

PROJECTING THE FUTURE

A big conversation about the future of the project profession

CHALLENGE PAPER 5

SMART CITIES, URBANISATION
AND CONNECTIVITY

FEBRUARY 2020

#projectingthefuture

ABOUT THIS PAPER

HOW DOES THE PROJECT PROFESSION THRIVE IN A CHANGING WORLD?

That is the question at the heart of Projecting the Future, a big conversation about the future of the project profession which has been led by APM throughout 2019-2020.

This is the fifth Challenge paper in the Projecting the Future series. It examines the emergence of smart cities, the ongoing trend of urbanisation, and the drive to improve connectivity – in urban areas and beyond. The global number of city dwellers is rising inexorably, exacerbating existing challenges and creating new ones: from reducing pollution, adapting to the effects of climate change, and using resources sustainably, to improving infrastructure, connecting with surrounding towns, and providing a standard of life that meets residents' rising expectations. Smart city systems have the potential to meet these challenges.

This paper offers a brief exploration of some of the key issues. It touches on themes already addressed in previous Projecting the Future papers – themes that are deeply interlinked – and, like those previous papers, it is intended to be a conversation-starter, not the final word on the subject. We want to talk about the implications of change in this field for the project profession – and that means we want to hear your views and insights about how the profession will thrive in the years ahead.

About Projecting the Future

Projecting the Future aims to kickstart a big conversation across the project profession as a whole about its future in a time of rapid and far-reaching change. It is a conversation that also has to include stakeholders outside the profession: those who will influence, and be influenced by, the profession. The scale of change ahead raises many complex questions which can only be answered through collaboration and discussion. Whether you are contributing as an individual, an employer, or an expert in the field, your voice is an essential part of the conversation.

We look forward to your input, and to working with you to develop a shared view of how the project profession as a whole can realise its potential as a true leadership delivery profession.

JOIN THE CONVERSATION

We hope you will share your views, insights and evidence with us and other project professionals on LinkedIn, Facebook, or Twitter.

   **#projectingthefuture**

You can also email your thoughts and comments to: ptf@apm.org.uk.

We are particularly keen to hear about examples of projects or strategies being put in place to address the points raised in this paper.

We recommend reading the original Projecting the Future discussion paper, and the other Challenge papers in the series:

1. The fourth industrial revolution: data, automation and artificial intelligence
2. Climate change, clean growth and sustainability
3. Ageing and demographics: the 100-year life
4. The future of mobility and transport.

See www.apm.org.uk/projecting-the-future

THE BIG ISSUES

Cities are more important to humanity than ever before. Some 55% of the world's population now live in urban areas, and rising: it is set to hit 68% by 2050.¹ As the fourth industrial revolution gathers pace, the application of 5G-enabled technology in cities will accelerate, with the potential to transform many aspects of urban life for the better.

The field of 'smart cities' is primarily about the use of digital technology and cyber-physical systems that help to manage urban life. It comprises digital connectivity, transport management, crime and security, development and regeneration, utilities, support for business growth and the economy, and more.

But technology is the means, not the end. As McKinsey has put it: "The entire point is to respond more effectively and dynamically to the needs and desires of residents. Technology is simply a tool to optimize the infrastructure, resources, and spaces they share." The result of implementing smart city systems should be "not only a more liveable city but also a more productive place for businesses to operate."²

So the challenges involved in creating smart cities are not just about 5G infrastructure, new ways of managing traffic, or improved public transport: they are about generating insights and analysis in ways that citizens share and can use to inform their own decision making. Smart city thinking has evolved

in recent years to recognise that citizen behaviour is every bit as important as technology. 'Smart' systems only work if citizens are 'smart' in using them. In practical terms that might mean the development of apps that provide timely, relevant information, enabling people to adapt their behaviour around the city.

Important as digital connectivity is to city life, it is also vital outside of cities. There are significant challenges facing the UK in delivering high speed internet connectivity in rural areas. Although it is recognised as a crucial component of national infrastructure and future productivity, high-speed internet remains unavailable in many rural areas.

In the UK, the discussion about smart cities takes place in the context of a tentative policy trend towards localism and the redistribution of political power, on the basis that local needs are best met by local decision makers – although sceptics query how far political rhetoric has yet been accompanied by genuine budgetary and decision-making power. Still, changes have recently been visible in the creation of eight metropolitan mayors across the UK, including in the West Midlands, Greater Manchester, Liverpool and the Tees Valley. If implemented, the Midlands Engine and Northern Powerhouse initiatives will lead to significant transformational projects, not least in transport infrastructure. Project professionals will play key roles in delivering these and other significant projects.

"The entire point is to respond more effectively and dynamically to the needs and desires of residents. Technology is simply a tool"

McKinsey Global Institute (2018)

IN NUMBERS

AROUND THE WORLD, MORE AND MORE PEOPLE LIVE IN URBAN AREAS

55%
TODAY

68%
FORECAST BY 2050

74% OF THE UK'S POPULATION ALREADY LIVES IN URBAN AREAS

MEGACITIES WITH POPULATIONS OVER 10M ARE EMERGING GLOBALLY: THERE WILL BE

43 BY 2030

SMART CITY TECHNOLOGY COULD:

- REDUCE CRIME BY 30-40%
- CUT GREENHOUSE GAS EMISSIONS BY 10-15%
- SPEED UP COMMUTES BY 15-20%
- SAVE CITY-DWELLERS 3% OF THEIR ANNUAL EXPENDITURE

SPENDING ON SMART CITY TECHNOLOGY IS FORECAST TO REACH

\$189.5BN GLOBALLY BY 2023

34th THE UK'S GLOBAL RANKING FOR BROADBAND SPEED

WHAT IS SMART CITY TECHNOLOGY?



ECONOMIC DEVELOPMENT

- Citizen engagement applications
- Digital citizen services
- Local e-career platforms
- Online retraining programmes
- Personalised education



HEALTHCARE

- Data-based population health interventions
- First aid alerts
- Infectious disease surveillance
- Lifestyle wearables
- Real-time air quality monitoring



MOBILITY

- Autonomous vehicles
- Bike and car sharing
- Intelligent traffic signals
- Real-time road navigation
- Smart parking



SECURITY

- Crowd management
- Data-driven building inspections
- Disaster early-warning systems
- Predictive policing
- Smart surveillance



UTILITIES

- Energy and water consumption tracking
- Building automation systems
- Dynamic electricity pricing
- Smart streetlights
- Water quality monitoring

OPPORTUNITIES AND CHALLENGES

The rise of megacities

There are 33 "megacities" around the world today – that is, urban centres with more than 10 million people. There were just 10 in 1990. The number is set to hit 43 by 2030, thanks mainly to growth in developing countries.^x

Growth and decline

Tokyo is the world's biggest city today, with 37 million people, followed by New Delhi, with 29 million. New Delhi is set to continue to grow rapidly and is forecast to overtake Tokyo around 2028, which is set to shrink as Japan's ageing population begins to dwindle. Shanghai currently has 26 million people, while Mexico City and São Paulo have around 22 million each. London is ranked by the UN as the 29th largest city in the world, with its population expected to hit 9 million by 2021.^{xi}

Understanding smart cities

What, exactly, defines smart cities? One research team argues: "A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement."^{xii} Consultants Frost & Sullivan suggest that there are eight 'smart' dimensions of a smart city, comprising governance, energy, building, mobility, infrastructure, technology, healthcare and citizens.^{xiii}

Adopting smart city technology

Early adopters of smart city technology included a number of European cities. Barcelona installed extensive sensor networks to provide government and the private sector with data on transport, energy use, air quality, noise levels, irrigation and more, with access through an open data portal.^{xiv} Amsterdam was another early adopter, using an open source approach that has made its city data accessible to a wide range of users, enabling a rich array of apps to emerge.^{xv} The Dutch port of Rotterdam – Europe's largest port by cargo tonnage – aspires to be "the smartest port in the world", with the aim of being capable of hosting autonomous ships by 2025. It is adopting IoT (internet of things) sensors, augmented intelligence and smart weather data to help identify the best times for ships to enter the port; a 'digital twin' allows for detailed and accurate scenario testing to help safely identify opportunities for improvements in the port.^{xvi}

Asia taking the lead

Some recent assessments suggest that it is now Asian megacities – with young, digital-native populations, and big urban problems – that are leading the way, with different cities taking different approaches in response to local priorities.^{xvii} Diverse approaches have been adopted around the world. Some cities, particularly in the US, have focused on residents' health; others have prioritised crime and security, as in Chicago and Rio. Beijing meanwhile has focused on air quality, making impressive improvements.^{xviii} The diversity of approaches raises the question of how insights, expertise and effective practices can best be shared, so that the experiences of early pioneers can accelerate progress elsewhere. Project professionals could play an important role – and will need to help ensure a focus on benefits (see page 7).

Climate change and city living

Around the world, more frequent extreme weather events, higher temperatures and rising sea levels pose serious risks to cities. How can cities ensure that the built environment protects itself and provides resilience for city technology, transport infrastructure and residents?

Decongesting traffic networks

One of the biggest potential advantages of smart city technology is reducing congestion and helping traffic networks cater for growing urban populations: the combination of city systems with autonomous vehicles could allow for road traffic to be directed away from busy areas, for example. New technology can also have a significant effect on other modes of transport, like in Copenhagen where a new metro line uses a fully autonomous fleet that runs 24/7. Developed with Hitachi, the system uses AI to detect increases in passenger demand and automatically changes the timetable to schedule more trains, without any human intervention. The system can detect when a platform is busier than normal – perhaps at rush hour, or after a big football match – and increase the frequency of trains. Just two years after the new system launched, results include a switch to trains by half of all bus users, and one in ten drivers.^{xvix} Other innovations will transform the experience of using different rail: Hitachi is also trialling smart sensors which could make ticket barriers at rail stations obsolete, for instance. It has released a concept station of the future, which can be 'toured' online.^{xx}



Climate change and urban transport

Climate change is a key driver of the development and adoption of new technology which, combined with smart network management, will offer advantages including reduced emissions. In the UK, Hitachi is looking at ways to introduce its 'intercity battery hybrid' and 'regional battery' train products to the UK, estimating that at least 1,400 trains in the UK could be using the technologies by 2030.^{xxi} World-leading urban design is not only about technology, though: in pursuing reductions in private car use, for example, Seoul has not only introduced smart technology, but has been reallocating street lanes to pedestrians and cyclists, and limiting parking spots in new public buildings.

Bringing nature back to cities

How can nature be better incorporated in cities? Andrew Grant, lead landscape architect of Singapore's acclaimed Gardens by the Bay, points out the benefits: "Being in nature retunes and calms our bodies and mind. Having easy and regular access to diverse nature extends our lives. Seeing and sensing green living landscapes increases our capacity to learn."^{xxii} In the UK, the Northern Forest^{xxiii} is a 25-year vision to plant 50 million trees across the north of England, including in its cities: Manchester's City of Trees initiative, for example, has planted over 450,000 trees to date, and has a goal of planting three million – one for each resident of Greater Manchester.^{xxiv} Eleven cities across Europe are part of a €12m project to rethink how 21st century cities can support and benefit from nature, to help address challenges such as sustainable urbanisation, human health, degradation and loss of natural capital, 'ecosystem services' including clean air, water and soil, climate change, and the increasing incidence of natural disasters.^{xxv}

Improving urban air

One key issue facing cities is that of air quality, described by the government as the "largest environmental health risk in the UK."^{xxvi} Vehicle emissions, agriculture and aviation are the major culprits. The problem is acute in London, where EU-wide legal limits on air pollution have been breached every year since their introduction in 2010. Congestion on the city's narrow medieval streets – and diesel vehicles in particular – have been blamed, and it could be leading to 9,000 premature deaths a year.^{xxvii} In fact, vehicle numbers in central London have though fallen by 25% in the past decade,^{xxviii} thanks to projects such as the congestion charge; the capital's Ultra Low Emission Zone launched in April 2019, levying fees on the most polluting vehicles, and will expand in 2021. Meanwhile, Birmingham, Leeds, Southampton, Nottingham and Derby have been mandated by the government to establish Clean Air Zones, while Bristol has approved plans to restrict diesel vehicles in the city centre from 2021.

Public trust

Smart technology demands data, which means that citizens' trust in the security and privacy of their data is vital. Project professionals will be involved in shaping answers to the questions this raises. It will mean building participation and consent-building into the development and implementation of smart systems, involving people in creating change rather than having change done to them.

A smarter capital

In the UK, the capital's Smarter London Together roadmap aims to make London the "smartest city in the world". It sets out five missions: more user-designed services, a new deal for data sharing, world class connectivity and smarter streets, digital leadership and skills, and improved city-wide collaboration.^{xxix}

Internet connectivity

Infrastructure to underpin high speed connectivity is a significant challenge for UK industry and will be critical to future economic activity, as cyber-physical and AI-controlled systems demand ever-increasing bandwidth and speed. In 2019 the UK was ranked 34th in the world for broadband speeds – a table topped by Taiwan and Singapore, with most of the top 30 spots taken up by European nations. The UK was overtaken in 2019 by Ireland, which leaped up seven places.^{xxx}

Full-fibre roll out

The National Infrastructure Commission's 2018 telecoms review led to a government-backed plan for 15 million UK homes to have full-fibre broadband by 2025, with full UK coverage achieved by 2033. The majority of provision will be delivered by private suppliers, though government has pledged to part-subsidise expensive rural roll-out. Yet concerns remain, as highlighted by Parliament's Environment, Food and Rural Affairs Committee in October 2019. Its chair, Neil Parish MP, has warned that "poor broadband and mobile data services continue to marginalise rural communities, particularly those living in hard-to-reach areas" – and he expressed scepticism that government could hit its targets for improving connectivity without "considerable and possibly controversial reforms".^{xxxi}

Equity and fairness

In light of those threats to connectivity, there are some concerns that smart cities will become gentrified technology hubs enjoyed by an urban elite, where new developments price out long-standing residents. But smart cities have the potential to deliver quality of life benefits for all: researchers at the McKinsey Global Institute estimate not only that city living costs would *not* increase, but that the average person could save 3% annually as a result of smart city systems.^{xxxii}

SMART IN WHAT SENSE?

Discussions about smart cities can sometimes become focused on the technology – but technology isn't everything.

Rather, projects should focus on the benefits that will be delivered.

The UK's 'smart cities tsar', Dr Jacqui Taylor, says that leaders need to focus on outcomes but too often obsess about which particular technology is adopted. She says: "Globally, technology has become the outcome; people have become focused on the technology only. That's missing the point. Technology is the enabler."^{xxxiii}

"Having something smart doesn't mean it's a smart city"

– Nathan Jones, Turner & Townsend

Nathan Jones, associate director at Turner & Townsend, echoes this point: "having something smart doesn't mean it's a smart city". Initiatives need to be tailored to the specific needs of a city and its residents, since "no two locations face the same challenges". As a result, he adds, "one smart city shouldn't follow another's model."^{xxxiv}

Emphasising the point, Taylor says that she prefers to talk about "communities", rather than cities. That helps to keep the focus on outcomes and benefits – and ultimately on delivering "what citizens need".

One example of focusing on the needs of citizens comes from Japan, in the form of its "Society 5.0" concept. Described as a national vision aimed at creating a "data-driven but human-centric" society, Society 5.0 incorporates ideas about healthcare, mobility, infrastructure and fintech. It envisages the use of technology to empower citizens, create more social connections, and provide for "network assisted" living.^{xxxv}

A PROJECT PROFESSION VIEW

We look at some of the potential implications of the challenges that lie ahead in the field of smart cities, urbanisation and connectivity.

How do you expect these challenges to affect the project profession? We look forward to hearing your views, and your examples of how the project profession is delivering the future through innovative projects today.

In many ways, smart cities bring into focus several of the challenges already considered through Projecting the Future. That means that project professionals will undoubtedly be at the heart of creating connected communities and smart cities in the years ahead.

The benefits of smart city systems could be wide-ranging: better infrastructure, greater sustainability, better human health and a higher quality of life. Smart cities could be a stimulus to development and regeneration with better transport links for previously neglected neighbourhoods. They should provide for future economic growth, offering entrepreneurs access to better business information.

There are of course challenges. Public trust, consent and participation in smart city projects will be vital. That is a significant challenge for civic leaders and politicians, at both national and local levels, but it also affects project professionals involved in designing and delivering change. It puts an emphasis on wide-ranging and effective stakeholder engagement techniques and the creation of opportunities for meaningful involvement, finding ways to crowd-source input and co-design smart city systems. Smart city systems are not smart because of clever technology: they are only smart if they reflect the needs of residents and deliver benefits to them.

The global trend towards urban living and the diversity of approaches to creating smart cities has allowed for experimentation and, in effect, for different cities to pilot different solutions to common problems. Another opportunity for project professionals will therefore be to share and transmit the insights, lessons learned, and expertise needed to help cities implement solutions that are right for their situations. This is an area where the UK has much to offer. As the Future Cities Catapult and Arup have argued, the UK's track record – from the 2012 Olympics to its role in regeneration in Doha – shows that the UK can confidently offer expertise, products and services to the global cities market.^{xxxvi}

That same expertise should deliver transformational change at home too, though there are challenges. Building successful smart cities demands solid foundations: smart road networks, for instance, are only a realistic proposition when basic road infrastructure is in place. While city leaders' attention, and resources, are stretched across other challenges, their appetite for more ambitious projects will be limited. And the UK faces major challenges in delivering upgraded urban infrastructure when so many of our cities rely on ageing systems, like Victorian water networks and sewers, that are hard-pressed to meet the needs of today's populations. As the chief information officer for Manchester, for example, has noted: the city aims to be ambitious on smart city technology, but "there are still quite a lot of core things we have to do."^{xxxvii}

The trend towards urbanisation and connectivity will only continue growing in the years ahead. Projects will be at the heart of creating smart cities that can meet the quality of life and standards of wellbeing we all demand.

DISCUSSION QUESTIONS FOR THE PROJECT PROFESSION

Throughout Projecting the Future, we want to explore the questions that matter about the future of the project profession.

We want to hear from you: from individuals, teams, departments, organisations, institutions and communities. We want your views, ideas and evidence relating to these questions – and we are keen to hear about case studies that show how the project profession is starting to adapt to these challenges.

1. What do you believe are the most important challenges facing the project profession in the fields of smart cities, urbanisation and connectivity?

2. Do smart city projects give sufficient time and space for communities in those cities to input and shape the projects? What is the profession's role in making sure that people's voices are heard?

3. How can the project profession best share insight and expertise between different cities globally to support effective delivery of smart city technology?

4. What examples of excellence from city projects around the world could UK cities learn from?

5. What opportunities exist for the project profession to spread expertise from the UK to other cities globally?

6. What are the implications of the issues raised here for projects intended to deliver benefits to communities in non-urban areas?

7. There are significant connections between the issues outlined in this paper and the topics covered in other Projecting the Future papers, including the fourth industrial revolution, climate change and rising human longevity. How can smart city approaches bring these things together to maximise benefits for residents?

See page 2 for details of how you can join the big conversation.

FIND OUT MORE: TOP SOURCES

- McKinsey Global Institute's 2018 report, *Smart Cities: Digital Solutions for a More Livable Future*, provides comprehensive analysis of global adoption of smart technologies and some of the opportunities ahead. www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future
- Future Cities Catapult is a public-private funded, non-profit body that aims to support UK businesses in creating and selling products and services for cities. It offers a wide range of research and policy briefings. <https://futurecities.catapult.org.uk/resources/>
- Smarter London Together is the London Mayor's plan for making the capital the "smartest city in the world". www.london.gov.uk/what-we-do/business-and-economy/supporting-londons-sectors/smart-london
- The Population Division of the Department of Economic and Social Affairs of the United Nations monitors global population trends, and its World Urbanization Prospects provide estimates and forecasts for urban populations. <http://www.un.org/en/development/desa/population/>
- Turner & Townsend's *360° view – Smart cities* is part of a series offering a range of perspectives on how projects and programmes can be future-proofed. www.turnerandtownsend.com/en/perspectives/360-view-smart-cities

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REFERENCES

ⁱ UN (2018). *2018 Revision of World Urbanization Prospects*. Via www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

ⁱⁱ McKinsey Global Institute (2018). *Smart Cities: Digital Solutions for a More Livable Future*. Via www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future

ⁱⁱⁱ UN (2018).

^{iv} OECD (9 October 2017). 'OECD Economic Surveys: United Kingdom 2017'. https://read.oecd-ilibrary.org/economics/oecd-economic-surveys-united-kingdom-2017/percentage-of-uk-population-living-in-urban-areas-is-the-highest-in-the-oecd_eco_surveys-gbr-2017-graph53-en#page1

^v UN, Department of Economic and Social Affairs, Population Division (2018). *The World's Cities in 2018 – Data Booklet*. www.un.org/en/events/citiesday/assets/pdf/the_worlds_cities_in_2018_data_booklet.pdf

^{vi} McKinsey Global Institute (2018).

^{vii} International Data Corporation press release (25 June 2019). *Smart Cities Initiatives Forecast to Drive \$189 Billion in Spending in 2023, According to a New Smart Cities Spending Guide from IDC*. www.idc.com/getdoc.jsp?containerId=prUS45303119

^{viii} Cable.co.uk (2019). *Worldwide Broadband Speed League 2019*. www.cable.co.uk/broadband/speed/worldwide-speed-league

^{ix} Adapted from McKinsey Global Institute (2018)

^x UN, Population Division (2018).

^{xi} Mayor of London (2016). Chapter 1 of *The London Plan*. Via www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan

^{xii} Caragliu, A, Nijkamp, P, Del Bo, C (2009). 'Smart Cities in Europe'. *Journal of Urban Technology*. Via www.researchgate.net/publication/46433693_Smart_Cities_in_Europe

^{xiii} Singh, S (19 June 2014). 'Smart Cities – A \$1.5 Trillion Market Opportunity'. *Forbes*. www.forbes.com/sites/sarwantsingh/2014/06/19/smart-cities-a-1-5-trillion-market-opportunity

^{xiv} Smart City Hub (14 July 2014). 'Barcelona: showcase of smart city dynamics'. www.smartcityhub.com/technology-innovation/barcelona-showcase-smart-city-dynamics

^{xv} Macpherson L (7 September 2017). '8 Years On, Amsterdam is Still Leading the Way as a Smart City'. *Towards Data Science*. www.towardsdatascience.com/8-years-on-amsterdam-is-still-leading-the-way-as-a-smart-city-79bd91c7ac13

^{xvi} Campfens, V, Dekker, C (31 January 2018). 'Turning Rotterdam into the "World's Smartest Port" with IBM Cloud & IoT'. www.ibm.com/blogs/think/2018/01/smart-port-rotterdam

^{xvii} McKinsey Global Institute (2018).

^{xviii} Climate & Clean Air Coalition (9 March 2019). 'Beijing's air quality improvements are a model for other cities'. www.ccacoalition.org/en/news/beijing-s-air-quality-improvements-are-model-other-cities

^{xix} *wired.co.uk* (15 November 2019). 'The world's cities face a congested future. Integrated, smart technology can save them.' www.wired.co.uk/article/the-worlds-cities-face-a-congested-future-integrated-smart-technology-can-save-them

^{xx} Hitachi press release (15 October 2019). 'Train station of the future unveiled which could use robots and digital technology'. www.mynewsdesk.com/uk/hitachi-rail-global/pressreleases/train-station-of-the-future-unveiled-which-could-use-robots-and-digital-technology-2931803

^{xxi} Agatsuma, K (2020). The trains of the future have arrived. Article by Hitachi Rail's group COO, rolling stock, provided directly to APM in January 2020

^{xxii} The Architecture Centre (3 July 2019). 'Andrew Grant: Bringing Nature Into Our Cities.' www.architecturecentre.org.uk/2019/07/andrew-grant-bringing-nature-into-our-cities

^{xxiii} The Northern Forest. <https://thenorthernforest.org.uk/>

^{xxiv} City of Trees. www.cityoftrees.org.uk

^{xxv} Trinity College Dublin (5 July 2017). 'Trinity team leads €12m EU-funded project to bring nature into cities.' www.tcd.ie/news_events/articles/trinity-team-leads-e12m-eu-funded-project-to-bring-nature-into-cities

^{xxvi} UK Government (14 January 2019). *Clean Air Strategy 2019*. www.gov.uk/government/publications/clean-air-strategy-2019

^{xxvii} Vaughan, A (15 July 2015). 'Nearly 9,500 people die each year in London because of air pollution – study'. *The Guardian*. www.theguardian.com/environment/2015/jul/15/nearly-9500-people-die-each-year-in-london-because-of-air-pollution-study

^{xxviii} Hook, L, Bernard, S (21 August 2018). 'Air pollution: why London struggles to breathe'. *Financial Times*. www.ft.com/content/9c2b9d92-a45b-11e8-8ecf-a7ae1beff35b

^{xxix} Mayor of London and London Assembly (retrieved 29 January 2019). *Smarter London Together*. www.london.gov.uk/what-we-do/business-and-economy/supporting-londons-sectors/smart-london/smarter-london-together

^{xxx} Cable.co.uk (2019); Fletcher, Y (2 July 2019). 'UK ranked 34th in world broadband-speed league table.' *Which?* www.which.co.uk/news/2019/07/uk-ranked-34th-in-world-broadband-speed-league-table

^{xxxi} Scropton, A (18 September 2019). 'Rural connectivity struggling to keep up with demand'. *Computer Weekly*. www.computerweekly.com/news/252470815/Rural-connectivity-struggling-to-keep-up-with-demand

^{xxxii} McKinsey Global Institute (2018).

^{xxxiii} Turner & Townsend (10 December 2019). 'Smart cities: moving beyond technology.' www.turnerandt Townsend.com/en/perspectives/smart-cities-moving-beyond-technology

^{xxxiv} Jones, N (3 December 2019). 'Data meets Darwin – urban life is evolving'. www.turnerandt Townsend.com/en/perspectives/data-meets-darwin-urban-life-is-evolving/

^{xxxv} Government of Japan (undated; retrieved 28 January 2020). *Realizing Society 5.0*. Via www.japan.go.jp/abonomics

^{xxxvi} Arup and Future Cities Catapult (2014). *Future Cities: UK capabilities for urban innovation*. www.arup.com/perspectives/publications/research/section/future-cities-uk-capabilities-for-urban-innovation

^{xxxvii} Magee, T (30 November 2018). 'Manchester City Council CIO Bob Brown on how to make a city smart'. *Computerworld*. www.computerworld.com/article/3427931/manchester-city-council-cio-bob-brown-on-how-to-make-a-city-smart.html



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