



Government  
Office for Science

# **FUTURE OF MOBILITY**

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Head of Sustainable Economy



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# Government Office for Science

Leading GO-Science is Professor Sir Mark Walport,  
Government Chief Scientific Adviser:

***“Our role is to advise the Prime Minister and Cabinet on all matters related to science and to ensure that government policies and decisions are informed by the best scientific evidence and strategic long-term thinking”***

Sir Mark is supported by Christopher Witty, Deputy Government Chief Scientific Adviser, and Chief Scientific Adviser for the Department for Health.





# How we work

The Government Office for Science has three areas of focus:

- **Science for resilience**
- **Science and technology for the economy**
- **Evidence and analysis for policy**

We add value to policy-makers by:

- Acting as a **transmission mechanism** between leading scientists, engineers, technologists and social scientists from academia and industry, and Whitehall policy-makers;
- Having **high quality futures capability** which enables rapid horizon scanning work, including on emerging technologies and more in-depth foresight work to understand longer term issues and trends;
- **Working across Whitehall departments** on complex issues that go beyond the domain of individual departments; and
- **Proactively identifying gaps and opportunities** for the UK, particularly in emerging technologies, to drive economic growth.



Infrastructure  
(Natural and built)



The economy

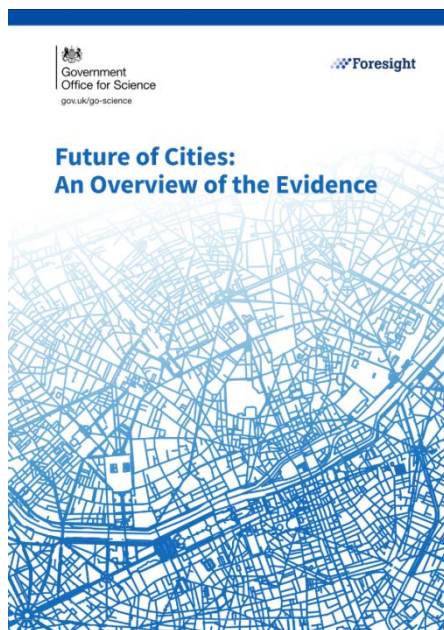
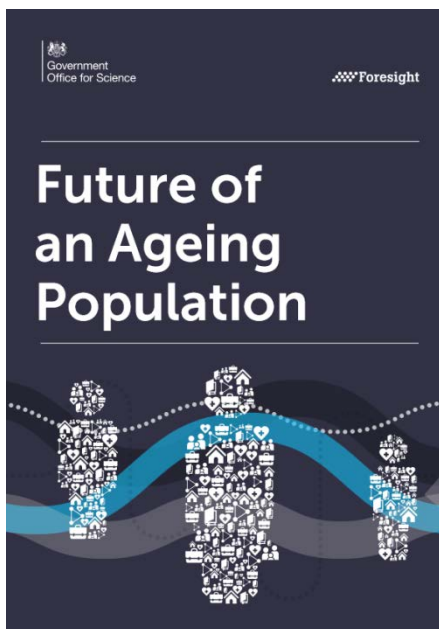


Emergencies



# About Foresight

- Provides evidence on long term trends for policy-making
- In-depth studies: 9-18 months
- Involving UK and international experts

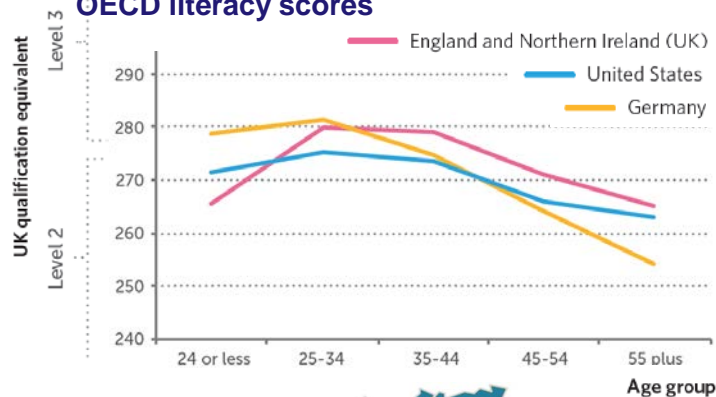




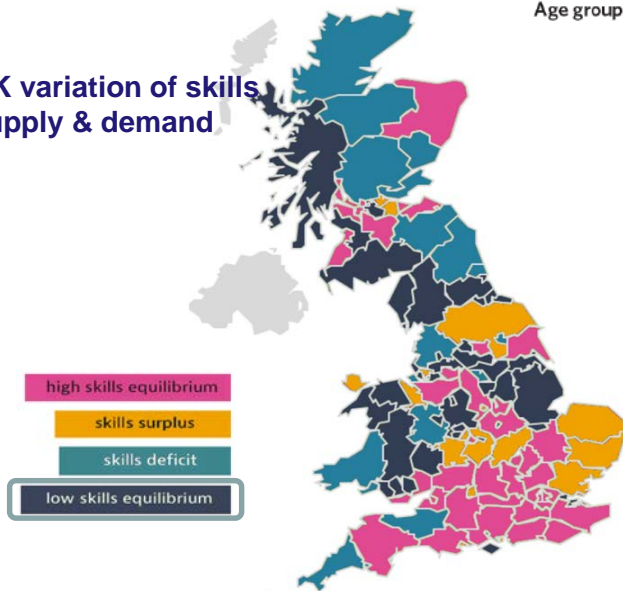
# Future of Skills and Lifelong Learning

*Understanding the long-term trends for the supply and demand for skills, and their impact on the prospects for a dynamic, socially-just economy.*

## OECD literacy scores



## UK variation of skills supply & demand



## Objectives

- To support long-term policy-making for cross-departmental challenges:
  1. Poor literacy and numeracy in young adults;
  2. Poor employer perception of work readiness of those entering the labour market;
  3. Relatively high underutilisation of skills;
  4. The emergence of low skills equilibria and;
  5. The decline in learning across the life course

## Approach

- To work with policy-makers and experts across the skills and lifelong learning domain.

## Impact (ongoing project)

- Provided robust evidence for DfE's Lifetime Learning review.
- DCMS development of policy ideas for enhancing digital skills.

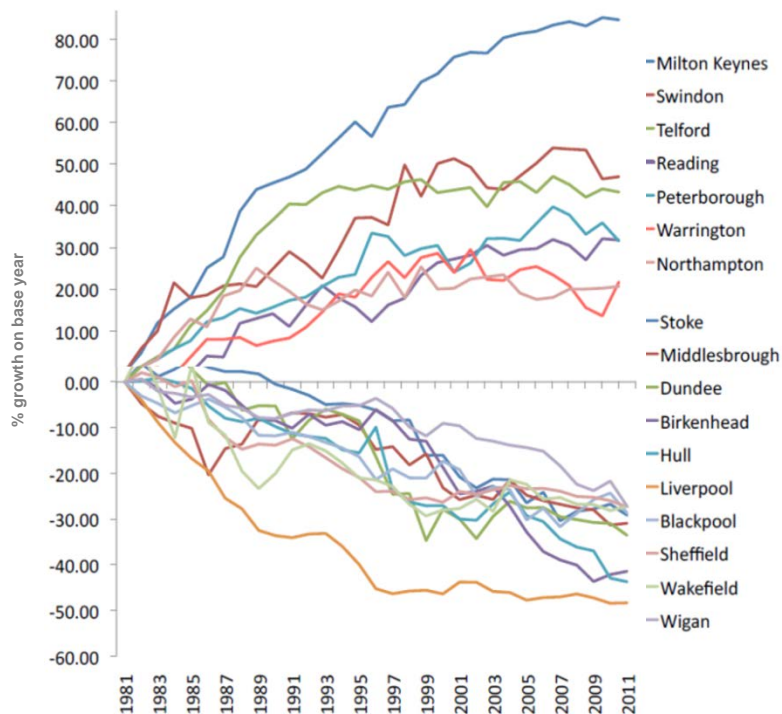




# Future of Cities

*Exploring future productivity, liveability and connectivity of UK urban areas*

**Fastest and ten slowest growing cities, 1981-2013**



## Objectives

- To understand what has caused variance in performance between UK cities over the last 30 years; to use this evidence to promote more equitable growth in UK cities.

## Approach

- Bringing together new and existing evidence including academic analysis, economic modelling and business input.
- Building alliances of people able to act: departments, local authorities, businesses, universities.
- Using an 'open policy making' approach to generate and prototype solutions created on the ground.

## Impact

- Identified opportunities and challenges facing UK cities over the next 50 years, including social and economic trends
- Worked with some UK cities to develop a vision for their long-term future: Milton Keynes Council agreed a plan for the city for next 30 years; Newcastle ran an exhibition on the future of the city and established a City Futures Development Group; Lancaster initiated a Youth Chamber to link 16-18yr olds to local businesses to develop their skills for the workplace.
- Generated new ideas with six UK cities to help them to attract graduate labour to boost local productivity (Birmingham, Bristol, Cardiff, Leeds, Liverpool, Manchester). Six pilots now running.



Key project question:

**What opportunities could the transport system of the future provide and what are the implications for Government and society?**

Rationale for project emerged from stakeholder discussions and initial desk research:

- **Theme 1:** Transport is essential for the UK's competitiveness both directly and indirectly.
- **Theme 2:** The future of mobility is dependent on important but highly uncertain interactions between technology and people.
- **Theme 3:** Changes to business models (e.g. mobility as a service) and traditional view of transport modes provide challenges to considering transport across modes.
- **Theme 4:** Scenarios can help Government both to plan for what it cannot control, but also make choices about the interventions that can significantly change the future.



# Theme 1: Transport is essential for the UK's competitiveness

- Effective modes of transport – including high-quality roads, railroads, ports, and air transport – enable entrepreneurs to get their goods and services to market in a secure and timely manner and facilitate the movement of workers to the most suitable jobs.
- World Economic Forum ranks the UK as the 7th most competitive country. Infrastructure is ranked 9th best; the transport components of infrastructure are ranked lower, and are in a downward trend.
- Inadequate infrastructure is seen as the second most problematic factor for doing business in the UK.
- However, the UK benefits from a more flexible, legal framework; technology can be piloted with a Code of Practice rather than primary legislation as required in most other EU countries<sup>1</sup>, this includes piloting of fully autonomous vehicles on public roads<sup>2</sup>.

## Implications for the future of mobility

- Existing value chains within companies are likely to deconstructed and reconstructed in other ways.
- The timing of decisions around transport investment will affect the UK's competitiveness and future prosperity.
- UK strengths in the financial sector in technologies such as blockchain could be applied to transport services through peer to peer payments, facilitating shared ownership or supporting seamless ticketing platforms.

## The Global Competitiveness Index in detail

	Rank / 138	Value	Trend
2nd pillar: Infrastructure	9	6.0	
Quality of overall infrastructure	24	5.2	
Quality of roads	27	5.1	
Quality of railroad infrastructure	19	4.8	
Quality of port infrastructure	12	5.6	
Quality of air transport infrastructure	18	5.8	

Source: World Economic Forum, Executive Opinion Survey 2016

## Most problematic factors for doing business

Tax regulations	14.8
Inadequate supply of infrastructure	12.6
Tax rates	12.5
Inadequately educated workforce	10.8
Inefficient government bureaucracy	8.9
Policy instability	8.7
Access to financing	8.1
Insufficient capacity to innovate	7.8
Restrictive labor regulations	7.0

Source: World Economic Forum, Executive Opinion Survey 2016

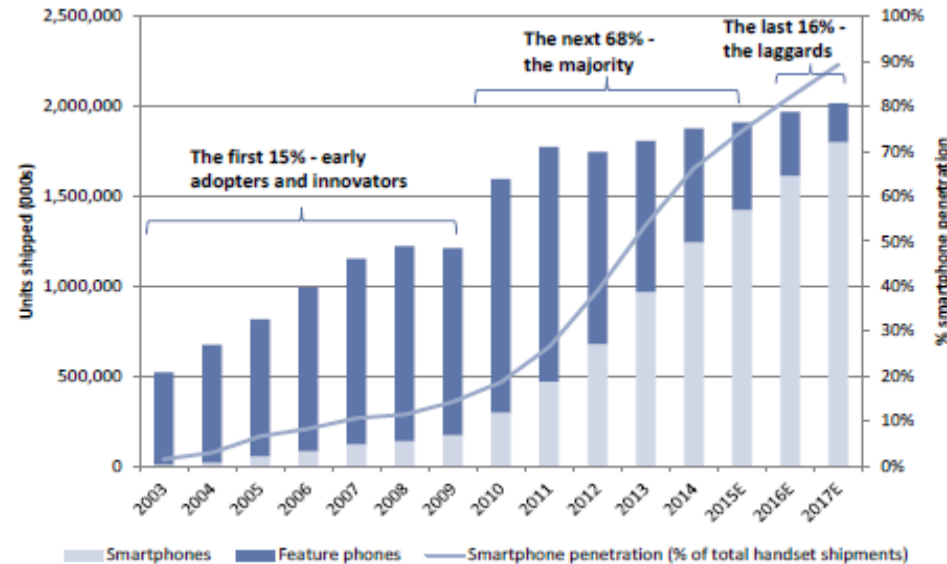
Note: respondents were asked to select the five most problematic factors for doing business in their country and to rank them between 1 (most problematic) and 5. The score corresponds to the responses weighted according to their rankings.





# Theme 2: Interactions between technology and people

- Different groups in society respond to technology differently, and the rate of adoption varies accordingly.
- While concern about data privacy is high, acceptance of personal data sharing appears to be increasing, with lower levels of concern among younger age groups<sup>1</sup>.
- Open data is pivotal in providing reliable delivery of information to travellers. The availability of transport data as open data has already delivered significant value, estimated at £58 million in London alone<sup>2</sup>.
- In a recent survey, around one in four young people trusted a machine to control a car in which they are travelling<sup>3</sup>.
- Frequent urban travellers make 17% more journeys than the UK average UK. Two thirds of these say they would consider driverless cars, significantly more than the 39% average<sup>4</sup>.



Smartphone adoption curve – the early adoption was slow at first but quickly accelerated due in part to the 2007 launch of the iPhone

## Implications for the future of mobility

- Public attitudes towards new technologies will impact on the speed of technology uptake and the rate of evolution of the UK transport system.
- Questions of ethics, trust and control are central to scenarios for future transport and mobility.

[1] Data Privacy: What the customer really thinks, DMA, 2015

[2] Mobility as a Service. Exploring the opportunity for mobility as a service in the UK. 2016

[3] Science Education Tracker: Young people's awareness and attitudes towards machine learning. The Royal Society, BEIS, 2017

[4] Traveller needs and UK CAPABILITY STUDY, 2015



# Theme 3: Changes to business models provide challenges

- The use of technology can enable much greater reach for sharing opportunities.
- Functionality is being integrated across platforms; e.g. Google Maps and Uber functionality is now integrated allowing users to privately hire cars without leaving the mapping application.
- International schemes are underway to integrate all forms of shared and public transport into single payment networks with real-time traffic information. Helsinki aims to allow minibus passengers to vote for their preferred routes via their smartphone and will then integrate them into an optimal route (by 2025).
- Whilst vehicle ownership is still dominant, attitudes to car ownership are shifting, with the percentage of under 20s owning a driving licence decreasing from 51 to 33% of men between 1995/97 to 2015 and from 36 to 32% of women.

LONDONERS USE UBER TO START THEIR MORNING COMMUTE  
LONDON, UNITED KINGDOM



- TRAIN STATIONS
- UBER TRIPS
- ZONES 1 & 2

Lines indicate Uber trips that started in Outer London on weekdays between 5 and 10 in the morning, and ended at a train station

Data from March 2016. Completed trips only. Points away from train stations have been jittered to preserve privacy.

## Implications for the future of mobility

- Mobility as a service could change travel behaviour and the transport sector. It has implications for policy areas such as access to health and leisure, promoting social inclusion, encouraging sustainable travel and access to jobs and skills
- There is increasing focus on the user and the end to end journey experience including better interchange between transport modes.



# Theme 4: Scenarios can help Government plan

Example scenario after early stakeholder engagement

- Inability to commission infrastructure projects
- Limited data sharing and passenger flow optimisation
- Low penetration of automation in personal mobility or commercial freight fleets

Limited government intervention

- Extensive private monopoly control over passenger and driver location data & services
- Shared private transport solutions begin to supplant public transport
- Automation and drone use pervades commercial delivery chains

Slow change adoption

“Now but Worse”

“New age”

“Uber-Google world”

“Singapore”

Fast change adoption

- Build-out of conventional transportation infrastructure
- Improved planning, service delivery
- Better integration of transport and local housing, work plans & priorities

High level of government intervention

- Regulated use of phone location data to optimise public transport passenger flows
- Real-time circulation flow modelling controls access, speeds and lane dedication on major roads.
- Automation in some bus routes, use of smart conveying in commercial fleets

- Scenarios can help decision-makers consider **pathways, options and no-regrets activities**. They can be the basis for a number of types of analysis, for example:
- “Backcasting”, allowing an analysis of which decisions or events may result in a given future scenario (which may be desirable or not). This can provide a platform for understanding when decisions need to be taken, when lock-in may occur, and what are the signals that a certain ‘scenario’ might materialise.

- Policy stress-testing can help identify how resilient different policy options may be to future scenarios and uncertainties. *For example, policy option 1 - road user charging - may only be possible with a high level of government intervention; policy option 2 - cross modal ticketing - may not be possible without data sharing. It may be possible to identify policy options which are “Very effective” across all scenarios.*

Policy options	“Now but worse”	“Uber-Google world”	“New age”	“Singapore”
1. Road user charging	Ineffective	Ineffective	Very effective	Effective
2. Cross modal ticketing	Ineffective	Effective	Effective	Very effective





# Summary: intended outcomes

1. Provide Government departments with evidence to make strategic investment and policy decisions which support national resilience and sustainable economic growth
2. Engage across Government to encourage joined-up decision-making to better serve the wider public need and long term national interest
3. Provide insight and support capability to maximise opportunities for transport to provide value to the citizen and promote UK competitive advantage





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