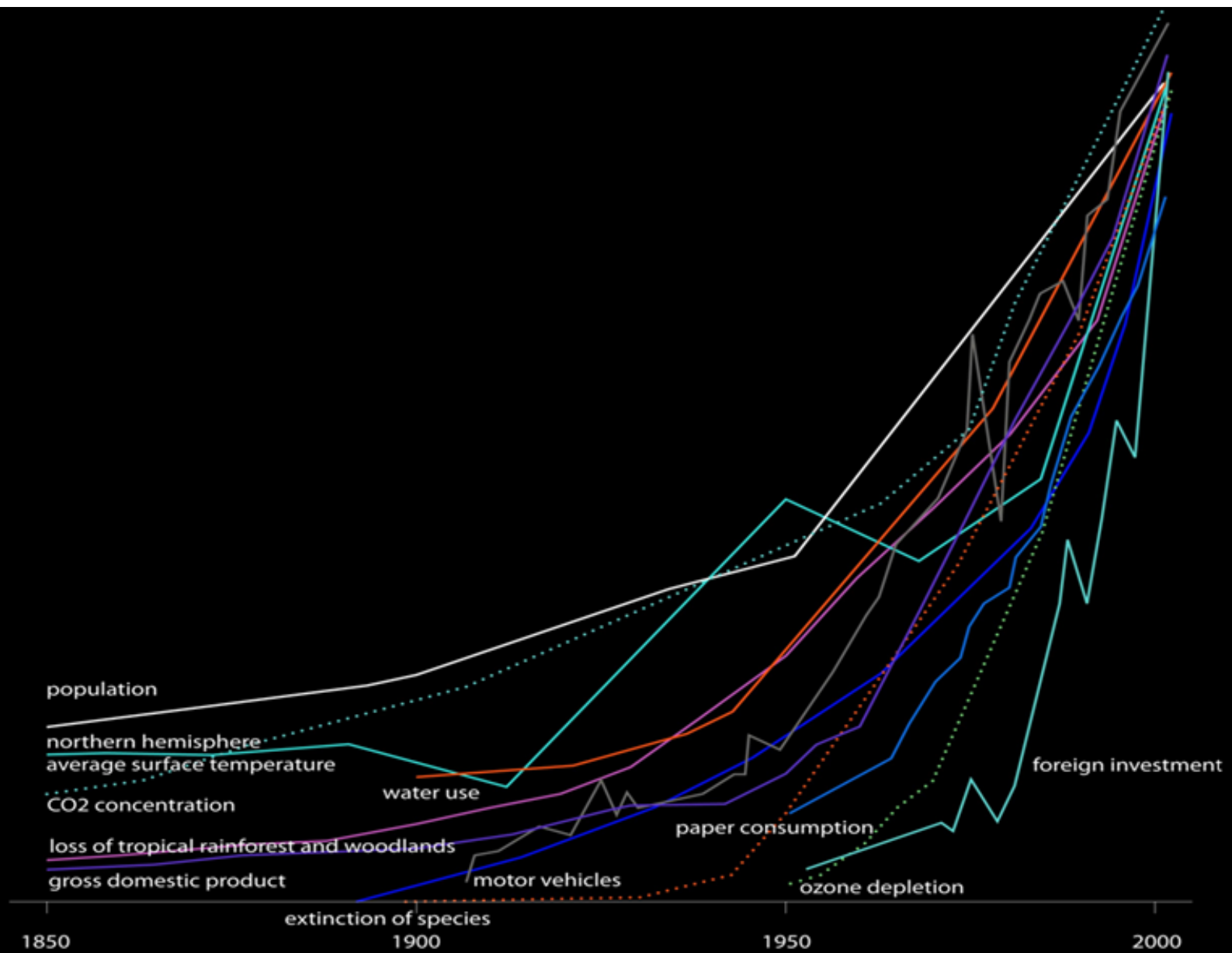
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Grantham Research Institute on
Climate Change and
the Environment



HEALTHY
PLANET
HEALTHY
PEOPLE



- Cities are a **resource-efficiency** story. They exist to eliminate transport costs for people, goods and ideas
- Cities are home to **half the world's 7 billion population**
 - produce ~ 75% of the world's GDP and total GHGs
- By 2050, 75% of the world population projected to be living in cities
 - The Asian Development Bank estimate **44 million people move to cities each year**

NEXT FEW DECADES WILL BE KEY!

- > **doubling to ~8 billion** over this century
- then in all centuries that follow, add **at most ~1 billion**





© AP Photo

A woman wearing a patterned headwrap and a brown jacket is sitting in a market stall. She is surrounded by a large pile of watermelons. She is holding a mobile phone to her ear and appears to be talking. The background shows a wooden wall and some other market items.

Static efficiency

Cities exist to eliminate transport costs and enable access to:

- goods, raw materials, finance
- labour and skills for employment
- consumer amenities
- ideas

Vulnerabilities and risks: **climate impacts**, e.g., heat, water, floods





Dynamic efficiency – innovation

Cities contain **concentrated mix of specialisation and diversity** and economic activity which generates a **fertile environment for innovation** in ideas, technologies and processes

- **Innovation**
- **Knowledge-sharing**
- **Learning and experimentation in governance and behaviours**
- **attract skilled labour/entrepreneurs/innovative firms, etc**
- **Attract finance and capital**




Positive and negative dynamic agglomeration economies

Virtuous spiral in productivity and wages. But urbanisation creates its own problems:

- Pollution
- Congestion
- Ill health
- Crime
- Affordability/housing
- Waste
- Alienation...

Unregulated, unplanned, **urban sprawl** is often the cheapest option in the short run, requiring minimal institutional interference, infrastructural provision and urban planning. **Long run: most costly and least connected**



An aerial photograph of a city, likely Beijing, showing a large bridge spanning a body of water and a complex highway interchange with multiple lanes and overpasses. The city is densely built up with many small buildings and some green spaces. The text is overlaid on the left side of the image.

Congestion loss of productivity

- European Union: 0.75% of GDP
- Buenos Aires 3.4%; Mexico City 2.6%; Dakar 3.4% of GDP (World Bank 2002)
- Cairo 4.0%; Jakarta 4.8%; São Paulo 7.8%; **Beijing up to 15%**
- The costs of traffic congestion in terms of lost time and increased transport costs: 2–5% of GDP in developing Latin America and Asia (ADB 2012).

Pollution loss of health and productivity

- Welfare losses **6.2% of global economic output** (Landrigan et al. 2018)
- Just one particulate pollutant, PM2.5: 432,000 premature deaths in 2012 in Europe alone (European Environment Agency 2014)
- Additional 75,000 people dying each year from exposure to NO2 air pollution
- In Europe, noise from road traffic has been classified as the second worst environmental stressor affecting human health (EEA 2014)
- World Resources Institute values the health impacts of PM2.5 exposure (including premature deaths) in China to **10-13% percent of annual GDP**, 2-5% in Europe

Urban form locking in mobility patterns

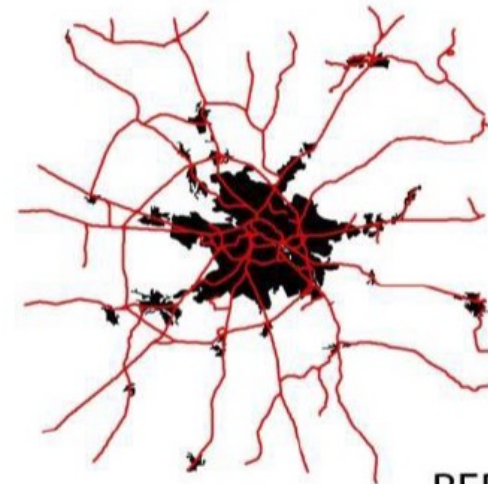
Source: LSE Cities 2014



Pop 5,430,549
GDP per capita 54,853\$

580 people per km² (average)
5% population living 500m from
rail based public transport network

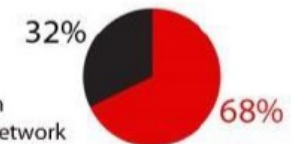
ATLANTA



Pop 4,280,544
GDP per capita 37,147\$

3,930 people per km² (average)
33% population living 500m from
rail based public transport network

BERLIN



LEGEND:

■ urban area
— rail based public transport network

0 15 60 km

Modal share in political city:

% Private motorised % Public transport, walking and cycling

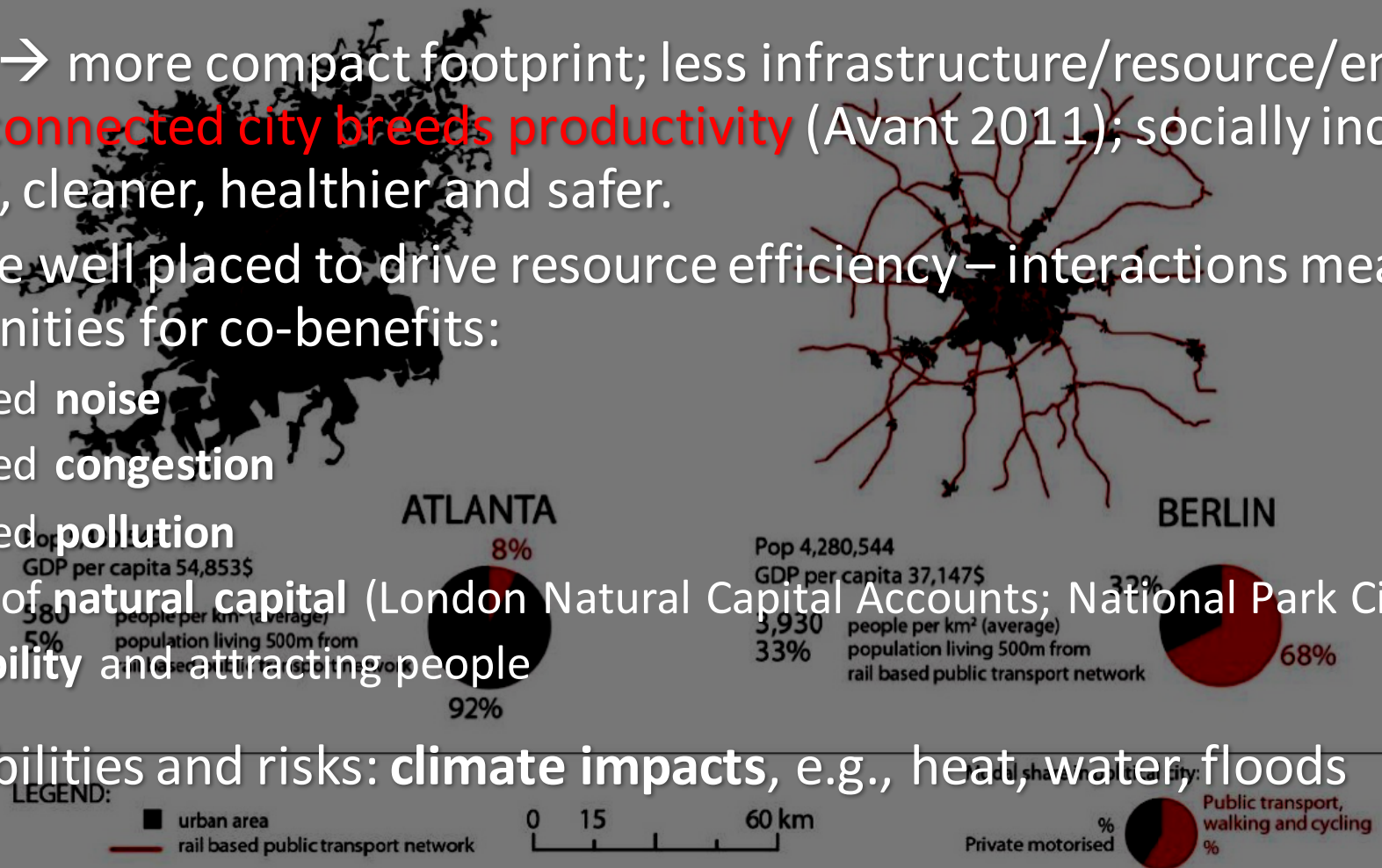
Urban co-benefits

Density → more compact footprint; less infrastructure/resource/energy spend; **connected city breeds productivity** (Avant 2011); socially inclusive; resilient, cleaner, healthier and safer.

Cities are well placed to drive resource efficiency – interactions mean policy opportunities for co-benefits:

- reduced **noise**
- reduced **congestion**
- reduced **pollution**
- Value of **natural capital** (London Natural Capital Accounts; National Park City)
- **Liveability** and attracting people

Vulnerabilities and risks: **climate impacts**, e.g., heat, water, floods





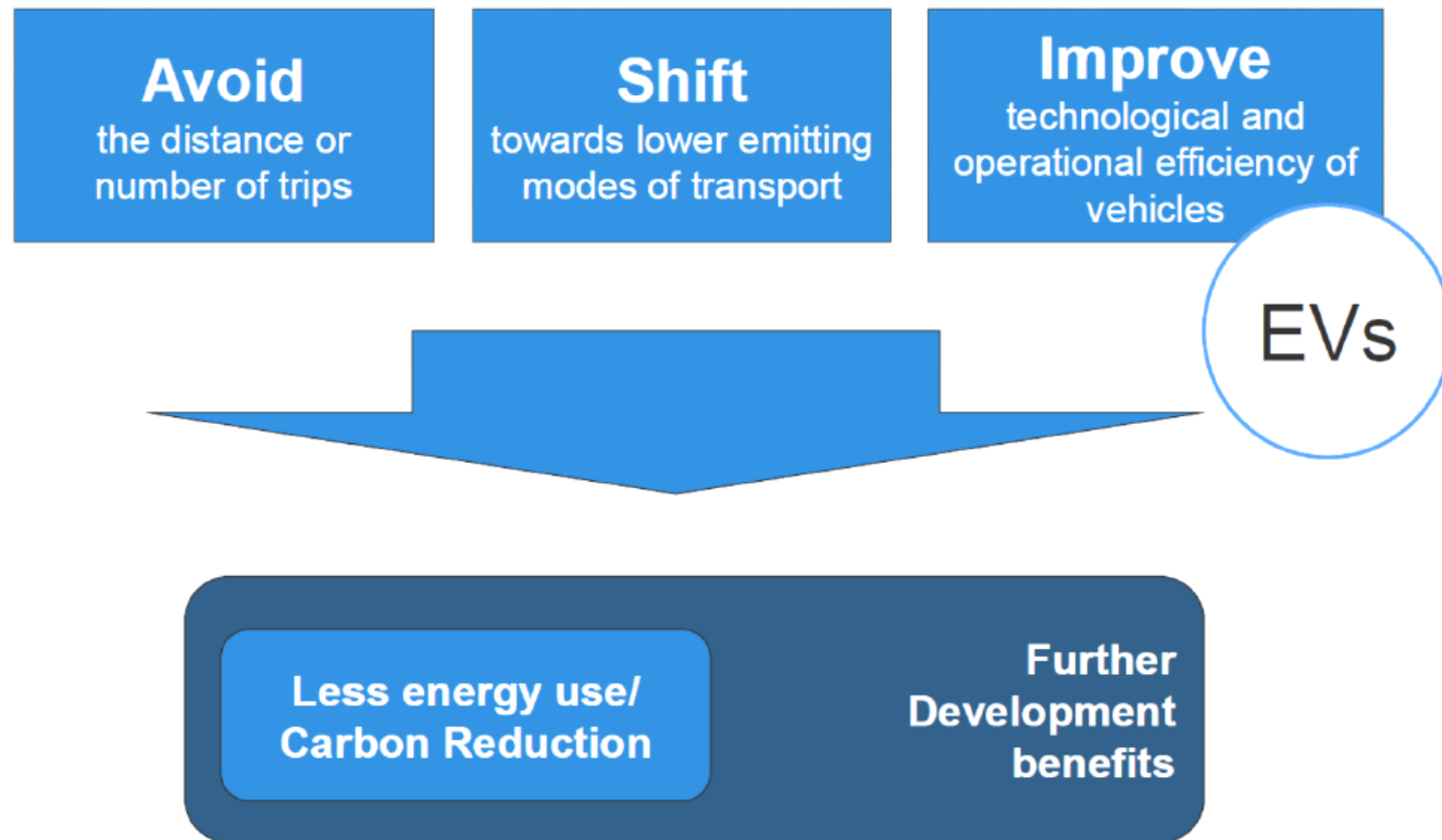
Mobility Stylised facts

- A typical American car spends **96% of the time parked** (Heck and Rogers 2014)
- An American road reaches peak throughput **5%** of the time and even then only 10% covered with cars
- **86% of fuel** in combustion engine inefficiency (a generator in each car) never turns wheels (engine losses, idling, transmission etc)
- Shared vehicle mobility-on-demand can reduce required car fleet stock to **1/3 current size** (MIT Spieser et. Al, 2014).
- But much time seeking charging points and **new infrastructure**
- Focus on road degrades other modes like **walking and cycling**; problems of sprawl and alienation remain



Mobility sustainable urban transport strategies

Source: Philip Goodwin 1991, UNEP/TRL 2011



Dynamic, diverse, resilient, prosperous cities

A green electric car is parked at a charging station on a city street. The car is connected to a charging cable. In the background, there are other cars and buildings.

Connectivity key to sustainable economic success

Investment and innovation in '**smart**' infrastructure

Integrated technologies will help make dense complex cities work efficiently.

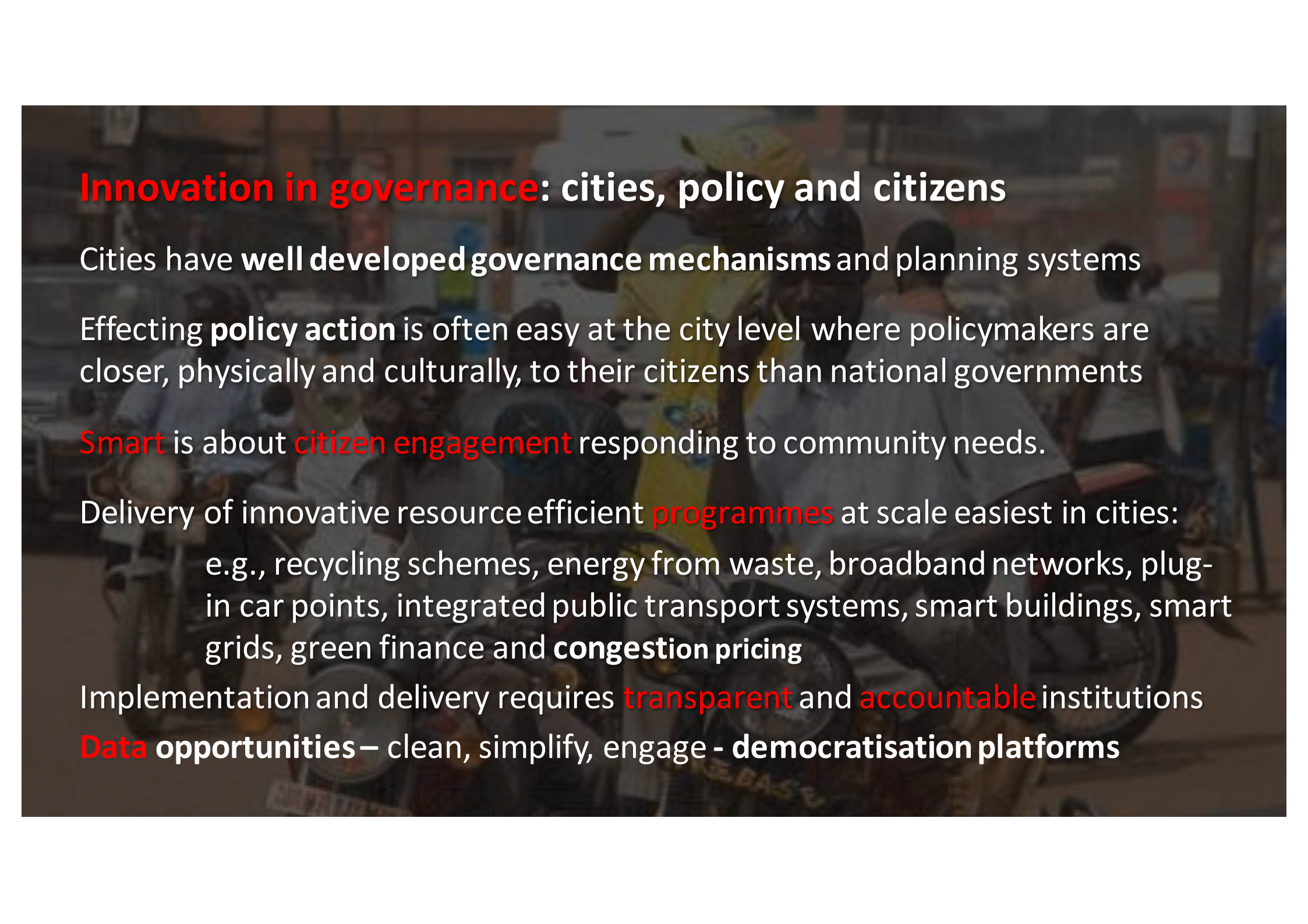
Cities are essentially **tightly integrated systems, but with humans!**

Cities that **think, adapt and evolve** will learn to optimize their resources, food, energy, health, communications and climate

- Smart Grid
- Smarter Healthcare
- Smarter Public Safety
- Smarter Bldgs/energy Management
- Smart Mobility
- Smart Governance
- Smart Learning
- Smart humans

A broadband digital infrastructure can **connect people to people, people to city systems and city systems to city systems**, allowing cities and **engaged** residents to **respond** to changing circumstances in near real-time





Innovation in governance: cities, policy and citizens

Cities have **well developed governance mechanisms** and planning systems

Effecting **policy action** is often easy at the city level where policymakers are closer, physically and culturally, to their citizens than national governments

Smart is about **citizen engagement** responding to community needs.

Delivery of innovative resource efficient **programmes** at scale easiest in cities:
e.g., recycling schemes, energy from waste, broadband networks, plug-in car points, integrated public transport systems, smart buildings, smart grids, green finance and **congestion pricing**

Implementation and delivery requires **transparent** and **accountable** institutions

Data opportunities – clean, simplify, engage - **democratisation platforms**



An aerial photograph of a city, likely Dubai, showing a dense grid of buildings and roads. A large body of water, possibly a canal or river, winds through the city. The image is slightly faded and serves as a background for the text.

Delay is costly

Delaying or postponing coordinated investment in resource efficiency is dangerous:

- Stock-flow of greenhouse gases, irreversible depletion of resources
- **Cities lock-in, infrastructure, technologies, mind-sets**
- Especially emerging economy cities **building the bulk of their infrastructures** in the next two or three decades, but also true of retrofitting and future-proofing developed world cities
- **Flexibility**: allow for new models, e.g. autonomous shared vehicles



Utilise **networks, feedbacks** and complementarities

Social psychologists, have long understood that solving coordination problems requires **anchoring expectations**

- **Bike lanes** → bike → bike lobbies
- **Sprawling suburbs** → cars - **green belt**
- Charging networks → **electric vehicles**
- Recycling, reusing, circular economy schemes → **community** engagement
- **Data** provision → smart apps
- **Autonomous vehicles**: sensors; GPS; processing power; AI;...

Flexibility to change in face of uncertainty

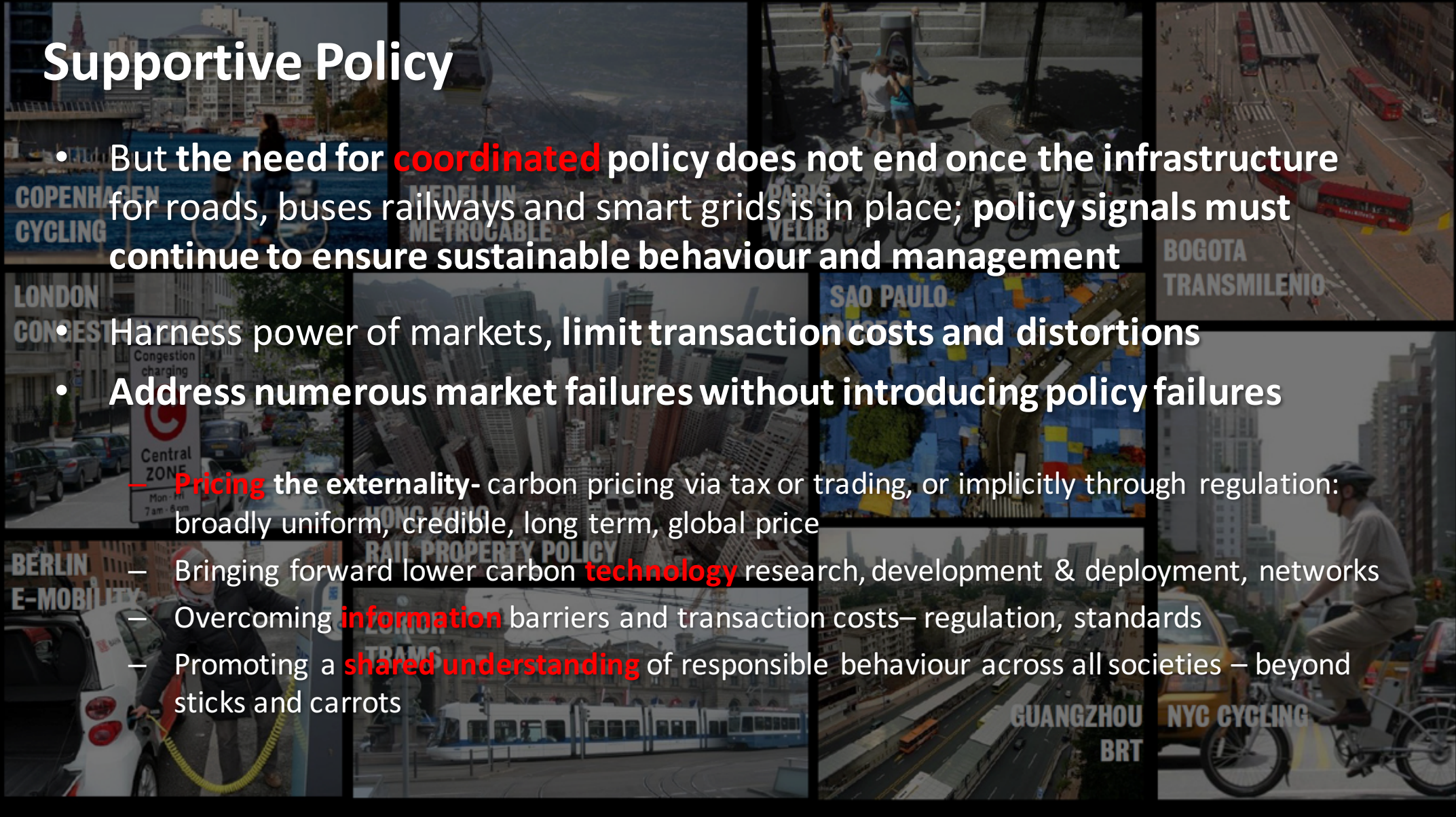
- **Autonomous vehicles** 'transport as a service' / fixed public transport infrastructure
- **Drones**: ATC, privacy; data systems
- **Data democratisation** platforms

Leadership is key!



Supportive Policy

- But the need for **coordinated** policy does not end once the infrastructure for roads, buses railways and smart grids is in place; policy signals must continue to ensure sustainable behaviour and management
- Harness power of markets, **limit transaction costs and distortions**
- Address numerous market failures without introducing policy failures
 - **Pricing the externality**- carbon pricing via tax or trading, or implicitly through regulation: broadly uniform, credible, long term, global price
 - Bringing forward lower carbon **technology** research, development & deployment, networks
 - Overcoming **information** barriers and transaction costs— regulation, standards
 - Promoting a **shared understanding** of responsible behaviour across all societies – beyond sticks and carrots





Conclusion

Cities can overcome common challenges around energy, transport, air quality, climate change, inclusivity etc... by deploying sustainable solutions and innovations

The next few decades will be critical

Cities generate resource efficiency

- Static
- Dynamic

Require policy action and coordinated planning

- Avoid lock-in and wrong paths; utilise complementarities and networks
- Connectivity, integration, flexibility and responsiveness – increasingly 'smart'
- Innovation in technology, governance and behaviours
- Leadership and planning are key

When we design cities we design of the future