SmartCitiesWorld City Profile

March 2021 London

In association with

AVEVA

Executive summary

SmartCitiesWorld City Profiles explore the world's leading cities as they use technology and smarter approaches to deliver better services and improve quality of life for citizens. The United Nations predicts that by 2050, 70 per cent of the world's population will live in urban areas. Every week another 1.5 million people around the globe move into a city.

For city administrators, this growth, encouraged – and accompanied – by unprecedented technological change, presents a myriad of challenges and opportunities, big and small, social and economic, human and technical, logistical and environmental. This series examines individual cities, identifying their most pressing issues and how technological innovation is helping to manage them.

In this edition, we focus on London, the capital of the United Kingdom and the largest city in England. Located in the south-east of the country and standing on the River Thames, it covers an area of 607 square miles.

London is a global centre for finance and commerce and its historic heart is the City of London, which is colloquially known as the "Square Mile". Throughout the 20th and 21st centuries it has earned a reputation as a global trendsetter. Culturally diverse and cosmopolitan, it is also seen as highly influential in a number of areas from science, research and education through to culture, media, fashion and architecture.

As a smart city, London is similarly seen as both a thought leader and pioneer. It launched the integrated transport Oyster smartcard back in 2003 and in the same year introduced a congestion charge. In 2010 it established an open data platform and brought in a pay-as-you-go bike scheme.

It's no surprise then that the city consistently performs well in smart city and other rankings. It was top in the annual IESE Cities in Motion Index 2020 for the second consecutive year, with the report hailing its human capital, governance, urban planning, mobility and transport, and technology.

In 2021, London overtook New York as having the highest concentration of dollar millionaires in the world. It is ranked joint top alongside New York in the City Wealth Index by property company Knight Frank based on the three factors of wealth, investment and lifestyle. There is, however, great disparity when it comes to income and wealth in the UK capital.

This, along with the longer term-impact of the UK's decision to leave the European Union (EU) and the country's poor performance in the Covid-19 pandemic, are among the complex set of challenges it faces if London is to remain one of the world's most influential and enviable cities.

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Population
9 million

Population density
5,701 per km²
(Greater London area)

Main languages
English, Bengali, Polish, Turkish, Gujarati

Median age
35.6 years

GDP per capita
£54,686

Introduction

London is made up of 33 boroughs, which each has its own government and identity. In 1998, the Greater London Authority, also known as City Hall, was created after a referendum when citizens voted in favour of a directly elected mayor to represent its interests and an assembly to scrutinise their work.

Mayor of London Sadiq Khan launched the latest smart city roadmap – Smarter London Together – in 2018 with the aim of making London the smartest city in the world. He sees its future as "a global testbed city for civic innovation".

The publication of the roadmap was the latest step in its smart city journey. In 2017, Khan appointed Theo Blackwell as London's first chief digital officer (CDO), to lead a citywide digital transformation, data and smart city initiatives at City Hall.

Blackwell is supported by the Smart London policy team that sits within City Hall's City Intelligence Unit. London's smart city efforts have also benefited from being a leading player in the EU Sharing Cities programme. Set up as a proving ground for creating common approaches to making smart cities a reality, London's Royal Borough of Greenwich has been acting as a testbed, collaborating with other European cities.

One of the objectives of the most recent roadmap is to "fix the plumbing", says Blackwell and "focus on connectivity and build collective capabilities, especially around design, data and collaboration". He adds that the aim is to take a "people first" approach. "We want to design to meet needs, build greater trust and show while doing."

The Smarter London Together roadmap is based on the following five missions:

- More user-designed services;
- Strike a new deal for city data;
- World-class connectivity and smarter streets;
- Enhance digital leadership & skills;
- Improve city-wide collaboration.

Progress has been made across all of these areas. As part of mission one, for example, citizen-led design has been put at the heart of what the GLA does. Londoners and councillors have been polled on the use of tech for the first time. Its Talk London platform is an online community platform that enables Londoners to give input on what is happening in the city. In 2019, as part of fulfilling mission five, London Office of Technology (LOTI) was established as "a collaboration vehicle" between all of the boroughs".

In December 2020, the first draft of the Emerging Technology Charter for London was published, which is designed to ensure new technologies that use 5G and artificial intelligence (AI), are transparent and designed around the needs of Londoners.

One of the key strengths of London's smart strategy has been its willingness to evolve, adapt and listen and learn from citizens and other parties. Ahead of formulating the latest roadmap, Blackwell and the team conducted a listening tour, attending more than 80 public meetings and events.

London is a smart city built on the firmest of foundations but the GLA and the Smart London team's ongoing commitment to civic innovation and collaboration, especially to help recover from Covid-19, shows no sign of complacency and a readiness to play a key part in confronting future challenges head-on.

City Challenges

- Covid-19 recovery: a report for the city in 2021 has revealed that central London is facing bigger challenges than many other major cities from continued home working and lack of tourism
- Air quality: tens of thousands of Londoners still breathe illegally polluted air and 99 per cent live in areas exceeding the World Health Organisation recommended guidelines for sources of air pollution
- Inequality: according to the charity Trust for London, the top 10 per cent of London's population hold more than 40 per cent of total net wealth and the bottom 30 per cent holds only 0.1 per cent

Mobility

- Prior to the pandemic, London's public transport network, run by Transport for London, supported 30 million journeys a day
- As the first wave of lockdown restrictions eased in summer 2020, passenger numbers reached around 30 per cent of previous levels on the tube and 50 per cent on the bus network
- The mayor is aiming for 80 per cent of trips in London to be made on foot, by cycle or using public transport by 2041

Economy

- London's economy is dominated by service industries, in particular financial and professional services
- London's economy proved to be the UK's most resilient during Covid first wave
- London is responsible for creating almost 24 per cent of the UK's GDP

Data

How data is treated is an infrastructure issue for London and one it ranks as important as its road, railway and energy networks.

London took a global lead when the GLA launched the London DataStore in 2010, making large amounts of data about the city freely available. How data is treated is an infrastructure issue for London and one it ranks as important as its road, railway and energy networks.

As part of mission two in its Smarter London Together roadmap, it said it would "strike a new deal for city data", to support data collaborations and increase data-sharing for the benefit of Londoners. It also pledged to develop a city-wide cyber security strategy to coordinate responses to online threats to public services, businesses and citizens, and strengthen data rights, accountability and trust.

It has been steadily working on a raft of projects and initiatives to achieve these aims since 2018, including the City Data Analytics programme, which provides additional resources to accelerate the process of data-sharing and collaboration in external as well as internal data projects and exercises.

The London DataStore is evolving into its 3.0 incarnation as a central register of data and APIs and forms part of an important ecosystem which, Blackwell says "respects the federated nature of London". The ecosystem will extend out to the boroughs and the London Office of Technology & Innovation (LOTI), as well as organisations such as Transport for London (TfL), NHS One London, London Data Commission, research bodies, civil society and central government.

"Going forward, we need the London DataStore to fulfil a slightly different function and want to enable it to share secure, private data as well as open data, which is extremely important to the future of a city," says Blackwell.

Underlining the city's data objectives is what he describes as a "purpose-led approach" and it works with organisations to ensure this, from the Alan Turing Institute to the Geospatial Commission. Currently, London's data architecture shares more than 6,000 datasets and metadata supporting planning, the environment, economic analysis and policy development.

In November 2020, the Planning London Datahub was soft-launched to local boroughs, which delivers a live feed of development proposals in the UK capital from boroughs and applicants and which claims to provide the most advanced planning data in the country. It has recently been launched live.

In addition, a portfolio of web maps and data services have been made freely available on the London.gov.uk site. They include maps that show the mayor's air quality actions, brownfield sites, green

Timeline

February 2003:
Congestion charge introduced in central London by the city's first mayor, Ken Livingstone.

June 2003:
Contactless Oyster smartcard introduced, which revolutionised paying for journeys.

January 2010:
London Datastore, an open data platform that made range of data on the UK capital freely available goes live.

July 2010:
Cycle hire is launched and achieves 6.2 million hires in its first 12 months.

July 2012:
The online community Talk London was set up so City Hall could hear from Londoners about big issues that matter to them.

July 2012:
London's Infrastructure 2050 plan published (and later updated in 2015), the city's first ever attempt to identify, prioritise and cost future infrastructure, given its rate of growth.

August 2012:
London hosts the 2012 Olympic & Paralympic Games.

March 2013:
Boris Johnson, then London mayor, launched the first Smart London plan. It was first updated in 2016..

September 2014:
Contactless travel introduced on London Underground, tram, DLR, London Overground, and National Rail services that already accept the Oyster card.

December 2016
London's BT Tower claims to host the highest Internet of Things (IoT) base station in the world, at a height of 180 metres.

infrastructure, tree canopy cover, where there is potential to create a decentralised energy network to cut carbon emissions, and a London solar opportunities map.

Coherent and consistent

There can few better examples of a "purpose-led" use of data in action than during the Covid-19 pandemic. A wide range of Covid-19 related datasets had been emerging but differing standards sometimes made it difficult for the boroughs to make full use of them. GLA created an API to help them ensure the coherency and consistency of the data. It also developed an interactive dashboard of cases and hospital treatments. The work was recognised by the UK government's Centre for Data Ethics and Innovation and featured in its Covid-19 Repository & Public Attitudes review, which described one of the successes of the project as bringing together data from different sources "to tell a clearer picture of what was happening across London".

Data also underpinned London's Covid-19 "busy-ness" project, which the GLA worked on with the Turing Institute and Microsoft UK. The analysis was used by the GLA and the boroughs to understand how spending and movement patterns have been impacted by the pandemic and lockdown using data from Mastercard and O2. "Covid-19 highlighted to us the need to partner with the private sector and use different sources of data to gain better insights into the impact on London's economy," says Blackwell.

London's commitment to strengthening data governance means ethics and accountability are topics high on the agenda of the Emerging Technology Charter for London, which will underpin all of London's future smart city projects. As part of this, it piloted its first data trust in 2020, a legal structure providing independent stewardship of data. One of the three key principles of the Charter is to collect, manage, use and share data legally, ethically and securely. This includes making it easy for anyone who does not wish their data used in a particular way or who wishes to opt-out at any time to be able to do so, as well as highlighting "publicly and clearly" the risks regarding its use.

Indeed, it underlines that data governance must be far more than a tickbox exercise and its stated aim should serve as a clarion call to other cities: "Living the spirit, not just the letter of GDPR, means seeing the requirements such as informed consent as deep ethical obligations as well".

Data

- The London DataStore is evolving into its 3.0 incarnation as a central register of data and APIs
- London's data architecture currently holds more than 6,000 datasets and metadata across a broad range of areas
- London piloted its first data trust in 2020 with the Open Data Institute

May 2015:
Santander and TfL announce seven-year partnership and Santander Cycle launch.

January 2016:
London joins the EU Sharing Cities smart cities programme. By 2021, work by the European cities taking part has triggered €250m investment in smart technologies. Learnings from project will be made available as playbooks.

May 2016:
Sadiq Khan beats Conservative candidate Zac Goldsmith to become mayor of London and the first Muslim mayor of an EU capital.

August 2017:
Theo Blackwell appointed London's first chief digital officer to lead on city-wide digital transformation, data and smart city initiatives at City Hall.

August 2017:
Mayor announces plan to boost connectivity and appoints a not-spot team to tackle problem areas.

August 2017:
Connected London team was formed. Since its inception, fibre coverage in London has risen from 4.7 per cent to 21.05 per cent.

March 2018:
Mayor publishes his Transport Strategy 2018 with the ambition for 80 per cent of trips in London to be made on foot, by cycle or using public transport by 2041.

June 2018:
Smarter London Together roadmap launched, which sets out how to make London the smartest city in the world.

April 2019:
World's first ultra-low emission zone (ULEZ) launched in Central London, replacing the Toxicity Charge.

Connectivity

London has an aspiration to be the best-connected city in Europe, where affordable full fibre connections are available to all homes and businesses. In 2017, Mayor Khan announced a package of measures to boost digital connectivity and tackle London's so-called 'not-spots' of no coverage. "Internet connectivity is now a key public utility and it is no surprise that some businesses see poor connectivity as a barrier to growth," he said.

A 'Not-Spot Team' was assigned to go out to London's most problematic connectivity spots to work with local authorities and providers to identify and deliver solutions to improve connectivity.

In 2018 the Connected London team was formed to fulfil statements made in the mayoral manifesto. During the three years the team has been in operation, the city's full fibre coverage – where a cable runs from a building all the way to a telephone exchange – has risen from 4.7 per cent to 21.1 per cent.

Ninety-five per cent of London has fibre-to-the-cabinet (FTTC) coverage, where a copper connection connects the cabinet and a building. It offers average speeds of 30MBps, whereas ultrafast broadband, an upgraded version of FTTC technology, offers speeds of at least 300MBps. It covers 76.7 per cent of London.

A 400km "full fibre spine" has been created along London's tube network and has a goal of being connected to 600-plus public buildings within five miles, making it easier and cheaper to connect nearby homes and businesses. Meanwhile, 4G is also being rolled out on the London Underground with a pilot on the Jubilee Line giving TfL and mobile operators experience of delivering mobile services.

In addition, the Connected London team is supporting a number of smaller fibre providers to stimulate competition, including London-focused broadband ISP Community Fibre, which aims to expand its fibre coverage to one million premises and G.network,

"Internet connectivity is now a key public utility and it is no surprise that some businesses see poor connectivity as a barrier to growth,"
Sadiq Khan, London mayor

Connectivity

- A 400km “full fibre spine” has been created along London’s tube network
- Fibre coverage in London has risen from 4.7 per cent to 21.1 per cent in the last three years
- Only 51 per cent of households with an income between £6,000 and £10,000 had home internet access during the pandemic

which is upgrading more than 80 per cent of residents and businesses in 13 London boroughs.

Connecting locals

An update from Connected London in October 2020 reveals how hard individual boroughs are working on their own digital district and fibre strategies. Westminster City Council, for instance, has secured £1.1m funding to run its Digital Street Markets project, which will see the deployment of wi-fi networks at all council-run street markets and offer a secure and reliable network for market traders.

Southwark Council now has more than 36,000 properties that are gigabit-enabled as part of a full fibre broadband project with Community Fibre and Hyperoptic. Both providers are in the process of providing a free life-long connection to a number of community centres, tenant and resident association halls and libraries.

Requirements in the Mayor’s London Plan, which came into force on 2 March 2021, are also designed to further boost connectivity. Future planning applications will need to demonstrate that residents will have access to FTTP technology. The policy also requires developers to work with mobile network operators and make sure a new building has the signal it needs but does not block connectivity for the surrounding area.

The planning changes are complementary to the mayor’s Digital Access for All programme, which aims to improve internet speeds and signals across London, as well as provide essential digital skills and a device to those who need them most.

Despite the work that has been done on improving connectivity, the coronavirus has highlighted that many Londoners are unable to benefit from the opportunities provided by the internet. More than half (55 per cent) of London’s civil society organisations reported an increase in demand for digital connectivity from the people they support during the pandemic while Ofcom estimates that 10 per cent of Londoners do not have smartphones. Meanwhile, only just over half of households (51 per cent) of households with an income between £6,000 and £10,000 had home internet access compared to 99 per cent in those households earning £40,000-plus.

In February 2021, the mayor and London councils launched a taskforce to tackle digital exclusion in the city. Led by Blackwell, one of its objectives is to “comprehensively” map out the need for devices and reliable connectivity across London. The taskforce will play a key role in helping allocate significant investment in digital infrastructure to help connect areas that continue to suffer from poor connectivity.

July 2019:
London named world’s first National Park City in recognition of its open spaces, waterways and natural environment.

June 2019:
London Office of Technology & Innovation (LOTI) established to help London boroughs work together, using digital, technology and data to improve public services.

November 2019:
O2 signs agreement to provide 5G connectivity for the testing of connected and autonomous vehicles at the London Smart Mobility Living Lab.

February 2020:
London and Los Angeles sign an agreement to become ‘Innovator Cities’ to tackle the globe’s biggest transportation challenges.

February 2020:
Mayor launches London’s first ever resilience strategy to address challenges such as climate change and Brexit.

March 2020:
UK prime minister Boris Johnson announces national lockdown to stop the spread of the coronavirus.

March 2020:
4G connectivity trialled on a stretch of the London Underground.

May 2020:
Alan Turing Institute mobilised to inform London’s response to Covid-19 lockdown.

May 2020:
Streetspace programme launched to rapidly transform London’s streets to accommodate the increase in cycling and walking when lockdown restrictions are eased.

July 2020:
Mayor secures new woodland areas to create more green space in Havering and Enfield.

Environment & energy

In October 2020, City Hall published new data showing the major improvements that have been made in London's air quality since 2016. It revealed a 94 per cent reduction in the number of Londoners living in areas exceeding legal limits for nitrogen dioxide (NO^2) and a 97 per cent reduction in the number of state primary and secondary schools located in areas exceeding legal pollution limits (455 in 2016 to 14 in 2019).

The world's first 24-hour ultra-low emission zone (Ulez), programmes such as Streetspace – which are designed to encourage more people to cycle, walk or scoot – and the Breathe London air quality monitoring project are among key strands of London's unflinching commitment to improve what Khan describes as London's "toxic" air quality.

New Deal for the environment

There is still much work to be done though and Khan's introduction of a Green New Deal for London aims to tackle the "twin dangers" of air pollution and the climate emergency as well as reinforce its commitment to be a zero-carbon city by 2030. It aligns with the principles of the global Green New Deal to which mayors around the world have pledged commitment and which seeks to protect the environment, strengthen economies and build a more equitable future. The tenets are at the heart of the UK capital's green recovery plans and which also aim to address London's inequality.

Writing on the C40 Cities blog, Shirley Rodrigues, London's deputy mayor for environment and energy, said that those living in deprived areas are most likely to experience poor air quality, cold, damp homes and limited access to green space. The city has some of the highest levels of fuel poverty in the country with government figures revealing one in nine households are unable to meet the cost of heating.

London announced a Green New Deal Fund in November 2020 with the first £10m being invested in projects that will initially support 1,000 jobs but also lay "green foundations" for supporting innovation, growing supply chains and investing in green skills.

Through the deal, the Ulezs will be expanded into 20 surrounding boroughs. The world's first 24-hour Ulez is credited with contributing to a 44 per cent reduction in roadside NO^2 levels in the central London zone (pre-Covid lowdown measures).

Individual boroughs have their own aims and aspirations. The City of London, for example, is piloting what claims to be the UK's first 24/7 zero-emission street and promises to turn part of the Square Mile into zero-emission zones by 2022. The City Corporation's CityAir app provides more than 35,000 Londoners with low pollution travel routes and it also claims to be the first UK local authority to deploy a full fleet of electric refuse collection trucks.

Electric mobility is central to clean air plans with further plans to electrify London's bus fleet. Meanwhile, electric charging in the UK capital hit a milestone in January 2021 with more than 500 rapid charge points and 5,500 residential ones. It also has points dedicated exclusively for almost 4,000 electric taxis operating in the city. The Mayor's Electric Vehicle Infrastructure Delivery Plan estimates that by 2025, the UK capital may need up to 4,000 rapid charging points and up to 48,000 residential chargers.

Boroughs are also progressing with their own electric mobility strategies. In 2020, Brent and Camden installed 200 "flat and flush" chargers from start-up Trojan Energy as part of a kerbside electric charging testbed.

Another backbone of the clean air strategy is London's network of sensors that collect data on air quality. The mayor launched a new partnership with Imperial College London and Bloomberg Philanthropies in December 2020 as the next phase of the Breathe London project. More than 100 sensors will be installed at hospitals, schools and other priority locations enabling Londoners to

Those living in deprived areas are most likely to experience poor air quality, cold, damp homes and limited access to green space.

see how polluted their local area is. In addition, business, community groups, charities and individuals can "buy in" to the network and host a sensor at the location of their choice.

The project is also designed to reduce the costs of sourcing reliable air pollution data for local projects or schemes like School Streets, whereby roads around schools are closed to traffic at pick-off and drop-off times. This project alone, which saw 30 sensors installed at the boroughs of Brent, Enfield and Lambeth, has reduced nitrogen dioxide levels by almost a quarter (23 per cent).

Like other cities, London has found that investment in environmental initiatives can bring a multi-dimensional return on investment by bringing benefits in areas such as congestion, energy-efficiency, air quality as well as bigger picture gains when it comes to quality of life and climate change. These sentiments are echoed by Rodrigues when she said that as we emerge from lockdown in the year of United Nations Climate Change Conference in Glasgow (COP26) we have "a once-in-a lifetime opportunity" to address critical challenges, "establishing a new fairer and low-carbon model that benefits all Londoners."

Environment & energy

- The mayor has set a target for London to be a zero-carbon city by 2030
- Since 2016, there has been a 94 per cent drop in the number of Londoners living in areas exceeding legal limits for NO^2
- The world's first 24-hour Ulez brought about a 44 per cent reduction in roadside NO^2 levels in the central London zone

July 2020:
London crowned smartest and most sustainable city in the world, according to the IESE Cities in Motion Index 2020 for the second year running.

September 2020:
Official launch of London's Smart Mobility Living Lab, which provides real-world testing for autonomous and connected vehicles.

September 2020:
School Streets air quality monitoring project launched, which will measure NO^2 levels at 18 schools.

September 2020:
Uber wins appeal to regain operating licence in London after losing it in 2019.

October 2020:
New data shows a 94 per cent reduction in number of Londoners living in areas exceeding legal limits for NO^2.

October 2020:
London pilots its first data trust via the Open Data Institute and Sharing Cities.

November 2020:
London joins Mastercard's City Possible co-creation framework that aims to help build more inclusive and sustainable communities.

November 2020:
The mayor announces a Green New Deal Fund to support its targets to be net-zero.

November 2020:
Tfl and London Councils launch a competition to select up to three operators for a 12-month rental e-scooter trial.

November 2020:
Planning London Datahub launches, which delivers a live feed of development proposals from boroughs and applicants.

Mobility

The mayor has an ambition for 80 per cent of trips in London to be made on foot, by cycle or using public transport by 2041. In 2018, Khan set out his plan to improve transport in the UK capital over the next 25 years. As well as record investment in rail, tube and bus services, the plan had what was described as “an unprecedented” focus on walking and cycling and a commitment to make the entire transport system zero-emission by 2050.

The impact of Covid-19 on transportation usage, behaviours and attitudes, however, means that London, in common with nearly every other city around the globe, has had to adapt and accelerate its mobility strategy.

The emphasis on walking and cycling proved prescient in the light of Covid-19. More than 100km of new or upgraded cycle routes have been delivered or are under construction since the start of the pandemic, as well as hundreds of kilometres of quieter streets and extended pavements. Over the last two weekends in February 2021, Transport for London (TfL) reports that cycle flow increased by 200 per cent compared to the same time in 2020.

Last year TfL celebrated 10 years of its bike-share programme and saw record demand that summer. Londoners now have access to 781 docking stations and 12,000 bikes, with an additional 1,700 new bikes being added. To extend micro-mobility and first- and last-mile options, TfL and London Councils have launched a competition to select up to three operators for 12 month trials of rental e-scooters, due to start in spring 2021.

Zeroing-in

In TfL, the GLA and the Smart London policy team have an integrated transport provider whose action plans and support go way beyond merely getting people from A to B and feed into areas such as air quality, citizen safety, connectivity and data.

A case in point is the introduction of the Vision Zero Dashboard, which enables organisations and citizens to easily interpret collision data and work together with boroughs and agencies to tackle problem areas. Similarly, its pioneering lorry safety Direct Vision Standard, which came into force in March 2021, has forced around 30,000 dangerous heavy goods vehicles to be fitted with the safety measures such as motion sensors and cameras to protect people walking and cycling.

TfL has and continues to work with a number of organisations and the private sector on connected and autonomous vehicles (CAV), which must follow guidance developed in collaboration with London councils and the boroughs when planning trials. Trials are ongoing with a number of organisations, including London’s Smart Mobility Living Lab (SMLL), which uses the Royal Borough of Greenwich and Queen Elizabeth Olympic Park in Stratford as a testing environment that facilitates interaction with live traffic and other road users. SMLL said that if its customers know something works in London, “it can work anywhere”.

Alongside micro-mobility and driverless innovation, investment in traditional forms of public transport will both expand and modernise the rail, tube, bus and tram networks. However, TfL has admitted its financial model “was not built to withstand the pandemic”, which raises questions about its plans.

Around 70 per cent of TfL’s income to operate the network comes from fares, which is relatively high compared to cities such as New York and Paris. Prior to the pandemic, London’s public transport network supported

“The impact of Covid-19 means that London, in common with nearly every other city around the globe, has had to adapt and accelerate its mobility strategy.”

Mobility

- Pre-Covid, London's public transport network supported 30 million journeys daily
- Londoners have access to 781 docking stations and 12,000 bikes, with an additional 1,700 bikes being added
- TfL has plans to electrify the entire bus network by 2030

30 million journeys daily. As restrictions eased in summer 2020, passenger numbers only reached around 30 per cent of previous levels on the tube and 50 per cent on the bus network.

So much of London's future as a smart and green capital relies on TfL being able to deliver a progressive integrated transport service to support the capital as it gets back to work while avoiding a car-led recovery and the ills that could bring. According to the annual Inrix Global Traffic Scorecard, in 2019 London was ranked eighth globally with drivers losing 149 hours in traffic each year.

That said, taxi and car-sharing operators are needed to play a crucial role in supporting key sectors of the London economy. There are currently 21,000 black cabs licensed by the Public Carriage Office and in 2019, more than 45,000 private hire drivers use the Uber app to earn money.

In future, London's mobility landscape may well be made up of autonomous and electric cars, river- and air-taxis but to achieve the right mix in the short-term, London's challenge will be making sure public transport and greener travel options are sufficiently attractive that citizens feel confident and safe enough to leave their own cars at home.

December 2020:
First draft of the Emerging Technology Charter for London published, designed to ensure new technologies are transparent and designed around the needs of citizens.

January 2021:
Nine thousand buses meet Ulez emissions standards across the entire city.

January 2021:
TfL launches its Vision Zero dashboard which aims to present collision data in a more accessible format as a tool to increase road safety.

January 2021:
Mayor declares a "major incident" following the rapid spread of Covid-19.

January 2021:
London hits electric charging milestone of more than 500 rapid charge points and over 5,500 residential charge points.

March 2021:
The London Plan, an ambitious planning framework and spatial development strategy for London, is published.

February 2021:
Applications invited from innovators to a £1m Resilience Fund to drive forward the city's recovery from the Covid-19 pandemic.

February 2021:
Taskforce formed to tackle digital exclusion in the city, led by Theo Blackwell.

March 2021:
Mayor of London and Bloomberg Philanthropies announce a £1.5m joint investment in air quality monitoring, which includes the funding of 195 air quality sensors.

March 2021:
Mayor kickstarts Covid-19 recovery with more than £544m investment announced at his inaugural Recovery Summit.

Urban space

World-renowned architects have changed the face, not to mention the skyline, of the UK capital in recent years with iconic buildings such as the Walkie Talkie, The Shard and the Gherkin. Its ever-evolving architecture demonstrates how this city, founded by the Romans in 47AD as Londinium, has always been willing to move with the times.

Of course, cities are no longer just about outward looks and the urban space must be filled with buildings that are sustainable and energy-efficient. When completed in 2024, it is believed that Citicape House, a five-star central London hotel and co-working venue, will be the city's greenest building. It will feature a 40,000 square foot green exterior, projected to be the largest living wall in Europe, and be planted with several of Britain's threatened native wildflowers. Developers promise the building will be able to absorb eight tonnes of pollution annually.

London's future sustainability must go beyond landmark individual buildings though and Khan hopes his London Plan, a spatial development strategy and planning framework for the capital published in March 2021, will help to embed sustainability into the city as well as address major issues such as affordable homes for Londoners.

The importance of the highly "joined-up", 542-page plan to London's future cannot be overstated. It is underpinned by what Khan calls "Good Growth" and aligns with the mayor's other strategies including the Covid recovery plan, the Global New Deal and his transport plans. Hence, it is designed to play its part in improving air quality, helping to make London a zero-carbon city by 2030 and supporting the modal shift to 80 per cent of journeys being made by walking, cycling or public transport by 2041. It also aims to protect London's green belt and, crucially, achieve a longer-term target of creating 50 per cent affordable homes in new developments.

London's population is projected to increase by 70,000 every year, reaching 10.8 million in 2041, which means to meet demand it will need to build tens of thousands of new homes, as well as space for new jobs, every year.

"The London Plan is fundamentally about taking a holistic approach and utilising all the levers we have in London to shape our city for the better, built around the needs, health and wellbeing of all Londoners," writes Khan in his foreword.

Key policies of the plan are to ensure space and quality standards for new-build properties to ensure they are a decent size and have better fire safety, tackling air quality, by making sure Londoners have access to open and green spaces, increasing local community infrastructure such as at schools and medical facilities, and helping high streets and town centres thrive across the capital by helping them adapt and include a mix of retail, leisure and workspaces.

The plan requests that the boroughs prepare green infrastructure strategies that identify opportunities for cross-borough collaboration. If a green infrastructure approach is to be successful, green and blue spaces, street trees, green roofs and natural or semi drainage features must be planned, designed and managed. Urban land fulfilling the correct criteria will be given the same status and protection as the green belt.

Boroughs should also develop an Urban Greening Factor (UGF) to ensure green cover is integral to planning

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Urban space

- The city's urban forest contains an estimated 8.4 million trees and covers around 21 per cent of the city's land area
- London's population is projected to increase by 70,000 every year, reaching 10.8 million in 2041
- The London Plan aims to achieve a longer-term target of creating 50 per cent affordable homes in new developments

and the design of new buildings and developments from the start. This chimes with London's overall approach to increasing its green cover, which was already high on the agenda before the introduction of the London Plan.

The city's urban forest contains an estimated 8.4 million trees and covers around 21 per cent of its land area. The mayor has a target to increase this by 10 per cent of current levels by 2050. Two new accessible woodlands are being created in London's green belt, spanning 83 hectares. The borough of Enfield is working in partnership with Thames 21 to restore the formerly wooded Enfield Chase area, while the Woodland Trust has secured new land to extend Hainault Forest. London has long been famous for its green spaces and in 2019 earned the accolade of being named the world's first National Park City.

The coronavirus has placed a new emphasis on outdoor spaces in cities around the world. In a relatively short time, programmes such as Streetspace for London and Healthy Streets for London have achieved a great deal when it comes to putting human health, wellbeing and experience centre stage. And the London Plan gives the UK capital every chance to embed some of these core principles into the city's development and daily life for all time.

Skills & ecosystem

London's smart city efforts have long benefited from being able to tap into a broad tech and skills ecosystem spanning universities, research institutions, living laboratories, testbeds, as well as private and public sector organisations.

The financial crash in 2008 is credited with spawning a vibrant start-up community, which grew out of the area of London referred to as Silicon Roundabout, otherwise known as The Old Street Roundabout in the east of the city. The government backed entrepreneur network Tech Nation reports that this original cluster has grown into a nationwide grid of more than 35,000 businesses.

London has continued to build strength and depth in the tech sector and Tech Nation says the strong foundations will help the industry emerge strongly from the financial crisis sparked by the Covid-19 pandemic. In 2019, London was a key driver of digital tech jobs and growth, accounting for 53 per cent of advertised roles, and it also offered the highest salaries.

The tech sector's strong foundations will help it emerge strongly from the coronavirus pandemic

UK government figures show that the UK's capital continues to lead the way as a global tech leader. London-based tech companies had already raised £3.2bn between January and June 2020, which it claims is more than Paris, Stockholm, Berlin and Tel Aviv combined (although most deals would have been done before the Covid-19 health crisis). It also shows that London leads Europe in the Fintech unicorn race. Fintech dominates fundraising in the capital accounting for almost 40 per cent of it.

Alongside start-ups, more than a third of all Europe's tech giants are based in London. It all adds up to a powerful digital and tech ecosystem but one that needs to be supported with the right skills and talent.

The mayor's office has always been committed to the sector, launching the £7m Digital Talent programme in 2017. More recently, digital, alongside the creative and environment industries, is set to benefit from more investment in training and jobs via Covid-19 recovery programmes and the Adult Education Budget. As part of the Green New Deal Fund, the mayor has also pledged investment in green skills and a £1m Resilience Fund will support innovative businesses in tech and other sectors to help drive forward the recovery.

Like all cities, London will need to draw on all of its strengths and talents to recover from the economic effects of Covid-19. Analysis published by the mayor at the end of 2020 showed that the pandemic could result in the largest fall in employment in more than 20 years with a possible loss of a further 350,000 jobs in 2021. Where there is tech there is hope though.

Skills & ecosystem

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Demographics

London is the most populated city in the UK. Its population sits at just under nine million but is projected to increase by 70,000 every year, reaching 10.8 million in 2041. It has a younger population than the rest of the UK with a median age of 35.6 years compared to just over 40.

According to the charitable organisation Trust for London, more than half of the population of the inner environs of the city are in their early 20s to early 40s. It is home to a higher proportion of young people than the outskirts of the city. This is due in part to people moving to London to work early in their careers but leaving to have a family or as they get older. Conversely, only 9.5 per cent of London's population is over 65 although in inner London this rises to 13.9 per cent.

The UK's most recent official demographic figures date back to 2011 (an update to its census is taking place in 2021). The figures reveal that around 37 per cent of London's population is based on immigrants from around the globe. Over the decades this has made London one of the most culturally diverse and multi-racial cities in the world. While English is the first language of nearly 80 per cent of the city's population, more than 300 languages are spoken, including Polish (1.5 per cent) and Bengali (1.3 per cent).

Almost 45 per cent of London's population is white-British and 14.9 per cent white from other parts of the globe. Asians account for 18.5 per cent of Londoners, while 13.3 per cent are black and five per cent mixed-race.

Government figures state that 44.5 per cent of Londoners are Christian, 14.2 per cent are Muslim and 29.4 per cent has no religion. The main other religions are Hinduism, Judaism, Sikhism and Buddhism.

While home to the highest concentration of dollar millionaires in the world, there is great disparity when it comes to income and wealth. London's Poverty Profile, put together by Trust for London, shows that 28 per cent of Londoners live in poverty after housing costs. Around 56,000 of London households are in temporary accommodation, which is an increase of 30 per cent on five years ago. More than three-quarters of those children classed as living in poverty are from working families, which is an increase of eight per cent from five years ago.

The disparity and inequality that exists in the UK capital has always been visible but it was brought sharply into focus in the coronavirus pandemic with London's BAME and poorest communities disproportionately affected. Analysis from Trust for London's partner, WPI Economics, found that even after accounting for a range of other relevant neighbourhood characteristics, the most deprived 20 per cent of neighbourhoods in London have seen, on average, 23 more Covid-19 deaths per 100,000 than the least deprived 20 per cent of neighbourhoods.

Like many cities, London has pledged to build back better and more justly and the mayor has put together a nine-mission Covid-19 recovery plan. Among its aims are achieving digital access for all, putting in place a safety net to support those to avoid or be lifted out of poverty and building stronger communities.

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Conclusion

London can be held up as a smart city role model for several reasons but perhaps most notable is its ability to listen, adapt, evolve, and crucially, collaborate. Beginning with the London Data Store open data platform as a bedrock back in 2010, it has put down strong foundations on which to build. Viewing data as an infrastructure issue has helped the city to implement strategies that succeed in cutting across silos, bringing a truly joined-up approach to creating a smart city. Many cities have pledged to build back better after the Covid-19 pandemic but, while the challenges are complex, London's smart base gives it every chance of realising its aims sooner rather than later.

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AVEVA

How AVEVA is driving liveability and sustainability in Bremen and Barcelona

AVEVA technology is helping city leaders make better decisions and improve the lives of citizens by collecting and analysing vast amounts of data.

As the world's population grows and the focus on sustainability increases, many civic authorities are looking to smart city operations to drive efficiency and improve liveability for their citizens. In technology terms, cities are considered "smart" when they integrate their information and communication technology (ICT) using IIOT sensors, combined with devices to gather, visualise and analyse that data into unified dashboards that identify trends and enable civic authorities to make changes that improve asset and resource management, efficiency of service delivery, and communications with citizens. This is no easy task and thus smart city technology is constantly evolving, pushing the boundaries of what citizens can expect and what civic operations can achieve.

AVEVA's vast portfolio of smart city software solutions spans applications including facilities management, utilities, telecommunication, transportation, health, and e-governance. Taking an integrated approach, AVEVA's solutions enables these disparate functions to collect, analyse, and then act on unified and holistic intelligence supported by the help of real-time data to enable civic leaders to make better decisions and improve living standards.

Many European cities have become "smart" using AVEVA's software and solutions. Two salient examples are the city of Bremen and the city of Barcelona.

City of Bremen

When the City of Bremen needed to modernise heating systems across several of its buildings, it analysed the project and realised an opportunity to do more. Besides improving energy efficiency, there was the potential to implement a new building management system (BMS) that would bring greater control and provide far-reaching sustainability benefits for the city's extensive portfolio of properties.

By using AVEVA's software portfolio, the city leaders unified operations for over 160 properties into a single BMS, bringing together data from five disparate districts. As a result of the AVEVA implementation, the city of Bremen reduced energy consumption by up to 18 per cent with a cost saving of $43,000 annually.

Further cost savings have been realised because most modifications and extensions are implemented by internal staff rather than outside suppliers, thanks to the AVEVA software's ease of use, standardised tags and repeatability. Moreover, with the AVEVA solutions in place across the entire City of Bremen system, engineers can share information

Smart cities use AVEVA software to manage their digital infrastructure and data to enhance liveability for their residents, workability for their businesses and sustainability for the environment.

and know-how, saving financial and technical resources. The shared user interface with its simple-to-understand visualisation of the BMS makes training more efficient and has increased user acceptance of the solution.

City of Barcelona

Barcelona is home to more than 1.6 million people and boasts a thriving tourism market of more than eight million visitors annually. Needless to say, the city infrastructure must efficiently manage everyday services such as water, landscape, elevators, escalators, and wastewater.

The more effectively the team can manage services, the greater the contribution to the health and well-being of all who use them. To address the critical infrastructure challenges faced by the City of Barcelona and its complex network of public works, the team chose AVEVA's software to drive efficiency throughout all municipal services.

Park Citadel in Barcelona

> "The remote monitoring of infrastructure processes created using AVEVA software is key to our success. The integrated software solutions enable our team to ensure energy use and supply of water is optimised to coincide with public demand. In addition, it manages the delivery of the right amount of water for irrigation based on current weather conditions and the needs of the plant."
> Cristina Vila Rutllant, General Manager, Barcelona de l'Aigua S.A., Barcelona City Council

Barcelona de l'Aigua S.A. is a municipal company that manages the water usage for the city. This includes operating, maintaining and planning the sewage network, ground water, city fountains, coastal waters, and drinking water. The company manages the water usage of different municipal services, as well as the distribution of water to homes.

AVEVA's software operates like a central nervous system for the water system, receiving and transmitting information by means of a strategically distributed network of sensors located throughout the city. This system monitors the smart water operations and ensures efficient resource management. For example, water consumption is optimised and controlled via a communications infrastructure that integrates the existing irrigation network, a customized SCADA system and actionable Human Machine Interface software provided by AVEVA.

Other smart cities use AVEVA software to manage their digital infrastructure and data to enhance livability for their residents, workability for their businesses and sustainability for the environment. For example, Anglia Water, a municipality serving much of the east of England, uses AVEVA's software to not only manage the network but also to cut leakage and reduce water losses in an area that is increasingly prone to droughts and severe weather.

AVEVA: a trusted partner for smart cities

As a lead partner of the Smart Cities Council and a corporate member of the New Cities Foundation, AVEVA provides world-class industrial software designed to unify people, information, and processes to enable cities to effectively manage their amenities and operations. Because AVEVA solutions are hardware and software agnostic they can integrate with all major tools, technology providers and incumbent players - there is no need to rip and replace. AVEVA's flexible architecture and business model ensures that you can "click in" its solutions at any point of the smart city operations, driving digital transformation and achieving ROI within weeks.

Working in partnership with AVEVA, many European cities from Barcelona and Bremen to London and Geneva are making smart living a reality, with leading-edge infrastructure and processes that enable teams to respond faster, optimise services, balance resources, and manage costs. With the acceleration of digital-first amenities in 2020 as a result of the pandemic, Europe's smart cities are leading the way for the rest of the world to follow.