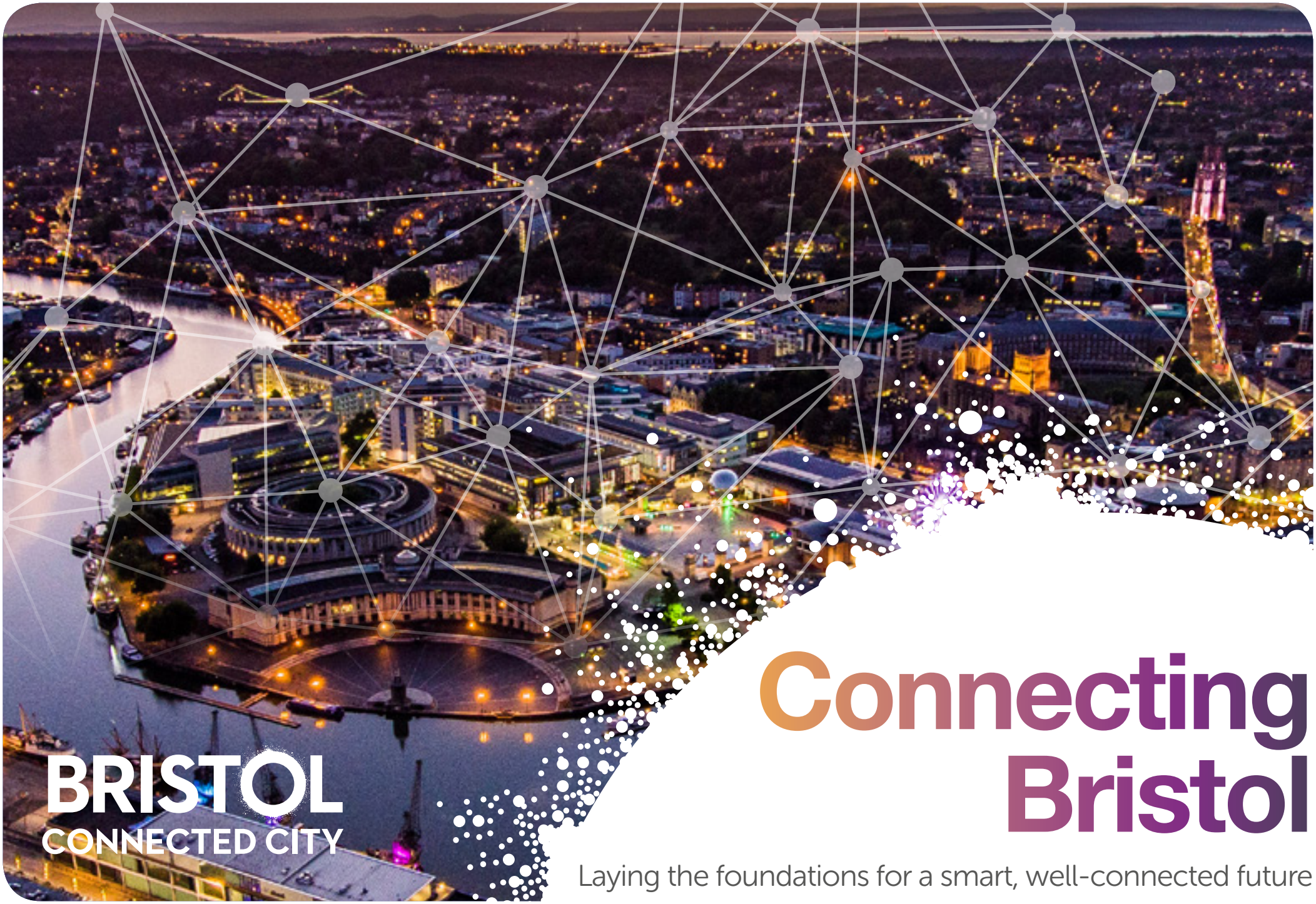
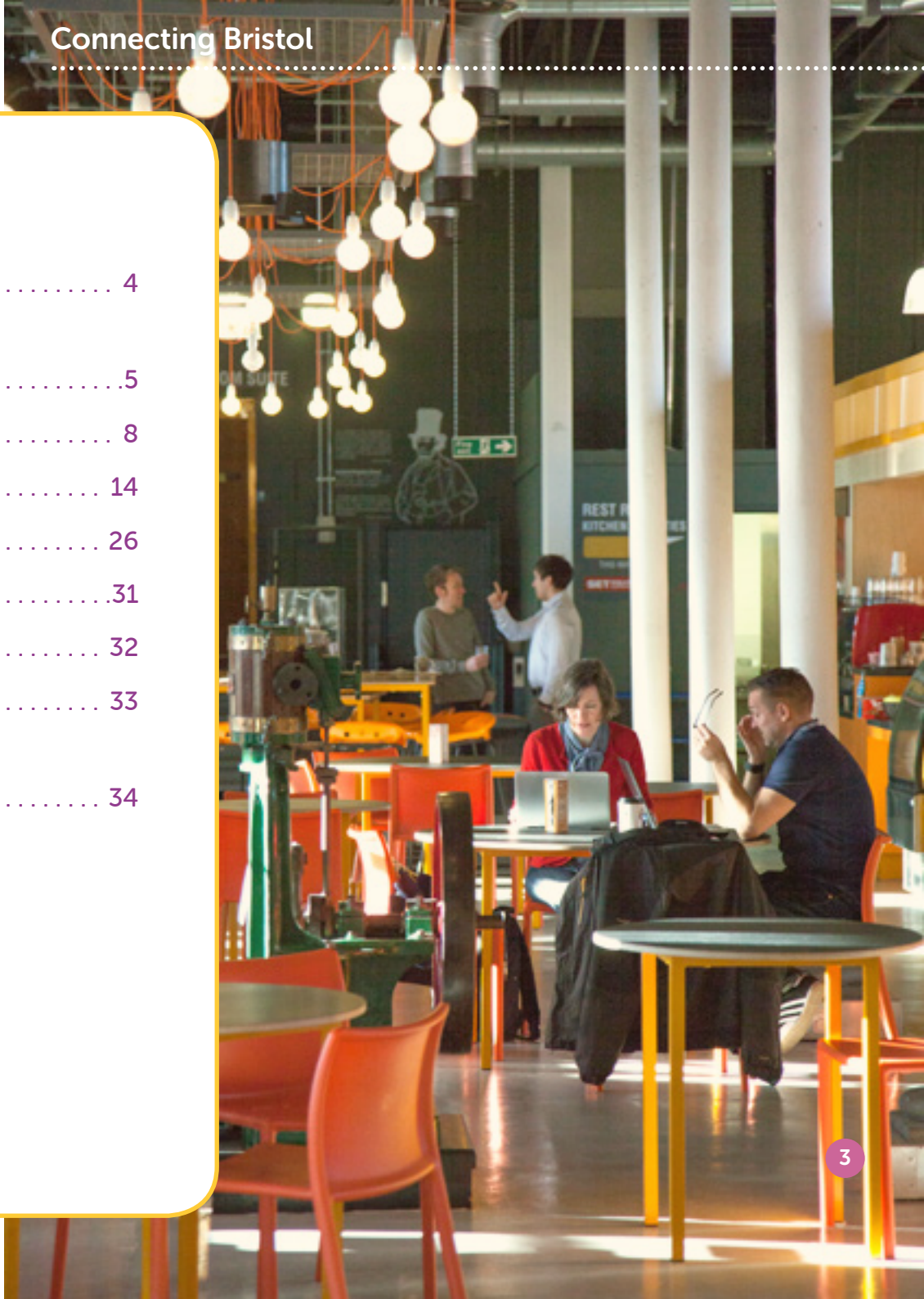


Connecting Bristol

Laying the foundations for a smart, well-connected future

Contents



Foreword

Our vision for Bristol is one of hope, aspiration and inclusion. To achieve this we must ensure the prosperity of the city is accessible to everyone. Bristol's first smart city strategy, Connecting Bristol, sets out our ambitions to deliver the digital foundations the city needs to realise this vision. This strategy represents the next phase of our innovation journey to support Bristol to develop world-class infrastructure so that the whole city is digitally enabled and well-connected. It will shape Bristol's transformation into a fair and inclusive city where everyone can benefit from, participate in and contribute to the social and economic benefits of digital technology and build on Bristol's history of innovation.

Emerging global challenges and competition for inward investment means we must work together with partners across the city and beyond. Our smart city strategy aligns to the One City Plan and will drive innovations that put people first, improve the quality of life for all Bristolians and deliver into the future. The pace of digitisation is swift and the implications far reaching. As Bristol embraces new digital and smart city technologies we must be aware of how these technologies shape the future of our city, our interactions and our opportunities. When focused on facilitating positive experiences that are city-led, applied technology can produce better social outcomes and inclusive growth. As long as people are at the heart of the solution, digital technology has the potential to address intractable challenges within the city. Our approach is for smart cities to be ethical, inclusive, transparent, and driven by responsible innovation.

Through collaborative leadership and action, Bristol has gained a reputation as a leading smart city. In 2018 we won the Smart City Award at the Global Mobile Awards and pole-position on Huawei's UK Smart City Index. We are proud of these achievements but our challenge is to make sure this potential is shared, accessible and unleashes the talent and innovation of the whole city.

I invite you to join us in delivering and further developing this strategy.

Marvin Rees, Mayor of Bristol

1 Introduction

Connecting Bristol is Bristol City Council's smart city strategy; it outlines our ambitions for the next five years and how we will support the delivery of Bristol's One City Plan[1]. The One City Plan is an ambitious vision for the future of Bristol, decade by decade up to 2050. It is built on six interdependent stories: Connectivity, Health and Wellbeing, Homes and Communities, Economy, Environment, and Learning and Skills. Our smart city strategy is aligned to these six areas.

Our shared **One City** vision is that:

In 2050 Bristol is a fair, healthy and sustainable city. A city of hope and aspiration; where everyone can share in its success. Bristol is digitally enabled and well-connected with world-class infrastructure and inclusive services for the prosperity of the city and its citizens. This supports access to employment, education and services for all.

Global goals for sustainable development

The Sustainable Development Goals (SDGs) are an initiative of the United Nations; a blueprint to achieve a better and more sustainable future for all. They address the key global challenges we face related to poverty, inequality, environment, prosperity, and peace and justice. The SDGs are interconnected and signatories have agreed the aspiration to achieve each Goal by 2030.

Cities are proving to be the laboratories for SDG innovation and are increasingly seen as fundamental in achieving the SDGs, translating global aspirations into local action[2]. Bristol, as a city, is a signatory of the SDGs.

The Bristol SDG Alliance has undertaken the UK's first Voluntary Local Review of SDG progress. The review has assessed progress against all 17 SDGs and includes data on over 140 indicators, and reflects a whole city approach to tackling the SDGs[3].

1: The Bristol One City Plan. See www.bristolonecity.com/one-city-plan/
2: Cities: the labs for Sustainable Development Goal innovation, Brookings, 18 Jun 2019, www.brookings.edu/blog/future-development/2019/06/18/cities-the-labs-for-sustainable-development-goal-innovation/
3: Bristol and the UN Sustainable Development Goals. See www.bristolonecity.com/sdgs/

1.1 Purpose of this smart city strategy

This strategy sets out how Bristol City Council will support Bristol's smart city journey. We aim to strengthen the city's digital foundations so that it becomes well-connected and better placed to deliver the technological innovation needed to keep the city moving, healthy and safe, in a sustainable way. Everything we do will be focused on ensuring Bristol achieves its exceptional potential.

In this document, our strategic framework sets out our top-level priorities for the next five years. This includes our guiding principles about how we will work collaboratively with partners to co-design solutions where possible, with a focus on social value. The strategy will be underpinned by a portfolio of initiatives that will deliver challenge-led innovation and build our digital foundations.

This document is a starting point from which we will develop our ambitions. This is the first iteration of a strategy which will grow and develop with partners and collaborators across the city with a view to it becoming city owned.

Our vision for a well-connected Bristol

It is 2025. Bristol is the UK's most digitally connected city. Our reputation as an internationally renowned smart city has brought inward investment. This has enabled businesses and talented people to prosper in Bristol, creating benefits and opportunities across the city and the region.

Communities of innovators and entrepreneurs come together, using world-class digital infrastructure and services to co-create new ideas, trial solutions and drive city-led initiatives. Our collaborative and technological strengths enable good ideas to achieve scale and deliver tangible impacts. Technology, data and innovation are tools to proactively pre-empt and tackle complex city challenges, enabling us to increase resilience and adaptability, and improve the city for everyone.

We are proud of our achievements, but we recognise that we must keep pace and continually build on our strengths to retain our position as the UK's smartest city and shape our future.

1.2 What do we mean by 'smart city'?

The term 'smart city' or 'smart' has come to be associated with the application of data and technology to increase efficiency, minimise costs and enhance convenience. The difficulty is that this perspective over-emphasises the role of technology. We risk framing complex city challenges as technology problems which can only be solved through the successful implementation of technological solutions[4]. We want to shift our thinking. Bristol is not a machine which can be optimised by smart technology; our city is a messy, emergent, social place in which people congregate to live, work and connect with each other. It is people that make our city smart.

Our view is that a smart city is a liveable, sustainable and prosperous city. It is attractive to both people and businesses because of the high quality of life, easy access to jobs, amenities and services, and vibrant culture. Our approach is shifting to using civic and social innovation in combination with technology to enhance, not degrade the messy, human magic of Bristol.

To be 'smart' we need to embrace this and focus on blending hard and soft infrastructure with a human-centred approach to:

- Make Bristol more liveable, workable and sustainable
- Manage the city and civic resources as effectively and intelligently as possible
- Deliver world-class citizen-centric city services
- Underpin a continuous process of reinvention, transformation and creativity, and
- Support economic development and long-term prosperity.

Future population growth across the region, accompanied by other major trends – such as the changing nature and location of work, ageing, rapid technological transformation and climate change – will have significant impacts on the structure and operation of Bristol. Becoming a smarter city now, with an ethos of partnership across public, private and political spheres, coupled with co-design and experimentation, will enable us to deliver on our commitments, achieve more with the resources available to us and improve Bristol's long-term resilience.

4: How smart should a city be? Apolitical, 19 June 2019, https://apolitical.co/solution_article/how-smart-should-a-city-be/
5: Bristol Legible City. See https://www.bristollegiblecity.info/
6: Legible Cities: The humanistic smart city model, Smart Cities World, 1 May 2019, www.smartcitiesworld.net/smart-cities-news/smart-cities-news/legible-cities-the-humanistic-smart-city-model-4125

case study

Bristol Legible City

Bristol Legible City[5] is a unique concept to improve people's understanding and experience of the city through the implementation of identity, information and transportation projects. These projects include direction signs, on-street information panels with city and area maps, printed walking maps, visitor information and arts projects.

These projects communicate the city consistently and effectively to visitors and residents alike. The focus is primarily on place-making and wayfinding. People's understanding and experience of the city can be enhanced significantly with a virtual layer of information, technology and sensors[6].

2 The Bristol context

Bristol is one of the ten biggest cities in the UK with 459,300 residents. The wider city region has over one million. It is estimated that Bristol's city population will exceed 500,000 as early as 2027. From its roots as a port and a trading city, Bristol has evolved into a city known for its edgy, unconventional and pioneering culture.

Bristol is one of the UK's success stories. Bristol is fast growing, productive and predicted to outpace London's gross value added growth rate over the next three years[7]. A strong heritage of aerospace and advanced engineering, combined with new, fast expanding industries like IT, creative and media, and high tech and digital is fuelling economic growth across the region. Bristol is one of the largest creative and digital media hubs in the UK[8]. Our creative sector has strong digital links and creative tech is a particular strength for Bristol. These sectors are underpinned by well-developed professional and financial services and a dynamic academic research and development base.

Some of Bristol's successes

As the capital of the West of England, Bristol has a long history of productive innovation and an independent spirit with community at its heart. For us, smart cities are about people, not technology.

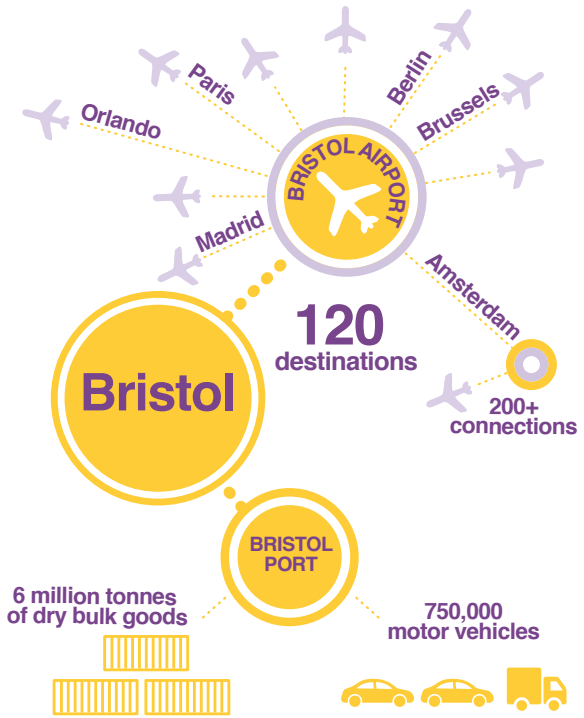
As the winner of Huawei's UK Smart City Index 2017, Bristol is leading the way with a list of accolades including Smart City Award (Judges' Choice) at the GSMA's 2018 Global Mobile Awards, Best Smart City Project at the 2018 Smarter Travel Awards[9] and a Smart Cities UK Award 2019 for community engagement in the REPLICATE Smart Homes[10] project.

Our smart city accolades compliment other strengths: we won European Green Capital in 2015[11], European City of Sport in 2017[12] and UNESCO's Learning City Award in 2018[13]. We are also a UNESCO City of Film[14], a member of the Rockefeller 100 Resilient Cities network and an iCapital Finalist in 2018 and 2019.

7: Bristol forecasted to be one of the UK's fastest growing cities until 2020, Business Leader, 12 Dec 2017, www.businessleader.co.uk/bristol-forecasted-one-uks-fastest-growing-cities-2020/38089/
8: Bristol and Bath: A long friendship with the USA leaflet, June 2019
9: Best Smart City Award goes to Bristol City Council, Intelligent Transport, 7 Nov 2018, www.intelligenttransport.com/transport-news/73238/best-smart-city-award-bristol-council/
10: Bristol project honoured at national innovation awards, 13 Feb 2019, https://news.bristol.gov.uk/news/bristol-project-honoured-at-national-innovation-awards
11: 2015 – Bristol, European Green Capital. See http://ec.europa.eu/environment/europeangreencapital/winning-cities/2015-bristol/
12: Bristol announced as European City of Sport for 2017, 10 Mar 2016, www.bristol-sport.co.uk/news/bristol-announced-as-european-city-of-sport-for-2017/
13: Learning cities in the UK: Bristol joins the UNESCO Global Network of Learning Cities, 2 Mar 2016, http://uil.unesco.org/lifelong-learning/learning-cities/learning-cities-uk-bristol-joins-unesco-global-network-learning. Bristol is the first city in England to become part of the UNESCO Global Network of Learning Cities, a worldwide network that champions learning as a way to transform lives, communities, organisations and cities. See www.bristollearningcity.com
14: Bristol UNESCO City of Film – a permanent status that celebrates Bristol's achievements as a leading city in the field of film and moving image. See http://filmbristol.co.uk/bristol-city-of-film/

Seen as one of the best places to live in the UK, Bristol's population is increasingly younger[15] and more diverse[16]. The strong economy and quality of life attracts and retains talented people, with many graduates choosing to stay after university. This rich talent pool makes Bristol and the West of England region an attractive location for the creative sector, high-tech businesses and entrepreneurs.

Bristol is geographically well-connected to the UK, Europe and the rest of the world. The port and airport provide important links for business to international partners. The Port of Bristol is the UK's most centrally located deep-sea port, 67% of port trade is with non-EU countries, and it contributes more than £1 billion to UK Gross Domestic Product (GDP)[17]. Bristol Airport is the UK's ninth largest airport[8], the fifth largest outside London and serves hundreds of destinations, with plans to rapidly grow to 12 million passengers per year[18]. The city is benefiting from £2.7 billion in infrastructure investment, especially transport, energy, housing and business[1].



2.1 Fast growing and entrepreneurial

Bristol is ranked in the top 10 European cities for technology[19]. The city is an integral part of the Bristol and Bath Innovation Cluster[20], cited as being one of the most productive and exciting innovation clusters within the UK[21] with 36,000 people currently employed in the digital tech cluster with a turnover of $10.2 billion[22].

Our economy is driven by a wide range of industries. This diverse activity, coupled with the geographical size of the region, encourages a level of cross-sector collaboration that is unique. The relationships between traditional industries and our creative, digital and tech industries means that the West of England is driving innovation across the UK and around the world[23].

Bristol's burgeoning technology start-up scene has secured more venture capital than any other city in the UK in 2019[24]. These progressive and transformative start-ups will directly contribute to the region's ambitions to deliver sustainable, inclusive growth and create high-quality, well-paid jobs[25]. Further investment into the region, with a skilled and talented population, is also positioning Bristol as a hub of scale-up businesses.

15: The average age of people in Bristol has fallen faster since 2010 than almost anywhere else in Britain, Bristol Post, 28 Jun 2017, www.bristolpost.co.uk/news/bristol-news/bristols-average-age-drops-faster-142520
16: There are now at least 45 religions, 187 countries of birth represented and 91 main languages spoken. See www.bristol.gov.uk/policies-plans-strategies/bristol-global-city
17: The Bristol Port Company. See www.bristolport.co.uk/about-us/bristol-port-company-today
18: Bristol Airport, planning for the future. See www.bristolairport.co.uk/about-us/who-we-are/our-future
19: Tech 'super-cluster' report names Bristol as sixth biggest in Europe, Bristol Business News, 7 Sep 2018, www.bristol-business.net/tech-super-cluster-report-ranks-bristol-at-sixth-biggest-in-europe/
20: Creative Industries Clusters Programme launched, Arts and Humanities Research Council, 22 Sep 2017, https://ahrc.ukri.org/newsevents/news/cicp-launch-greg-clark/
21: Bristol-Bath Innovation Cluster, SQW Report, 7 Nov 2018, www.sqw.co.uk/insights-and-publications/bristol-bath-innovation-cluster/.
22: Tech Nation Report 2018. See https://technation.io/insights/report-2018/bristol/
23: West of England Local Industrial Strategy. See www.westofengland-ca.gov.uk/ourstrategy/
24: Venture Pulse Q1 2019: Global analysis of venture funding, KMPG, 11 Apr 2019, https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/04/venture-pulse-q1-2019.pdf
25: West of England Local Industrial Strategy: Summary of evidence, Feb 2019, www.westofengland-ca.gov.uk/wp-content/uploads/2019/02/1-WofE-LIS-Summary-of-evidence-2.pdf

Being smart and sustainable in response to global and future challenges

Some of the challenges that affect Bristol are global in nature, such as the need to respond to climate change and city growth in a sustainable way. In November 2018, the council unanimously set an ambition for the city as a whole to be carbon neutral by 2030. This ambitious pledge and a commitment to the United Nations Sustainable Development Goals are written into the 2050 One City Plan.

Looking to the future, the so called Fourth Industrial Revolution will create both challenges and opportunities for the city as trends like automation, the internet of things (IoT), artificial intelligence (AI) and disruptive business models influence the city. These forces will change how we work, live, play and move around the city and address energy use challenges in the future. A smart city is one that is able to explore these future scenarios and use those insights to plot a course that allows the city to remain resilient and successful across a range of possible outcomes.

Developing a low-carbon and sustainable city will enhance Bristol's ability to remain competitive in the global economy and be more resilient. Smart technologies have an important role to play in reducing carbon emissions and are becoming more commonplace. For instance, smart systems can return excess energy to the grid and supply it at the most efficient time helping to minimise overall peak demand emissions. City data is increasingly being used to provide people with accurate and timely information for bus, rail and car travel through smart apps and at pre-boarding locations which can help make sustainable modes of travel more attractive.

case study

Playable City

Smart cities are not just about big corporations and infrastructure organisations. Bristol's distinctive approach to digital innovation places people at the centre and takes an engaging approach to tackling serious urban challenges.

The Watershed's Pervasive Media Studio hosted a five-day Playable City sprint that brought together creatives from East Asia and the UK. Participants worked together to experiment and prototype new ideas for Bristol that used creative technologies to playfully rethink public space. Since then Playable City has gone international "putting people and play at the heart of future cities around the world"[26].

Hello Lamppost, funded by a Playable City Award in 2013, was a project designed to bring the city to life by inviting people to communicate with street furniture like lamp posts, post boxes and bus stops. This simple and inclusive approach to digital technology shows how it is possible to shape people's collective experience of a place.

26: Playable City. See: www.playablecity.com

2.2 A tale of two cities

This picture of prosperity is not true for everyone. There are stark disparities in social equality across Bristol with areas within central, south and north-west Bristol ranked among the country's most deprived[27]. These areas experience multiple indicators of deprivation[28]: poor health, low levels of employment, low income, high benefits dependency, poor education and poor access to services. Between affluent and disadvantaged areas of the city, life expectancy can differ by as much as 12 years[29]. These place-based differences are persistent and exacerbated by a backdrop of public sector budget constraints.

Other challenges include:

- A lack of affordable homes – the cost of the cheapest Bristol home is over eight times the annual earnings of the poorest households[30]
- High numbers of people who are sleeping rough or homeless[31]
- One of the most traffic congested cities in the UK with ~300 deaths annually attributed to air pollution[32].

With these marked disparities, Bristol has been described as a city of villages, with some communities becoming isolated and left behind as other areas thrive around them.

Bristol has formed the City Office, bringing together key city institutions including local health trusts and universities, to tackle these challenges and develop a long term plan for the city. The 2050 One City Plan gives clarity on where the city wants to go and how together, we can tackle some of our city challenges.

27: Deprivation in Bristol, Bristol City Council, Nov 2015, www.bristol.gov.uk/documents/20182/32951/Deprivation+in+Bristol+2015/429b2004-eeff-44c5-8044-9e7dcd002faf.
28: Deprivation: what is the Index of Multiple Deprivation 2015?, Bristol City Council, www.bristol.gov.uk/statistics-census-information/deprivation
29: You could die 10 years younger depending on which part of Bristol you live in, Bristol Post, 15 Feb 2018, www.bristolpost.co.uk/news/you-could-die-10-years-1219073
30: Bristol Housing Market in 2017, Bristol City Council, www.bristol.gov.uk/documents/20182/361915/Bristol+Housing+Market+in+2017/f949f541-5129-4103-a40e-f7625142b3ac
31: Rough sleeping and overcrowding figures prompt calls for action, The Guardian, 31 Jan 2019, www.theguardian.com/society/2019/jan/31/rough-sleeping-rises-in-nearly-all-englands-major-cities-london-birmingham. See also https://bristol.citizenspace.com/housing-landlord-services/homelessness-and-rough-sleeping-strategy-2019-24/supporting_documents/Draft%20Homelessness%20Review.pdf

case study

Supporting the One City priority of period dignity through open data and hackathons

Significant change can happen when people come together to address real world needs and develop solutions that help improve our city. Through Bristol's Open Data Platform[33] local people, innovators and organisations can access, use and benefit from over 180 data sets ranging from air quality and quality of life data, through to electric vehicle charging points and energy consumption. Much of the data available is collected by Bristol City Council.

The Bristol One City Plan named period dignity as a priority for 2019, and Bristol hosted the UK's first period poverty summit[34] to see how the city could attempt to eradicate the problem. Open data is being collected to support the period dignity initiative.

The City Innovation Team host frequent hackathon events and data jams that bring together the collective know-how of innovators and citizen data scientists across Bristol to develop potential solutions to challenges we all face. Building on previous success of hosting hackathons and pitching mini projects, a new app hopes to help raise awareness of where sanitary products are available to donate and collect around the city.

32: Air Quality Annual Status Report (ASR), Bristol City Council, Sep 2017, www.bristol.gov.uk/documents/20182/32675/Air+Quality+Annual+Status+Report+ASR+Report+2017.pdf/9c167d10-1fef-bf3b-15eb-fa07d9e13f9d
33: Bristol Open Data Platform. See https://opendata.bristol.gov.uk/pages/homepage/
34: Bristol holds the UK's first period poverty summit, The Big Issue, 23 Jan 2019, https://www.bigissue.com/latest/health/bristol-held-the-uks-first-period-poverty-summit/. Period poverty refers to a lack of access to and affordability of menstrual products.

2.3 Bristol's digital divide

Bristol is a divided city. On one side of Bristol 80% of young people go to university, but an eight-minute drive away is an area where less than 5% get a single A-level. The elderly are similarly divided. In the last 10 years, the number of people in Bristol over the age of 85 has increased by 50%. Many of them live isolated lives in underprivileged areas disconnected from their community. These students and elderly people have something else in common: they both tend to live in places that lack high-speed internet access[35]. Currently Bristol is not as digitally well-connected for all citizens as it has the potential to be.

This digital divide – a term that reflects the disparity between communities with and without adequate access to technology and the internet – is holding Bristol back, socially and economically. This smart city strategy focuses on how technology, data and innovation can play a role in making Bristol a better place for everyone. Our priority is to ensure that our digital infrastructure is fit-for-purpose and accessible by everyone, wherever they live, learn, play or work in the city. Often those who stand to benefit most from smart technologies are those currently furthest away from utilising them.

As a local authority we have an important custodial role to play in accelerating the deployment of full fibre and mobile networks. In line with UK policy, we want Bristol to have world-class digital connectivity that is gigabit-capable, reliable, long-lasting and widely available across the city[36]. This vital foundation will benefit both citizens and businesses, enabling our region's inclusive growth prospects, increasing digital inclusion and delivering a wide range of societal benefits. This is a priority reflected in the region's Local Industrial Strategy (LIS) which sees digital infrastructure as the cornerstone of a modern, inclusive regional economy[23].

Economic benefits of better online connectivity

- National Infrastructure Commission sponsored research estimates that the net benefits from investing in 100% full fibre coverage could be up to £28bn (in present value terms) by 2050[37].
- Full fibre is expected to unlock considerable economic value from wider technological developments. In the manufacturing sector alone potential economic benefits are in the order of ~£16bn: £1.1bn (future healthcare applications), £5bn (smart city infrastructure), and £10bn (Internet of Things)[38].
- An Ofcom study found that broadband investment brought significant benefits to the UK economy and that increased connectivity stimulated economic growth and productivity[39].
- A City Fibre commissioned report indicates that the impact of full fibre roll-out in Bristol would be a £49m direct gain from the initial transition and additional benefits of £745m (5G), £245m (Internet of Things) and £138m (smart cities) in industry sectors that are dependent on full fibre, but would also need their own investment[38].
- Next generation wireless (5G) is predicted to deliver over £6bn worth of savings[40] to UK cities.

35: Bristol Is Open CEO reveals what makes Bristol the UK's top smart city, Computer World, 15 Jan 2019, www.computerworlduk.com/infrastructure/bristol-is-open-md-explains-what-makes-bristol-uks-top-smart-city-3690284/
36: Future Telecoms Infrastructure Review, The Department for Digital, Culture, Media and Sport, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf
37: Building a digital society. National Infrastructure Commission, www.nic.org.uk/assessment/national-infrastructure-assessment/building-a-digital-society/
38: The Economic Impact of Full Fibre Infrastructure in 100 UK Towns and Cities, Regeneris, Mar 2018, www.cityfibre.com/wp-content/uploads/2018/03/The-Economic-Impact-of-Full-Fibre-Infrastructure-in-100-UK-Towns-and-Cities-12.03.18.pdf
39: The economic impact of broadband, Ofcom, 27 Apr 2018, www.ofcom.org.uk/research-and-data/telecoms-research/broadband-research/economic-impact-broadband
40: Upgrade UK cities now or miss out on productivity savings of £6 billion a year from 5G, O2 / Telefonica, 14 Mar 2018, https://news.o2.co.uk/press-release/upgrade-uk-cities-now-miss-productivity-savings-6-billion-year-5g-o2/

2.4 A regional perspective

A lot of the issues and opportunities that smart technologies could address do not adhere to local authority boundaries. Bristol is a porous city whereby people continuously flow across city boundaries. People who frequently work in Bristol do not necessarily live in the city, residents travel beyond the city boundaries for work and leisure, and others visit sporadically.

Our success as a city will also come from our ability to build links with, and support, communities outside of our immediate borders. From traffic congestion to air pollution, energy security to flooding, we need to think beyond the city boundaries, and develop solutions regionally, and nationally, if we want to collectively realise the full potential of digital innovation.

We will actively seek to influence this for the better, by engaging with the West of England Combined Authority (WECA) and regional partners to create a Smart Alliance that positions Bristol and our regional neighbours as a location of choice for inward investment. We will work with local and regional partners to improve the current mechanisms that enable regional and national collaboration on smart cities and digital innovation.

3 Building our digital foundations

We want Bristol to be a smart city trailblazer. This strategy is intended to be a flexible five year plan to develop the foundations for a well-connected future. It has been aligned with the council's Corporate Strategy, the long-term ambitions set out in the One City Plan and the priorities of our regional partners in the West of England Combined Authority (WECA). These plans give focus about the commitments we have made and the benefits we need to deliver.

The first three foundations are about transforming the city using technology, data and social innovation to address city priorities, rolling out digital infrastructure across Bristol and stimulating city-wide digital innovation. The remaining areas are council-focused with a view to transforming how we innovate, deliver public services and manage the city.

3.1 Focus on city challenges

Our ambitious One City Plan, and council and regional strategies, present various opportunities to harness new ideas, tools, technologies and novel approaches to achieve the desired outcomes. Complex city challenges – such as public safety, the needs of older people and effective health and social care – will require collective talent, clever technologies and a committed focus to address the real problems that affect Bristol.

In Bristol, we will lay our digital foundations across six crucial areas:

The role of the City Innovation Team is to help facilitate the innovation process, working with council stakeholders, the City Office and other key partners across the city to collaboratively design, develop and deploy solutions. We bring an understanding of relevant technology, good practice, potential partners, funding sources and the ability to transition new solutions into mainstream public services.

Each year we will mobilise smart city projects that align with the city challenges and annual priorities. These initiatives will keep us challenge-led and focused on delivering tangible benefits to Bristol.

Here is a sample of ongoing projects and potential initiatives:

- Run open data hackathons on period dignity and affordable child care.
- Support the development of a city dashboard[41] and impact measures.
- Establish a Digital Connectivity Forum as part of the One City governance framework to coordinate, integrate and co-design digital initiatives.
- Establish a mechanism to identify emerging technologies, ideas and promising new solutions.
- Expand the West of England's electric vehicle charging network, and increase the number of new electric vehicle (EV) registrations, working towards the One City Plan goal of establishing 35 new EV charging points in Bristol.
- Enable more people to be included in digital connectivity opportunities. For example, by providing community learning digital skills courses, and by supporting the development of online learning and information about education, training and employment services.

41: A city dashboard is an online platform that will provide a shared, transparent view of the performance of Bristol against key metrics, and measure progress against the One City Plan.

case study

Digital Profile

Digital Profile[42] is a digital enterprise start-up that is working with Bristol City Council and Cardiff Council to build a career and recruitment platform that connects people, businesses and education.

With the Bristol Community Learning Team, Digital Profile is providing free tools to help users create a 'living' online CV, which replaces the traditional CV and helps learners to develop the digital skills and confidence they need to find local employment opportunities. The site also allows companies to post career opportunities directly to schools and education providers; this enables them to connect their students to potential employees in a wide variety of businesses and sectors.

Digital Profile is also helping both councils gain a better understanding of their local skills and employment pipeline, and monitor the social value commitments and performance of all major publicly funded investments. Suppliers now have an easy way to advertise and recruit to their contracted commitments, such as apprenticeships, work placements and local labour.

3.2 World-class connectivity

In Bristol, we have smart city capabilities and assets that are already some of the best in the UK – including the Bristol Network (B-NET), Bristol Is Open[43], the Bristol Operations Centre and the Open Data Platform[33] – but we have an aspiration to become the UK's most connected city with high-quality, secure and reliable digital connectivity. This will ensure that all communities and businesses across Bristol can benefit from a world-class network and communication infrastructure, meet growing demands for digital services and make sure than no one is excluded from the digital economy due to poor connectivity.

Effective roll-out of this core infrastructure is critical and it provides the backbone for improved wireless and mobile networks, like ultrafast public Wi-Fi, better 4G and next generation wireless technologies. It will need to be multi-tenant and agnostic to supplier usage. This underlying connectivity will provide a route to securely deploy smart technologies, such as the Internet of Things (IoT) – a giant network of connected 'things' (which also includes people)[44] – and unlocks the potential of city data and analytics. Importantly it enables us to deploy smart technologies without affecting the integrity of the council's operational network.

Intelligent data is key to a smart Bristol. We need to harness city data to support decision-making, generate practical insights and take an evidence-based approach to city management. If developed alongside core principles of cyber resilience, open standards, common platforms and interoperability[45,46], then our world-class connectivity will improve the way we manage the city and many aspects of everyday life. Collaborating with partners across the region to deliver network and data connectivity at scale will further unlock the West of England's full potential.

42: Digital Profile. See www.digitalprofile.com
43: Bristol Is Open. See www.bristolisopen.com
44: A Simple Explanation Of 'The Internet Of Things', Forbes, 13 May 2014, www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/#ffb1a131d091
45: The NCSC supports industry drive towards common standards for secure communication, National Cyber Security Centre, 25 Apr 2018, www.ncsc.gov.uk/news/ncsc-supports-industry-drive-towards-common-standards-secure-communication
46: Government technology standards and guidance, Government Digital Service, 27 Mar 2019, www.gov.uk/government/publications/technology-code-of-practice/technology-code-of-practice-related-guidance

Here is a sample of ongoing projects and potential initiatives:

- Complete the Social Housing Broadband pilot, and transition from pilot to scale up to deliver more affordable connectivity, competition and choice.
- Continue to develop Bristol's testbed – Bristol Is Open (BIO) – to enable the development of novel and emerging technology solutions for Bristol City Council and their holding companies, and help deliver key projects such as extending the Open Programmable City Region (OPCR) network[47] to the digitally disconnected areas south of Bristol.
- Continue the city-wide expansion of BNET – a council-owned duct and fibre communications network – embed best practice[48] in digital infrastructure deployment, support better access to digital services, and encourage digital companies into new areas of the city.
- Support the development of a council-wide data and information strategy that will set out how we will use data to improve transparency, enable data-driven decision-making and support service re-design.
- Install smart sensors on street lights connected to the Bristol Operations Centre, on 10% of Bristol's streets. These sensors are used to make streets safer and healthier for citizens.

case study

Exploring how smart technology can improve safety

As part of a WECA-led 5G Smart Tourism project, Bristol has trialled technology that alerts the emergency services when people fall into the city's harbour[49]. Bristol Is Open alongside Bristol City Council, the University of Bristol and Zeetta Networks collaborated to run a trial which began on 31 October 2018 by Prince's Street Bridge, an area with high footfall and incidences of people falling into the harbour.

The unique and effective simulation of 5G with thermal cameras set up at specific 'trigger' entry points creates a virtual barrier on the harbour wall and combines devices with network slicing to enable waterside safety information to be relayed to a central control point – the Bristol Operations Centre – with an onward connection to the appropriate emergency service.

Within 36 hours of the trial starting, the system was triggered by a pedestrian falling into the harbour and generated an alert for assistance. The use of thermal cameras meant the emergency services were provided with accurate location information.

This trial shows how smart connectivity can have an immediate, positive impact on people's lives and improve citizen and visitor safety.

47: Through the creation of a high-speed private network, OPCR aims to create economic growth, including jobs, attracting companies to the area, creating spin off companies and support health projects that will improve services for all.

48: Good practice examples including the UK Government's Digital Infrastructure Toolkit. See https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728269/Digital_Infrastructure_Toolkit.pdf

49: Bristol tests Smart Digital technology to improve safety in the iconic harbour, Bristol Is Open, 6 Feb 2019, www.bristolisopen.com/bristol-tests-smart-digital-technology/

3.3 City-wide innovation ecosystem

We want to nurture a city-wide approach to developing a smart Bristol which will encourage digital innovation and city-led initiatives across a diverse and inclusive network of institutions, communities, and individual entrepreneurs. It will ensure that smart city innovation is done by the city, for the city.

Firstly, we want to bring together the collective creativity of the city to help co-design solutions to complex city challenges. Across Bristol there are rich, diverse, energised communities of innovators and entrepreneurs, all passionate about making Bristol a great place to work, visit and live. Together our influence on the digital fabric of this city could be transformational.

Secondly, we want to foster a more inclusive, aspirational approach to smart cities that is more in line with our reputation as a Learning City[13]. Linking the development of a smart Bristol with skills and education engagement, for people of any age, will sustain access to employment and job creation in key areas of our regional economy.

Facilities and activities across the city, from well-connected community hubs, living labs and incubator spaces, to hackathons and innovation events, will be augmented by a virtual open innovation infrastructure. This will enable us to empower community-led innovation and attract the most ambitious and innovative partners from around the world into this ecosystem.

Here is a sample of ongoing projects and potential initiatives:

- Further develop Bristol's Open Data Platform by increasing the number of council data sets available, encouraging city partners to publish, alongside delivering an engagement programme focused on solving city challenges with open data and apps.
- Develop an online city innovation toolbox that provides citizens and small businesses with the tools, techniques and practical know-how to become smart city innovators.
- Create a capacity-building programme of engagement events with communities and public-sector staff on creative use of data and technology for problem-solving, share good practice, and facilitate networking.
- Support the provision of new, well-connected incubation and accelerator workspaces, including digital makerspaces and a regional network of living labs, that support productivity and digital innovation in start-ups, SMEs, and community hubs where smart solutions can be designed, tested and developed.

case study

The Factory at Knowle West Media Centre (KWMC)

KWMC The Factory[50] is run by Knowle West Media Centre, a charitable arts organisation that has been supporting the local community in Knowle West since the 1990s.

The Factory is a digital fabrication, design and prototype micro-manufacturing hub and makerspace, working with creative practitioners, technologists and community members. It provides a site for people to explore new modes of manufacturing, circular economy and sustainable materials through to acquiring new skills, product development and business models. It actively creates a bridge between lab development and commercial deployment, and encourages the creation of cross-city networks that support open, scalable and inclusive civic participation.

These connections are vital for Knowle West, an area of economic deprivation, where the closure of local factories led to high levels of unemployment.

50: Knowle West Media Centre – The Factory. See https://kwmc.org.uk/thefactory/

3.4 Responsible innovation

A future smart Bristol might be enabled by technology and data, but it will only be sustained by trust. Cities are increasingly important in the emerging data economy, representing a major source of data that enables modern tech firms and start-ups to prosper[51]. Whilst we want Bristol to become well-connected and data-enabled, there is a risk that this transformation undermines the social benefits that we seek to deliver.

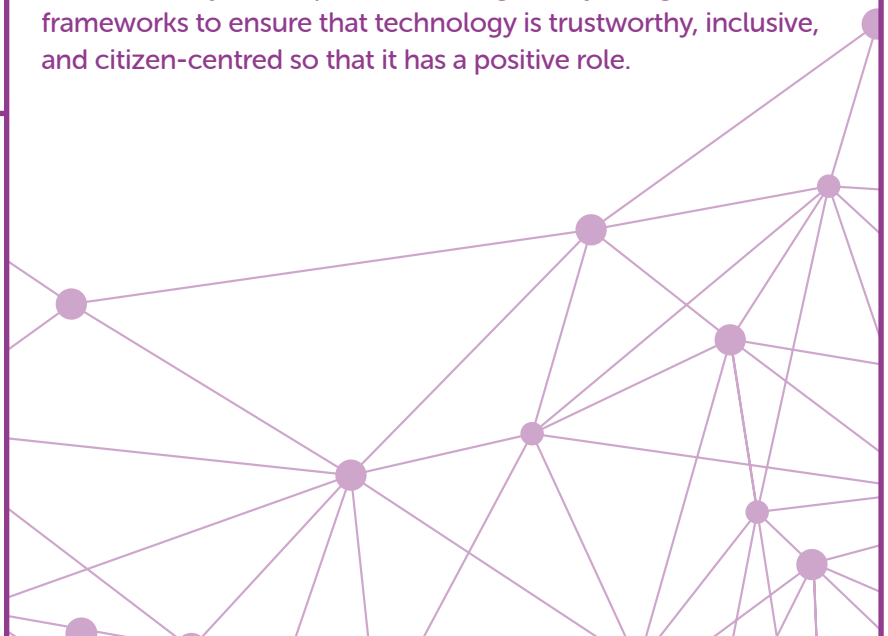
We want to lead on the ethics and governance side of smart city and digital technologies, and ensure that solutions comply with privacy and data protection regulations of personal data to ensure it does not create even wider imbalances of socio-economic power. It is also important we remain mindful of environmental impacts of smart solutions, such as energy intensive ICT practices.

Smart cities need smart citizens. We believe that a people-centred approach will lead to more inclusive city-wide transformation. However, we need a broader ethos of responsible innovation to ensure that we are alive to the ethical, societal and regulatory challenges of smart cities. A smart Bristol should be about the use of technology and data for public good.

The trust paradox

An emerging challenge of trust and public acceptance is building alongside the accelerated adoption of autonomous systems, artificial intelligence (AI) and data-driven innovation to develop smart cities. These technological advancements are beginning to solve some of our most intractable problems and shaping nearly all aspects of our daily life. Yet they are viewed as a double-edged sword. "People are both increasingly dependent on, and distrustful of, digital technology"[52], especially emerging technologies that are new and unfamiliar. At extremes, technology is viewed either as a silver bullet or it heralds a future of unintended consequences and societal breakdown.

Our focus in Bristol is to use technology for public good. We are exploring fundamental questions of perception and acceptance to understand how to develop trusted systems and unlock the immense opportunities digital innovation could bring. Drawing on the expertise of those who are already beginning to shape this agenda in the UK and around the world[53], we need to collaboratively develop the ethics, regulatory and governance frameworks to ensure that technology is trustworthy, inclusive, and citizen-centred so that it has a positive role.



51: Reclaiming the Smart City: Personal data, trust and the new commons, Nesta, Jul 2018, https://media.nesta.org.uk/documents/DECODE-2018_report-smart-cities.pdf
52: Trust in digital technology will be the internet's next frontier, for 2018 and beyond, The Conversation, 4 Jan 2018, https://theconversation.com/trust-in-digital-technology-will-be-the-internets-next-frontier-for-2018-and-beyond-87566
53: For example: Centre for Data Ethics and Innovation (see www.gov.uk/government/groups/centre-for-data-ethics-and-innovation-cdei), the Local Digital Declaration (see https://localdigital.gov.uk/declaration) and Cities Coalition for Digital Rights (see https://citiesfordigitalrights.org)

Ethical data practices, equitable use of technologies, combined with a continued focus on digital inclusion, skills and community engagement will ensure that people can become involved with a smart Bristol in different and relevant ways. This will enable communities to influence how technology is used in Bristol, and become more connected and included in the social and economic benefits digital technology brings to the city.

Here is a sample of ongoing projects and potential initiatives:

- Continue to deliver a digital inclusion programme, working with partners and companies who want to develop initiatives and volunteering to increase digital skills and understanding.
- Develop ethics guidelines and practices that promote the inclusive, ethical and responsible use of technology when designing and implementing digital and smart city services/ solutions. This could include a data ethics framework to inform how we collect, use and share city data, to transform services[54].
- Support the development of a refreshed consultation, engagement strategy and toolkit ensuring the council carries out high-quality public engagement and consultation to understand the views and needs of citizens, in particular, making sure that under-represented voices are heard.
- Develop a Bristol data trust[55] that provides a robust data framework to enhance digital rights locally, giving people control over personal data and minimise the risk of data-enabled solutions discriminating, excluding or eroding privacy.

case study

Flexible learning for inclusive growth

The Flexible Learning Fund from the Department for Education (DfE) supported learning providers and employers to develop flexible and accessible ways to teach adults.

Community Learning West has developed online resources and a blended teaching approach that incorporates both classroom and online learning for adults with low English, Maths and digital skills and who experience barriers or restricted access to regular classroom learning. In addition, tutors have been upskilled through the Blended Learning Essentials course and trained in a variety of digital tools such as Google Classroom[56]. Outcomes to date have shown that where the learners engage with the digital resources they make faster and sustained progress.

The resources have been used across the area by Community Learning West, three local colleges, two independent learning providers, and with local employers to develop flexible early morning and evening sessions for shift workers.

54: Data ethics tools. See https://theodi.org/article/data-ethics-canvas/ and https://www.gov.uk/government/publications/data-ethics-framework/data-ethics-framework
55: How can we make data work for everyone?, Open Data Institute, 15 Apr 2019, https://theodi.org/article/huge-appetite-for-data-trusts-according-to-new-odi-research/
56: Google Classroom is a free tool for schools that helps educators to manage teaching and learning. See https://edu.google.com/products/classroom/

3.5 Innovation management

Bristol City Council has a strong heritage of taking research and development projects through an innovation pipeline to achieve better outcomes and cost savings. However, we recognise that we can do better in the way that we design, develop, and deploy initiatives if we are to deliver our priorities and successfully support wider city plans.

To innovate with purpose, monitor impact and deliver value for money we need a more robust approach to manage and support innovation. This will enable us to take new ideas, test and scale them effectively and proactively manage risks. Alongside this, transparent smart city governance structures would ensure that our decision-making processes, reporting structures and roles and responsibilities all support innovation delivery and enable us to respond effectively to opportunities.

We want to excel in our ability to frame innovation challenges and goals, exploit emerging technology, assess new ideas, and introduce innovative solutions and better ways of doing things in order to deliver tangible impact and social good.

Here is a sample of ongoing projects and potential initiatives:

- Continue to explore collaborative procurement frameworks with other local authorities across the UK to achieve economies of scale for capital investments and access to smart city capability.
- Create a portfolio of smart city projects that balances short-term versus long-term impact, risks, investment and social value, and establishes a traceable line of sight from projects to key strategic outcomes.
- Develop a structured innovation management framework and innovation toolkit that builds on best practice from a broad range of relevant sectors.
- Adopt and support the development of relevant UK and international Smart Cities Standards to build trust and confidence, ensure interoperability, and provide shared frameworks for city transformation plans.
- Develop a smart city governance framework to ensure a well-integrated smart city approach and coordinated governance of critical elements associated with data and information management, cybersecurity, procurement, ethics and privacy.
- Connect and share smart city knowledge, learning and assets with the West of England and national partners to ensure efficiency, create greater scale and maximise impact.
- Play a leading role in the West of England's emerging Global Centre of Innovation Excellence[23] to help facilitate innovation around complex social and urban challenges.

case study

Flourish

Bristol City Council's City Innovation Team was part of the multi-million pound Flourish[57] research and development project investigating the roll out of Connected and Autonomous Vehicles (CAVs) in the UK. Flourish explored how future mobility solutions can benefit older adults, people with restricted mobility and social isolation with a user-centred approach to technology development[58]. The project included a wide range of business, academic, charity and public sector organisations including Age UK, Airbus and Bristol Robotics Laboratory.

Flourish allowed the council to experience these cutting-edge technologies first hand in order to be able to prepare for their advent. By working with leading social science researchers at Traverse and the Centre for Transport and Society we have had access to research about people's readiness and trust for adopting CAVs.

Bristol has a long and distinguished reputation for wireless communication and CAV communication is the logical next step. The project expands the West of England CAV capability and positions the area as a centre of excellence.

There has been significant interest from around the country and abroad in the technologies and social research done by Flourish including significant media coverage, a ministerial visit and a number of papers published in prestigious academic journals. The project culminated in a successful demonstration of the Aurrigo Pod Zero at the St Monica retirement village in Bristol, gaining major media interest.

57: FLOURISH was a multi-sector collaboration that helped to advance the successful implementation of Connected and Autonomous Vehicles (CAVs) in the UK. See http://flourishmobility.com/

58: FLOURISH launches film to demonstrate benefits of connectivity, Flourish, 2019, http://flourishmobility.com/news/flourish-launches-film-demonstrate-benefits-connectivity

3.6 Public service innovation

Rising demands, diminishing budgets and big ambitions means that the council, specifically, needs to explore different, better ways to manage the city and deliver public services. The challenge to do more with less, especially for health and social care, means that innovation and reinvention is a necessity.

Within Bristol City Council, we are undergoing our own digital transformation that will make change possible. New technologies, such as cloud infrastructure, can kick-start new conversations and new ways of working that fuel change. The question is: how can we better use our collective talents, data and technology to improve citizen engagement and make our public services simpler, stronger and more effective?

Embedding a bold ethos of entrepreneurial civic innovation at the heart of service delivery will enable us to deliver frictionless, well-designed, effective services and infrastructure that deliver the step changes outlined in this strategy and support the aspirations of the city and the region[59]. As we explore how to build better public services, we will look to established centres of excellence[60] and reach beyond the public sector for good practice. User-centred design thinking and agile development methods will ensure that citizen experience informs service design.

The goal is to transform our analogue, paper-based, or legacy systems used to interact with residents and make them open, citizen-centric and accessible[61]. Cost savings are utilised elsewhere to deliver core services that our citizens continue to need support with and our inclusive-by-design approach is addressing our digital divide.

Here is a sample of ongoing projects and potential initiatives:

- Support the council's digital transformation to design, develop and deliver new ways to provide public services and manage the city with a focus on digital health and social care.
- Support the development of our data and insights infrastructure to manage the production, maintenance and provision of data from different stakeholders, including public officials, developers, companies and citizens. Ensuring data is harmonised through open standards to meet agreed criteria – formats, licences, information policy – will enable the council and the city to effectively leverage data to improve quality of life and address city challenges.
- Develop a citizen-centric approach to data management so that people provide their data once to Bristol City Council and it is reused many times as agreed with the owner: being stored securely, shared only with permission and compliant with GDPR legislation.
- Develop a Bristol Digital Twin – a virtual model city combined with analytics and visualisation tools to support data-driven city management and planning. Predictive modelling will enable what-if scenario planning and de-risk future city developments.
- Complement the council's existing data science and insights capability with the use of Artificial Intelligence, machine learning, data analysis, predictive analytics and algorithms to transform service delivery and monitor outcomes.

59: The West of England Local Industrial Strategy highlights the need to embed innovation into our approach to tackling the infrastructure and productivity challenges of the region.
See www.gov.uk/government/publications/west-of-england-local-industrial-strategy. We recognise that public sector innovation has a vital role to play in delivering the infrastructure required for economic growth and actively enabling greater business productivity, better access to economic opportunities and accelerated scale-up.

60: For example, the Government Technology Innovation Strategy (see www.gov.uk/government/publications/the-government-technology-innovation-strategy) and Nesta (see www.nesta.org.uk/government-innovation/)

61: Here's what we need for civic tech to flourish in government, Apolitical, 21 Dec 2018, https://apolitical.co/solution_article/heres-what-we-need-for-civic-tech-to-flourish-in-government/

case study

Digital Inspector

The Digital Inspector project is investigating how digital technologies can help local authorities undertake statutory carriageway inspections more efficiently and effectively. In partnership with Blackpool Council and Cumbria County Council, the Department for Transport and technology company Gaist Solutions Ltd, Bristol City Council are trialling the use of high-definition vehicle-mounted cameras to collect real-time images of road and path conditions. This data can then be analysed by computers to highlight where roads are deteriorating, enabling more timely and cost effective repairs.

A smart city relies on having a resilient, safe and well-maintained network that enables people and goods to move around the city easily and continuously, and the impact of poor roads is significant. Motorists have received nearly £18,000 in insurance pay-outs in the last three years because of dangerous potholes on Bristol roads[62]. Every year around 5,000 potholes are repaired across the city's network, which covers over 1,000km of roads and nearly 2,000km of paths. Better inspection and maintenance will reduce costs and minimise the impact of personal injury claims, and reductions in congestion caused by poor roads will improve air quality.

We are currently planning follow-on projects that will further automate the process of identifying road defects using artificial intelligence. This ground-breaking project has the potential to bring benefits to all authorities across the UK.

62: The most dangerous and expensive pothole locations in Bristol, Highways Industry, 22 Jan 2019, www.bristolpost.co.uk/news/bristol-news/most-dangerous-expensive-pothole-locations-2453904

4 Connected City: team and approach

Connected City is the umbrella term for the complementary, but distinct innovation and delivery capabilities within Bristol City Council. Together we collaborate on smart city and digital technology projects, and wider city innovation initiatives with other council services and external partners.

4.1 Connected City team

- **City Innovation Team** – A small, diverse team of in-house innovation advisors with a broad base of expertise that includes smart technologies, data, social and human factors and user-centred design, design thinking, futures thinking, social innovation, and community engagement. The team collaborates within the council and across the city to support innovation, tackle challenging urban issues and implement smart city solutions.
- **Bristol Is Open (BIO)** – The city pilot test-bed that allows us to safely and securely pilot new digital solutions and services before scaling them into city wide initiatives. Bristol Is Open was developed in partnership with the University of Bristol using a mix of government funding (local, national and European), academic research grants and private investment. Bristol Is Open has now matured into a wholly owned council company.
- **Bristol Operations Centre** – The smart city hub that helps the city keep moving, be safe and healthy. It is a unified centre delivered in 2017, as part of an £8.3 million investment programme. It delivers a range of services including traffic management, bus lane enforcement, public space CCTV monitoring, call handling and security alarm monitoring. There are collaborations and partnerships with emergency services, First Bus and the Environment Agency, among others.

- **Bristol City Council Information Technology (IT) services** – provides an assurance and governance function for all aspects of IT delivery and complementing strategies across the council, both internally and externally, and owns decisions concerning the IT approach. It has ownership of the internal digital transformation programme and delivery of supporting enabling technology and operational IT services to the council and partner organisations.
- **Service teams throughout Bristol City Council** – council intrepreneurs including those responsible for formal service innovation, and others who continually deliver change, solving problems and improving the way services are delivered. Innovation takes a variety of forms and happens across the organisation and everyone has the ability to create positive change in their own teams and areas of expertise.

4.2 Bristol design principles

We work to a set of design principles that will guide what we do and how we do it:

- Transparent, inclusive and ethical
- Open by default and interoperable
- Start with challenges and user needs
- Engage, collaborate and co-design
- Technology should make things easier
- Create positive experiences and outcomes
- Do the hard work to make the complex simple.

These principles are meaningless if people are not experiencing them, seeing them and using them every day. So, like this strategy, they are a starting point. We will develop a shared set of Bristol design principles that are co-developed and adopted by the city.

Explore, enable and lead

Bristol City Council will be inclusively innovative by not always leading on the development of solutions. We work with partners, stakeholders and communities across the city in one of three ways:

Co-creating smart cities: top-down versus bottom-up

Smart city initiatives follow a pattern. Many are top-down, following an industry or local government driven approach where new technologies are rolled-out with little citizen involvement or the city becomes a test-bed for new technologies. Others are bottom-up community-led initiatives where solutions are developed by citizens. We believe each approach has merits and limitations.

Wholly top-down technology driven initiatives are unlikely to deliver the social impact we seek, but equally, bottom-up, grass-roots innovation can struggle to scale effectively into city-wide solutions. We advocate a holistic third-way approach that combines elements of both, underpinned by a belief that smart city initiatives which involve or are led by citizens will have greater buy-in and support, and as a result will be more successful and sustainable.

4.3 Focusing on real world problems

Our challenge-led approach will ensure that our projects are grounded by specific challenges aligned with our broader city vision and corporate strategy, and have clear metrics and targets so we know when we have achieved our goal.

We will use a range of techniques to gain a rich understanding of what is needed before co-creating new technologies and solutions with people, such as:

- Bristol's Quality of Life Survey – sent to over 10,000 randomly selected homes each year to provide ward-level data on the quality of life in people's neighbourhoods.
- Bristol Citizens' Panel – a 2,500 strong panel of volunteers who are representative of the population of Bristol.

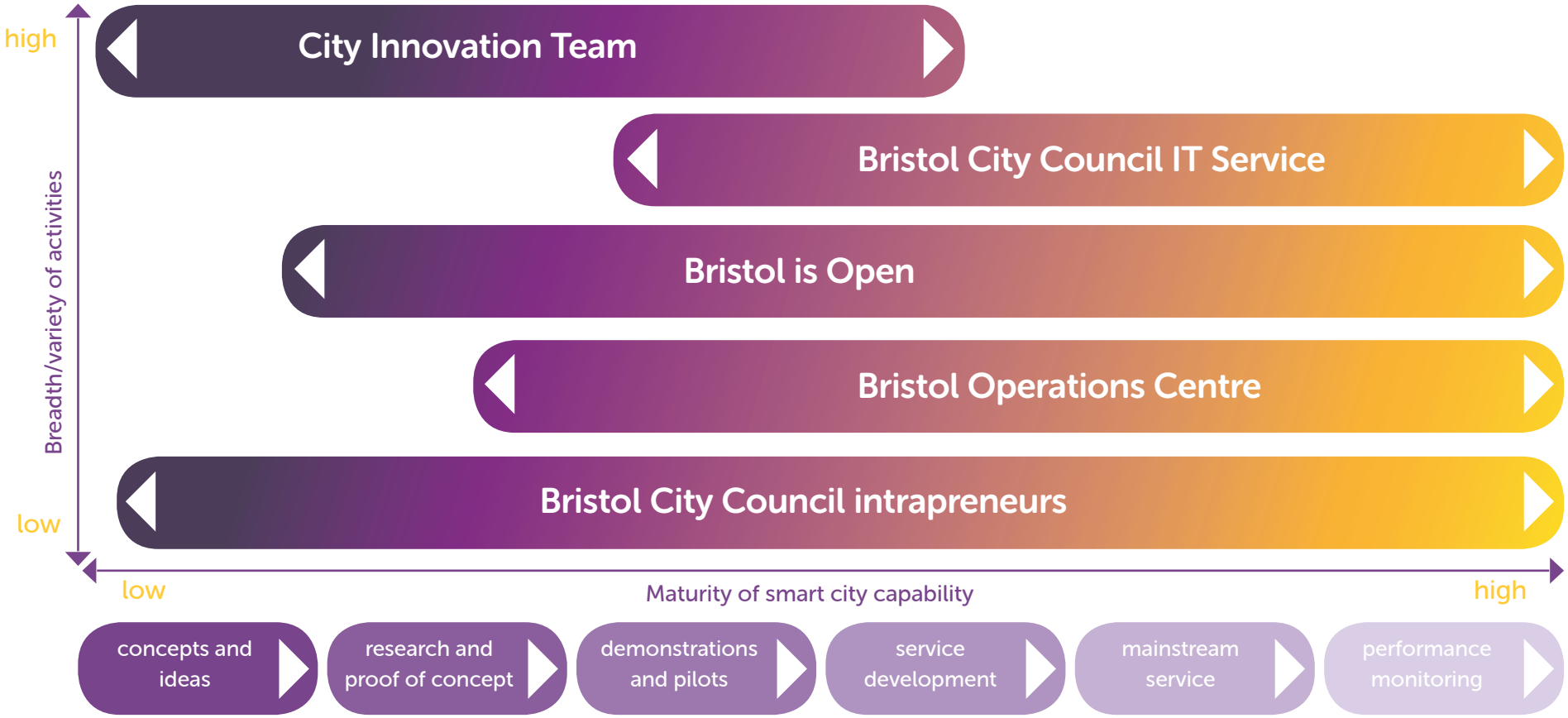
To encourage wider involvement, share results and enable people to track progress we will publish details of planned initiatives, ongoing projects and outcomes on our website. We will organise and attend events, and share information on social media to engage citizens, providing opportunities for people to get involved and learn more about what we are doing.

4.4 Lifecycle approach

Moving beyond the technology-push, we believe that a combination of city-wide collaboration, common objectives and coordinated initiatives reflect Bristol's priorities and will collectively contribute to creating solid foundations for Bristol's digital future.

We will develop a smarter Bristol through testing, experimentation and scaling what works through a challenge-led, agile, holistic approach starting with user's needs. This will ensure that we are focused on positively shaping the way people experience the city rather than being driven to implement the latest technology.

The Connected City team will take ideas from inception through design and development, and deploy ultimately into mainstream service delivery. We will run pilots to demonstrate emerging technologies and the potential benefit of these technologies to the city and its citizens. Our success lies in our ability to rapidly learn and iterate at the outset before transitioning proven pilots into business as usual operations and service delivery.



case study

Using the lifecycle approach in the REPLICATE programme

The REPLICATE programme[63] is a demonstration of this lifecycle approach that has seen ideas develop from concepts through to pilots and larger scale demonstrators. REPLICATE is a five year European pilot programme exploring how new technology could benefit communities in Bristol, San Sebastian and Florence. The REPLICATE team have worked directly with communities in the Ashley, Easton and Lawrence Hill districts of Bristol so that people can trial integrated energy, transport and information communication technology (ICT) solutions.

This suite of projects has collectively called upon the City Innovation Team and partners' expertise in smart energy, smart mobility, intelligent data, digital infrastructure and digital inclusion, with a strong focus on community engagement and co-design. From the outset the focus has been on identifying how to create a pathway from pilot to delivery, and ultimately scale-up successful elements of the programme into mainstream council services, and city business models.

This development approach is not limited to technology. The REPLICATE Smart Homes project has combined the principles of the Bristol Approach[64] with Asset Based Community Development methodologies to co-create a community engagement approach which has empowered community organisations and individuals to take the lead on engaging citizens. Through working with Bristol Energy Network and Knowle West Media Centre, the project engaged an inclusive and diverse cohort of residents: 31% of households participating are from Black, Asian, Minority or Ethnic (BAME) backgrounds, 14% are registered disabled and 29% live in social rented housing.

Recently the programme received a national award in recognition of its Smart Homes community engagement successes[10].

REPLICATE

63: REPLICATE stands for REnaissance in PLaces with Innovative Citizenship And Technology. For more details about the project see www.connectingbristol.org/replicate/

64: The Bristol Approach focuses on supporting people to work together to 'pull-in' the knowledge, technology and resources needed to tackle a problem. See https://kwmc.org.uk/projects/bristolapproach/

5 Financing Connecting Bristol

To support Bristol's journey to becoming a more equal and sustainable place to live we need to be a city that is able to finance our smart city initiatives. Alongside existing mechanisms, we will explore innovative procurement and commercial models, as well as the different funding and investment options available. This could include:

- Development of a regional Smart Alliance, through which Bristol will seek to share knowledge and learning; identifying collaborative opportunities to secure new investment and focus on digital skills as a prerequisite of inclusive growth.
- A prospectus[65] model to invite expressions of interest and create financial partnerships to solve challenges and provide innovative solutions. The prospectus model enables market testing, identifying potential partners and finance infrastructure through strategic investment from a range of sectors and sources.
- Bristol's City Funds[66] aim to create positive and transformative change in Bristol through business, community organisations, funders and the public sector coming together to share resources and raise finance in order to help address key priorities in Bristol.
- Investment and commercial opportunities from utilising council-owned assets, such as B-Net, buildings and street furniture.
- Innovative procurement processes that aggregate demand or create outcome based solutions to enable joint procurement, at scale across several cities (regionally, nationally and internationally), ensuring cost-effective deployment. Underpinning this is a requirement for common specifications, standards and collaborative procurement frameworks[67].
- Social, green and/or positive impact bonds as a way to support initiatives focused on city challenges by attracting investment aligned to delivering sustainability and social value.
- Novel funding mechanisms, such as initial coin offerings; a fund raising method based on distributed ledger technology and crypto-currencies that offer alternative ways to raise capital that enables investors to buy into future capacity.

Ultimately our aim is to deliver economic **and** social benefit. Increasing social value is a key driver in our approach to innovative and sustainable smart city development. It shapes what services and solutions we will deliver, but also how we will deliver them. Social value will be considered in relation to all our commissioning and procurement activity[68], and we will seek to understand our social return on investment alongside financial returns.

65: This process has been used previously for City Leap. See http://www.energyservicebristol.co.uk/prospectus/
66: Bristol City Funds. See www.bristolcityfunds.co.uk/
67: Such as those offered by the Crown Commercial Service. See https://ccsheretohelp.uk/ and https://ccsheretohelp.uk/how-to-buy/aggregation/
68: Bristol City Council has committed to ensuring that at least 40% of our total procurement budget is spent on micro, small and medium size businesses, social enterprises and voluntary / community organisations.

6 Strategic relationships and collaboration

Bristol City Council continues to seek a broad range of partners from across the city and wider. Complex city challenges require diversity of thought and inclusive, interdisciplinary approaches. We have the ability to bring disparate sectors together through broader, cross-sector partnerships, and within Bristol City Council we will work across traditional departmental structures to ensure that resources are not duplicated, but are fully integrated and reused at every opportunity.

Whilst Bristol has a great story to share, we have a lot to learn. We will collaborate locally, regionally, nationally and internationally and seek to do more. We are actively developing collaborative partnerships with other cities across the UK to learn, share and collectively improve. It is through collective action that we all benefit.

Bristol's Smart City Steering Group has been established with responsibility for overseeing delivery of the smart city strategy and associated action plan, providing leadership, support and accountability to monitor progress and outcomes. The group is currently comprised of representatives from Bristol City Council and representatives from our wholly owned companies.

We will work with the West of England Combined Authorities (WECA), the region's four universities and the emerging Smart Alliance, as well as the many other talented organisations and individuals within the area to make the most of innovation opportunities across the region. This regional collaboration will enable us to add value during the delivery of existing strategies, such as our Joint Local Transport Plan[69], Joint Spatial Development Plan[70] and the region's Local Industrial Strategy[23].

69: JLTP4 – Joint Local Transport Plan, TravelWest. See https://travelwest.info/projects/joint-local-transport-plan
70: West of England Joint Spatial Plan. See www.jointplanningwofe.org.uk/consult.ti?

Regional research excellence and industry innovation with global reach

Bristol and Bath boast teaching and research excellence with four universities in the region, with advanced research departments leading in robotics, life sciences, and assisted living among other innovations. Alongside this, the region is a centre for Industry 4.0 with particular strengths in aerospace, robotics, additive layer manufacturing and composite material application.

The universities sit at the heart of the region. For example Engine Shed, a collaboration between Bristol City Council, the University of Bristol and the West of England Local Enterprise Partnership (LEP), is a hub where businesses, entrepreneurs, academics, social innovators and corporates collaborate. Strong links between the universities and city administrations have attracted multi-million pounds worth of project funding for city innovation around smart energy, transport and infrastructure, with citizens at the heart.

In recognition of this established city-university collaboration, Bristol has been accepted into the MetroLab Network[71]. The city has extensive reach through global networks including EUROCITIES[72], the Global Parliament of Mayors, Rockefeller 100 Resilient Cities, and the UK Foreign and Commonwealth/Department for International Trade network overseas, as well as city-to-city partnerships in Europe, US and Asia. Bristol has a strong profile overseas as a leading smart, sustainable and innovative city[65].

71: The MetroLabs Network is a growing collaborative of over 45 cities and 60 universities focused on civic innovation. Beginning in January 2019, the US originated network opened its membership to partnerships between universities and cities in the UK. See https://metrolabnetwork.org/
72: EUROCITIES is the network of major European cities. The network, which offers members a platform for sharing knowledge and exchanging ideas, has representatives from local governments of over 140 of Europe's largest cities, across 39 countries, and aims to allow city governments to tackle strategic challenges at local level. See http://www.eurocities.eu/

7 Implementation and next steps

This strategy is the next phase of Bristol's journey to becoming a well-connected city. We want to stay as agile and responsive as possible so that we can deliver tangible value to the city and the region.

Our next step is to develop a flexible action plan of initiatives that contribute to building our digital foundations. Through an annual update of this action plan we will iterate our understanding of what works, what does not and what needs to evolve.

As this strategy is delivered, we will report progress, consult with stakeholders and initiate wider citizen engagement to ensure future development of the strategy into a city wide document. We hope you will join us.

8 Glossary of terms

AI machine learning – Analyses big data, makes assumptions, learns and provides predictions at a scale and depth of detail that people cannot.

Algorithms – A set of rules or detailed instructions for doing a task or solving a problem. Algorithms are commonly used for data processing and manipulation, and in computer operations.

City dashboard – A city dashboard is an online platform that will provide a shared, transparent view of the performance of Bristol against key metrics, and measure progress against the One City Plan.

Civic innovation – A new idea, technology or methodology that challenges and improves existing processes and systems, thereby improving the lives of citizens or the function of the society that they live within.

Creative Industries Cluster / Innovation Cluster – The Arts and Humanities Research Council's (AHRC) Creative Industries Clusters Programme is designed to create a step-change in collaboration between the country's internationally-renowned creative industries and universities across the UK.

Data jam – Bringing people together to solve problems using data sets. Data jam gatherings may produce data visualisations and apps.

Full fibre – Optical fibre all the way to the home or premises. Also known as Fibre to the Premises (FTTP) or Fibre to the Home (FTTH).

Gigabit capable – An internet connection capable of download and / or upload speeds of at least 1 gigabit per second.

Hackathon – Hackathon events bring together the collective know-how of innovators and citizen data scientists to develop potential solutions to challenges we all face.

Incubation and accelerator workspaces – Shared work spaces that support early stage businesses.

Internet of Things (IoT) – An IoT network consists of everyday objects – mobile phones, washing machines, vehicles, buildings, wearable devices – that 'talk' to each other via embedded software, sensors, and network connectivity.

Interoperability – The ability of two or more components or systems to exchange information and to use the information that has been exchanged.

Intrapreneurs – Employees working to create positive change within their own organisation.

Makerspaces – Creative spaces where people can gather to collaborate, make, learn, explore and share. They often have 3D printers, software, electronics, craft and hardware supplies and tools, and more. Sometimes also referred to as hackspaces and Fab Labs.

Network slicing – Network slicing allows multiple virtual networks to be created within a shared physical network infrastructure. These virtual networks can be configured or customised to meet specific needs of applications, services, devices, customers or operators.

Predicative analytics – Making assumptions and testing based on past data to predict future what-ifs.

Social innovation – New ideas to tackle social problems or meet social needs. It may be a new product, service, initiative, organisational model or approach to the delivery of public services.

Super clusters – Technology clusters are based on a city's level, concentration and growth of tech sector employment. Super clusters are locations with between 50,000 and 70,000 people working in high-tech jobs.

Thanks to contributors

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If you would like this information in another language, Braille, audio tape, large print, easy English, BSL video or CD rom or plain text please contact: **city.innovation@bristol.gov.uk**

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