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INTRODUCTION

The term ‘smart city’ has many different definitions and these have evolved over time. In the early days, smart cities were all about big infrastructure projects, centrally controlled systems and top down approaches. This made smart city projects expensive, intrusive and on occasions brought little or no value to the people living, working and visiting the cities. However, the lessons learned from these early smart city projects prompted change and a new type of smart city has evolved. Present-day smart city initiatives look to increase collaboration, use technology and harness the power of data to make cities more liveable and drive benefits for citizens.

WHAT DOES THE TERM ‘SMART CITY’ MEAN TO CARDIFF?

Based on research and evolving smart city definitions, Cardiff’s definition of a smart city is best summarised as follows:

“ A ‘Smart City’ is a collaborative space, where people are better connected and the use of digital technologies and data are seamlessly woven into day-to-day activities to enhance the lives of the people living and working within the city, as well as those that visit it. The ‘Smart City’ is responsive to its own unique challenges and is better prepared to address and prevent any social, economic, health and environmental issues that it may face. ”

‘Cardiff’s Smart City Roadmap’ sets out our future aspirations to make Cardiff a smart city. A ‘smarter approach’ will allow us to remove obstacles, break down silos, and create an inclusive environment where everyone has the opportunity to fulfil their potential. New, smart approaches will help to make the city more resilient to the challenges of the future and provide many economic benefits.

This ‘draft’ roadmap has been designed to be flexible and will act as a catalyst for collaboration, innovative thinking, better designed services and allow us to exploit advances in technology.

The five missions in this document have been designed around priorities that we believe are important to the city. These missions promote collaborative working, advocate data-driven decision making, aim to expand connectivity, seek to improve health and well-being, enhance mobility, and will help to ensure that Cardiff continues to be a sustainable city.

It is important to point out that our smart city approach is ambitious but attempts to avoid the pitfalls of the early smart city initiatives. It doesn’t involve huge centralisation projects or advocate the use of technology with no real purpose. Instead, we intend to learn from other cities experiences, work with our citizens and target initiative’s that will deliver high value solutions for the people who live, work and visit the city.

Successful smart cities continually collaborate with the whole city - their citizens, businesses, entrepreneurial start-ups, universities, health boards and public bodies.

Our smart city missions will become a mechanism for transformation that will facilitate better city-wide decision making. They will look to enhance existing services and create new services that are at the forefront of digital innovation.

We want to innovate beyond what other cities have already done and explore new ways of providing value added services that make a real difference to the city and contribute to its success. Importantly, we recognise that to become a smart city we have to collaborate, embrace advances in digital infrastructure and work intelligently with data to create a better environment for our citizens, businesses and visitors.

“A smart city is a process, not an end-state. This roadmap will help us all to collaborate in harnessing new technology for a better city”

Professor Peter Madden, OBE, Cardiff University

SUPPORTING BUSINESSES IN CARDIFF

TECH READY WORKFORCE

Cardiff has one of the fastest growing tech-based workforces in the country.

Over 5,000 people employed in ICT, 3,000 employed in Life Sciences and over 15,000 employed in creative industries in Cardiff.

CARDIFF IX

Cardiff Internet Exchange has 21 connected businesses, the largest number outside of London.

Businesses that use Cardiff IX have improved bandwidth, reduced latency and faster data transfer.

4G / 5G / FIBRE TO EMPOWER BUSINESSES

The business sectors of Fin-Tech, Reg-Tech, Creative Industries, Life Sciences and Complex Manufacturing have all been identified as the most requiring support from technological infrastructure.

Invest in Cardiff is helping businesses in these sectors to best leverage the benefits of Cardiff IX and other infrastructure benefits.

SMART CARDIFF ROADMAP



‘Cardiff’s Smart City Roadmap’ has been designed to provide direction and scope to our smart city initiatives, in order to take advantage of advancements in technology and data innovation. Cardiff Council has already implemented smart technology in the city. However, we have never had a single document which sets our ambitions to make Cardiff a ‘smart city’.

‘Cardiff’s Smart City Roadmap’ is a non-statutory document that serves as a statement of our aspirations to make Cardiff a smart city. This roadmap will evolve over time to incorporate new technology and harness opportunities that emerge. The ‘proposed’ actions detailed within this roadmap are designed to make the missions achievable. However, it is important to note that the stated actions are not exhaustive but show our intention to focus on particular components of a smart city.

This roadmap sets out specific missions and actions that we wish to explore. It aims to bridge gaps in existing service provision, by supporting and adding value to our existing strategies and plans. This roadmap is closely aligned to the intended outcomes from published Council plans and strategies as listed below:

- ▷ Capital Ambition
- ▷ Cardiff Digital Strategy
- ▷ Cardiff Well-Being Plan
- ▷ Cardiff Transport Strategy
- ▷ Cardiff Economic Strategy
- ▷ Adopted Local Development Plan (LDP)

We will provide regular ‘progress updates’ on our websites and review the roadmap every three years to ensure that our stated missions are meeting the needs and expectations of the city.

This is a draft document that will be used to engage with the city and to generate public awareness of our smart city aspirations.

We aim to address the missions in this roadmap and need your participation and feedback to help shape the future of the city.

GET INVOLVED

We want everyone to be involved and to participate in making Cardiff a smart city, so we are asking for your views and ideas so that you can help shape the future of the city and make Cardiff a smarter place to live, work and visit:

You can provide direct feedback and views on this roadmap by going to www.smartcardiff.co.uk

There will be various smart city events held in the city. If you would like to register your interest for these events then please go to our website www.smartcardiff.co.uk

Copies of this roadmap are available from www.smartcardiff.co.uk/roadmap

“This is an exciting opportunity for Cardiff. The Smart City Roadmap has the potential to bring the city together, promote digital innovation and improve services in the Capital.”

Isabelle Bignall, Chief Digital Officer



THE CHALLENGE – TRANSFORM INTO A SMART CITY

How does Cardiff transform into a smart city, to improve collaboration with city stakeholders, drive efficiencies, improve services and harness the power of data to enhance the lives of the people living, working and visiting the Capital?

Cardiff is Wales' strongest economy and is the fastest growing core city (in terms of percentages). By the year 2039, Cardiff's population is projected to increase by just over 20 % (an additional 74,400 people). This will see an increase in people of school age, working age and will see an increase in the number of older people living in Cardiff (over 65 years of age). This rapid growth in population will bring with it a range of challenges and opportunities.

INCREASED PRESSURE ON PUBLIC SERVICES – Severe and sustained budget cuts, combined with increased demand for public services has been a difficult problem to address. The repercussions of having to do 'more with less' have been felt all over the public sector with areas such as health, social care and policing all feeling the strain. The economic situation ahead looks unlikely to change and will be further impacted by future population growth and changing demographics. This has the potential to put more pressure on our public services, particularly our health and social care departments.

INCREASED STRAIN ON TRANSPORT INFRASTRUCTURE – Cardiff is one of the fastest growing Cities in the UK and Cardiff's Adopted Local Development Plan (LDP) sets out that 41,000 new dwellings and 40,000 new jobs will need to be created by 2026. This unprecedented level of growth will place additional pressure on the transport network, our main challenges are to keep Cardiff moving and ensure we hit our target of a 50:50 modal split by 2026 (50 % of journeys to be made by sustainable modes of transport).

INCREASED DEMAND FOR ENERGY – Growth and wealth in the city will further increase the demand for energy. Cardiff's demand on energy infrastructure is already projected to outstrip all other major British Cities. The electrification of transport systems, electrification of heating and ventilations systems, changing work patterns and changing demographics will change the way we supply and use energy. There have been significant developments over the last few years when it comes to low carbon storage and generation technologies, and the cost of installing certain renewable technologies has fallen considerably. The challenges comes with picking the right technologies – technologies that are low carbon, robust, cost-effective, integrated and meet the varied needs of the city.

UNCERTAIN ECONOMIC CONDITIONS – Uncertain economic conditions characterised by 'Brexit', public sector austerity and uncertainty about future UK funding will make the next few years tricky to navigate. Cardiff's growth will provide major economic opportunities, with a young and skilled workforce playing a huge part in the transition to becoming a more innovative and productive economy. The challenge is to ensure that Cardiff is resilient and can adapt to future economic conditions.

INCREASED PRESSURE ON THE NATURAL ENVIRONMENT – Cardiff is the fastest growing local authority in Wales. This growth has the potential to impact on the natural environment if it is not managed sustainability. The protection of the natural environment plays a huge role in the Adopted Local Development Plan (LDP) and our challenge is to ensure that Cardiff's growth is managed responsibly so that environmental needs and climate change is carefully balanced with social and economic needs.

Cardiff's growth opens up many opportunities, this smart city roadmap aims to exploit the following opportunities:

IMPROVE PUBLIC SERVICES AND DELIVER A SMARTER CARDIFF – The smart city roadmap will look to create more efficient and improved public services across the city using digital technology. It aims to bring the city together, using collaboration as a mechanism to make better use of the city's resources and to promote innovation. There is a strong focus on modernisation and making better use of data to provide critical business insights and improve decision making. It will look to reduce the strain on public services by supporting health and social care initiatives so that people can remain independent in their own home and stay active and healthy.

EXPLOIT DIGITAL TECHNOLOGY TO IMPROVE TRANSPORTATION – New technology and data innovation offers Cardiff an exciting opportunity to reduce the strain on our transport network. The adoption of smart technologies will enable us to effectively and efficiently manage the transport network to improve journey times, tackle air pollution and prioritise public transport and active travel provision. Smart technology plays a huge role in this area as it can be used in a variety of different ways - it can be used to simply guide us through the city or contribute towards influencing travel behaviour through educating and encouraging sustainable modes of travel. The potential use of technology and data in this area is vast and the smart city roadmap will explore the various options that could be used to improve transportation in and around the city.

IMPROVE ENERGY INFRASTRUCTURE - The implementation of smarter energy infrastructure along with low carbon alternatives will have a positive impact on the environment and will contribute towards Welsh Governments ambition to make the Welsh public sector carbon neutral by 2030. The electrification of our transport systems will help reduce emissions and provide us with an opportunity to use any source of energy, including renewable sources. This roadmap will concentrate on ways we can improve energy efficiency, reduce costs and support zero carbon alternatives.

IMPROVE ECONOMIC AND SOCIAL BENEFITS – The actions set out in this roadmap come with a variety of social and economic benefits. For instance, digital processes can help boost productivity and lead to economic growth. Whereas, faster and improved connectivity comes with a range of socio-economic benefits such as economic growth, employment opportunities, improved collaboration and it can help to accelerate innovation. The proposed open data platform will give our businesses access to the data that they need in order to build products and services and make evidence based decisions. The smart city roadmap will look to create new opportunities, improve lives and attract new businesses to the area.

HELP THE ENVIRONMENT – There are a range of actions that will help to improve the natural environment. These include actions around the Internet of Things (IoT), connectivity and analytics to give us a better understanding of energy and environmental data. Other actions include extending our smart street lighting into residential areas to reduce energy consumption and improve street lighting in the city. The main goals are to reduce carbon emissions, become more energy efficient and improve air quality to become a healthier city.



CARDIFF'S CHALLENGES

POPULATION

POPULATION INCREASE OF 20 % OVER
THE NEXT 20 YEARS

PUBLIC SERVICES

INCREASED DEMAND ON
SERVICES

MOBILITY

INCREASED STRAIN ON OUR
TRANSPORT INFRASTRUCTURE

ENERGY

INCREASED DEMAND ON
ENERGY SUPPLIES

ECONOMY

UNCERTAIN ECONOMIC CONDITIONS

ENVIRONMENT

INCREASED PRESSURE ON THE
NATURAL ENVIRONMENT

CARDIFF'S OPPORTUNITIES

GROWTH WILL PROVIDE MAJOR ECONOMIC,
SOCIAL & CULTURAL OPPORTUNITIES

POPULATION

OPPORTUNITIES TO COLLABORATE, CREATE
EFFICIENCIES AND IMPROVE SERVICES

PUBLIC
SERVICES

REDUCE CONGESTION, INFLUENCE TRAVEL
BEHAVIOUR AND MOVE TO GREENER
MODES OF TRANSPORT

MOBILITY

MAXIMISE ENERGY EFFICIENCY AND THE ADOPTION
OF RENEWABLES AND LOW-CARBON TECHNOLOGIES

ENERGY

ATTRACT BUSINESSES TO THE AREA, PROMOTE
INNOVATION AND CREATE NEW OPPORTUNITIES

ECONOMY

REDUCE CARBON EMISSIONS AND BECOME A
HEALTHIER, MORE SUSTAINABLE CITY

ENVIRONMENT

SMART CARDIFF'S VISION



OUR VISION IS FOR CARDIFF TO BECOME AN INCLUSIVE, SUSTAINABLE, HEALTHY AND PRODUCTIVE CITY THAT USES TECHNOLOGY AND DATA TO ENHANCE THE LIVES OF THE PEOPLE LIVING, WORKING AND VISITING THE CAPITAL.

During the creation of this roadmap, we thought about how a 'Smarter Cardiff' could solve the city's challenges and considered how we could set up missions that will resolve the questions below:

PEOPLE

- ▷ How can we engage with the city better?
- ▷ How can we get more people involved in shaping the city?
- ▷ How do we create awareness of digital opportunities?

DATA

- ▷ How can we use data in secure ways to inform decision making, whilst protecting privacy?
- ▷ How can we become more transparent and promote data sharing across the public sector?
- ▷ How can we use data to enhance services?

CONNECTED

- ▷ How can we improve connectivity in Cardiff?
- ▷ How can we ensure businesses and people have the connectivity they need?
- ▷ How can we ensure Cardiff's connectivity is future-proofed?

MOBILITY

- ▷ How can we use technology to reduce congestion in the city?
- ▷ How do we prepare for the future of transport?
- ▷ How can we promote the use of zero/low carbon vehicles in the city?

SUSTAINABLE

- ▷ How can we generate more renewable energy and use it in a smarter way?
- ▷ How do we reduce energy usage?
- ▷ How can we improve air quality?

HEALTH, CARE & WELLBEING

- ▷ How can we use technology to support people to remain independent?
- ▷ How can we involve professionals and service users in designing health technology?
- ▷ How can we join up public services to share information better?

CARDIFF'S SMART APPROACH

SMART
CARDIFF

CAPITAL
AMBITION

Working for Cardiff

Working for Wales

Working for the future

Working for public
services

CHALLENGE

TRANSFORM CARDIFF INTO A SMART CITY

MISSIONS

A Collaborative
City

A Data-Driven
City

A Connected
City

A Mobile &
Sustainable City

A Healthy
City

INITIATIVE
AIMS

Citizen focused and
collaborative

Future proofed,
improved
connectivity

Joined up public
services

Improved decision
making

Low carbon living
and sustainable
transport

Economic growth



OUR
PROGRESS
SO FAR



SMART CITY STUFF...



These are some examples of smart city projects that are currently in the process of being 'rolled out' or have been completed. There are other smart city initiatives happening in and around the city and some further examples are detailed throughout this roadmap.

SMART STREET LIGHTING



Cardiff has more than 15,000 connected LED street lights deployed across the city's strategic road network. We decided on using 3,000 Kelvin (K) LED lighting, making Cardiff the first city to use this for city wide deployment. 3,000 K lamps provide a warmer white light with less glare making it more comfortable for public spaces.

Testing

Before awarding the contract the council invited a group of leading LED manufacturers to demonstrate their products using a large-scale test bed along two city roads. The test bed allowed real-world comparisons and enabled citizens, key stakeholders and specialist groups to review the lighting quality.

Participants in the study responded using a pre-set scored questionnaire to determine their responses and preferences across several aspects including uniformity of lighting, colour rendering, levels of glare, colour appearance/temperature, and lamp aesthetics. The test area was also used by the project team for technical analysis of Lux levels and other lighting metrics.

Drivers

The main drivers were to achieve savings on the city's energy bills, reinforced by a desire to cut carbon emissions and provide a controllable responsive lighting network.

Benefits

The new system has reduced the city's annual energy bill by £800,000 in the first year and is expected to pay back the project costs within 5 years. In addition, around £130,000 is expected to be saved annually in maintenance and management costs. Cardiff is the only UK city recognised by the International Dark-Sky Association for its efforts to reduce the impact of artificial lighting on the night sky.

The smart lighting initiative has exceeded its original energy estimates and has made 'fault finding' around the city much easier.



15,000 connected street
lights on our road network

The smart lights are GPS enabled which allows for future-proofed real-time asset management. The lights can be controlled and monitored by an intuitive Central Management System (CMS).

SMART PARKING



Cardiff now has more than 3,300 sensors deployed around the city which are connected to SmartSpots throughout the city. These relay information to a cloud based back office system which collects data. The Council uses this data to monitor its parking assets and to plan improvements to the management of parking in the city.

The system also feeds parking availability data to a free app that allows users to see in real time which of the on street spaces are available and also directs them to an available space. The user is also given a link that allows them to pay for parking via a remote payment solution (miPermit). ParkCardiff is Europe's first city-wide application of smart parking technology.

Testing

Cardiff initially deployed 225 Smart Parking RFID equipped sensors in central parking hotspots to see if the technology worked.

Drivers

Looking for parking spaces causes congestion, increases fuel consumption and raises carbon emissions in the area.

Benefits

The system provides vital parking data to the Council and gives users real-time information on available spaces throughout the Cardiff area. The app is bi-lingual (English and Welsh) and helps to alleviate city congestion, reduces user's fuel consumption and carbon emissions.

The app is available to download on Android or iOS



BIKE SHARING SCHEME - NEXTBIKES

The success of Cardiff's bike sharing scheme is a great example of partnership working. The bike sharing scheme has 500 bikes and 60 stations now in operation and is set to double this year. The success of Cardiff's nextbike scheme has exceeded all expectations and has now become an integral part of the city's transport infrastructure.

Drivers

The bike sharing scheme was supported by Cardiff Council and Welsh Government to help reduce congestion, free up parking spaces and provide a healthy, sustainable way to travel around the city. Cardiff wants to become a cycling city and the nextbike scheme aims to encourage people to leave their cars at home and consider alternative travel options.

Benefits

The nextbike scheme has been a huge success and its users are helping Cardiff achieve its target of a 50:50 modal shift by 2026 (50% of journeys to be taken by sustainable modes of transport and 50% by car). The bike sharing scheme has improved the visibility of bikes in the city and has encouraged greater cycle use which brings with it health and environmental benefits.

The nextbike scheme is due to extend later this year allowing users access to 1000 bikes, across 130 stations.

Over 278,000 nextbike rentals have taken place since the schemes launch in 2018.





Cardiff is looking to develop into a cycling city where cycling is an accessible, easy and natural choice for everyone. Over the past few years cycling has become more visible within the city and Cardiff is determined to change its transport infrastructure so that it becomes more bike-friendly.

There are 5 proposed cycleway routes across the city:

- ▷ **CYCLEWAY 1:** City Centre to Cathays, University Hospital Wales, Heath High Level and Heath Low Level Rail Stations, and North East Cardiff Strategic Development Site
- ▷ **CYCLEWAY 2:** City Centre to Adamsdown, Newport Road retail parks, Rumney, Llanrumney and St. Mellons Business Park
- ▷ **CYCLEWAY 3:** City Centre to Cardiff Bay
- ▷ **CYCLEWAY 4:** City Centre to Llandaff, Danescourt and North West Strategic Development Site
- ▷ **CYCLEWAY 5:** City Centre to Riverside, Ely and Caerau.

Cycleways are continuous, segregated cycle paths that will provide a safer, faster and more direct journey to and around the city. Cycleways will improve air quality in the city, promote active lifestyles and will help increase the modal share for bicycles in the City.



CARDIFF CAPITAL REGION METRO

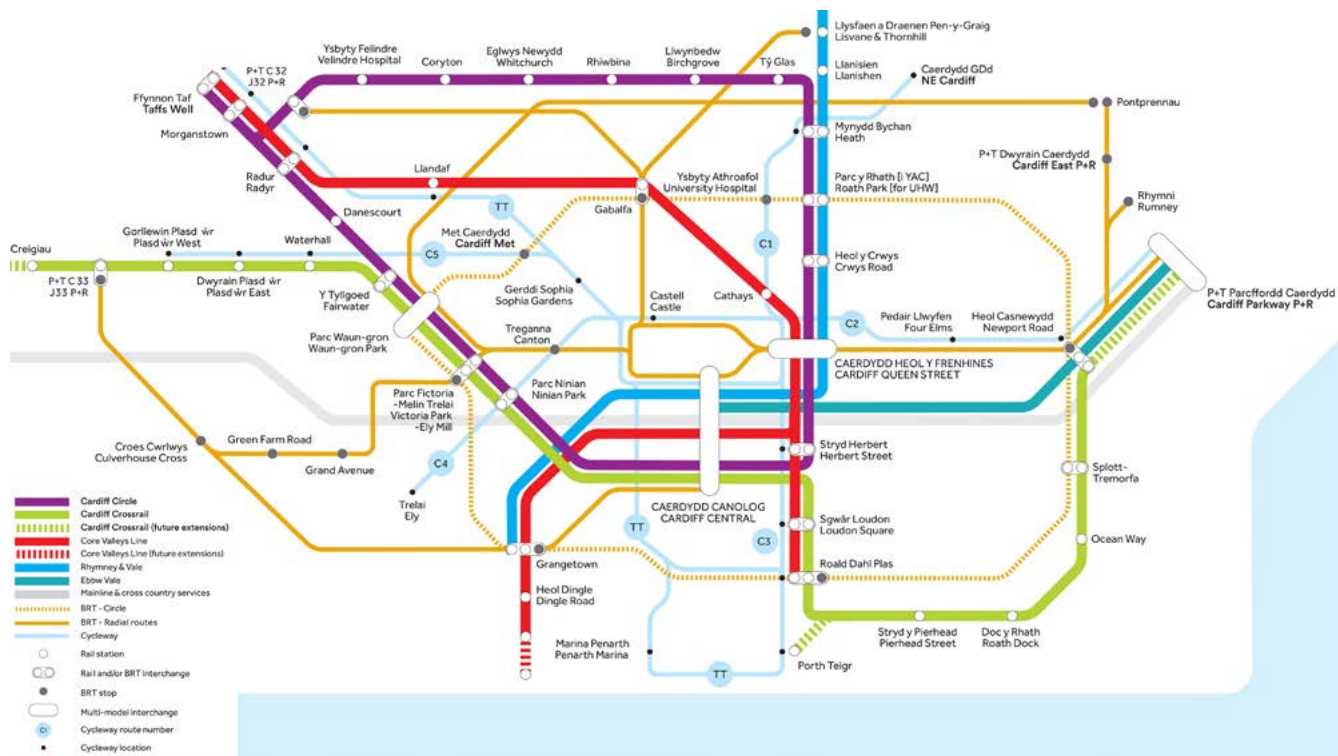
Cardiff is working closely with Welsh Government, Transport for Wales (TfW) and other partners to support delivery of the 'Metro'. The Metro will comprise of a combination of rail-based (heavy and light) and bus-based rapid transit routes linked through interchanges.

The Metro will deliver fast and frequent services connecting the city centre with its suburbs and key destinations across the region. The plan is to integrate all existing city bus networks with the new Metro services to offer seamless interchange between services.

The connectivity provided by 'Metro' style networks can help attract economic investment and better, higher skilled jobs.

Plans for the South East Region can be found at

www.tfw.gov.wales/whats-happening-south-east-wales




MISSION OVERVIEW




Cardiff will carry out the following missions to contribute towards solving the City's challenges


MISSION 1: A COLLABORATIVE CITY - Ensure people have an opportunity to be involved in Cardiff's Smart City Transformation

- 
- ▶ Collaborate and explore better ways to engage with the city
 - ▶ Engage with employees to maximise outcomes
 - ▶ Tackle digital exclusion and digital literacy
 - ▶ Commit to partnership working


MISSION 2: A DATA-DRIVEN CITY - Use data to improve decision making, provide better services and promote innovation in the city

- 
- ▶ Use data more effectively
 - ▶ Invest in and develop data skills
 - ▶ Make data more openly available
 - ▶ Develop public trust in the sharing and use of data


MISSION 3: A CONNECTED CITY - Ensure connectivity is future proofed, resilient and improved so that our digital infrastructure can compete with the best in the UK

- 
- ▶ Improve fibre infrastructure
 - ▶ Embed Cardiff Internet Exchange into the region
 - ▶ Ensure the smooth roll out of 5G & enhance mobile connectivity
 - ▶ Harness the power of the Internet of Things (IoT)

MISSION 4: A MOBILE & SUSTAINABLE CITY - Use technology and innovation to improve the city's transport infrastructure and support Cardiff in becoming a low carbon city

- 
- ▶ Use the latest technology to keep Cardiff moving
 - ▶ Explore infrastructure requirements for autonomous vehicles
 - ▶ Develop smarter infrastructure and smarter built environments
 - ▶ Implement smart energy infrastructure

MISSION 5: A HEALTHY CITY - Ensure that public services are joined up and that people stay healthy and independent

- 
- ▶ Use digital technology to support users to remain independent
 - ▶ Co-design health technologies
 - ▶ Join up public services
 - ▶ Use technology to improve physical activity and improve well-being

Mission 1

A Collaborative City



- Ensure people have an opportunity to be involved in Cardiff's Smart City transformation

MISSION 1 – A COLLABORATIVE CITY



How we work together and share information within the city is important. To succeed as a smart city we believe that people should be at the forefront of everything that we do. We need to engage with our citizens, businesses, universities, health board, charities, community groups and entrepreneurial start-ups to ensure that we are creating a smart city which meets their needs and expectations.

The Capital has diverse needs and difficult challenges ahead. These challenges will only be solved through collaboration and engagement.

In order to achieve this mission Cardiff will work on the following:

- Collaborate and explore better ways to engage with the city
- Engage with employees to maximise outcomes
- Tackle digital exclusion and digital literacy
- Commit to partnership working

COLLABORATE AND EXPLORE BETTER WAYS TO ENGAGE WITH THE CITY

We will ensure that all city stakeholders are involved in our smart city journey - this includes our citizens, businesses, universities, third sector, health partners, emergency services, entrepreneurs, start-ups and public bodies. In order for Cardiff to evolve into a smart city it needs to maximise the use of clever ideas and look for innovative new ways to solve problems and develop services. By working together we can develop better living, working and playing spaces that meet the needs of everyone in the Capital.

The city has some of the best universities in the UK and has become a hub for innovators, with entrepreneurial start-ups 'springing up' all over the city. Our Health Boards, public sector partners, third sector and businesses are working on and completing an array of different projects. However, in some cases a key ingredient is missing – the 'joining up' of all these different activities and projects so that people can share knowledge, collaborate and help to solve some of the challenges that the city faces. We need to provide a mechanism where people have the opportunity to share ideas, expertise and knowledge so that everyone has an awareness of the good work being undertaken across the city.

We have an exciting opportunity to create a more 'joined up' approach. We will engage with the city and improve collaboration so that we can work together to make Cardiff a smarter city. We will use a range of different digital and non-digital engagement tools so that everyone has an opportunity to participate. We will look to accelerate our smart city aspirations by leveraging the skills and expertise in the city.

ACTIONS:

- Host events to promote the 'Smart Cardiff Roadmap' and obtain feedback and views.
- Set up website functionality which allows innovators to submit 'smart' ideas to improve the city.
- Host and participate in workshops, hackathons, question and answer sessions and focus groups to identify and solve smart city challenges.
- Engage with the city using online platforms and social media to share best practice, to innovate and facilitate networking.
- Investigate funding mechanisms to support smart innovation in the area.

ENGAGE WITH EMPLOYEES TO MAXIMISE OUTCOMES



Council employees need to be empowered and given the opportunity to contribute their ideas in to the smart city space. Various departments within the council will be involved in implementing 'smart approaches' so we need to ensure that employee engagement is a priority. Involving employees will help us quickly and effectively transform the city.

We will ask our employees to step outside of their existing delivery processes, and look for new ways to improve the city. We want them to explore and identify new opportunities that will make a difference. Sometimes, it's the little things that make a difference such as 'process redesign' which can create efficiencies and bring real value to our citizens.

We will involve employees in decision making so they are involved in everything that we do. In order to drive the city forward we must show employees that we respect their expertise and listen to their views. We will look to support 'smart' ideas and action feedback with the intention to continually improve and transform the city. Our smart city approach will be embedded into our workplace culture to ensure that we are constantly innovating and maximising outcomes.

ACTIONS:

- Internally promote our smart city aspirations so that employees understand why we want to become a smart city.
- Create innovation groups to find areas where smarter approaches can dramatically improve outcomes in the city.
- Encourage, support and bring about cross-departmental collaboration to ensure projects are delivered smoothly.
- Obtain feedback and views from employees and use this to shape the future of Cardiff.
- Ensure employees have the necessary support to deliver smart city initiatives.

EMPLOYEE CHARTER – A CARDIFF STANDARD

Cardiff is committed to getting the best from its staff and as a result it has created an 'Employee Charter' which is a statement of what the council will do for its employees and what it can expect in return.

The charter defines a 'Cardiff Standard' which details clear values and priorities that everyone who works in the organisation will need to know and aspire to. It will play a key role in helping to embed the Council's new values of being Open, Fair and Together.



TACKLE DIGITAL EXCLUSION AND DIGITAL LITERACY



We aim to tackle digital exclusion by ensuring everyone has the capability to access online services and has a 'voice' in shaping services for the future.

We will design services which meet the needs of our users without them having to understand the intricacies of council processes and remove barriers which prevent people from accessing online services.

We have a rapidly growing digital tech sector in Cardiff and we need to ensure that this momentum continues. To support this growth we need to ensure that pupils and students are provided with the 'right' digital skills to prepare them for the work place of the future. We need to showcase the opportunities that are presently available and give them sight of emerging opportunities that will arise from the progression of technology (such as artificial intelligence and nanoscience).

To ensure we are prepared for the rapid growth in the digital tech sector we will work with our schools, colleges, universities, public bodies and businesses to ensure that current and future needs are met whilst ensuring nobody is left behind.

ACTIONS:

- Ensure that when we are designing digital services we remove barriers that prevent people from accessing services.
- Work with our Cardiff Commitment Team, schools, universities and the private sector to ensure that pupils are getting the opportunity to explore their own potential through technology.
- Investigate how smart city initiatives can be used as a cross-curricular topic of study in Wales' new school curriculum.
- Collaborate with our public bodies and private sector partners to showcase digital technology in the area.
- Provide support to local community groups who are working to improve digital inclusion in the area.

CARDIFF COMMITMENT – BRINGING THE PUBLIC AND PRIVATE SECTOR TOGETHER TO CONNECT YOUNG PEOPLE



The **Cardiff**
Commitment
Addewid Caerdydd

Cardiff Council has established Cardiff Commitment which brings the public and private sectors together to work in partnership connecting young people to the vast range of opportunities available in the world of work.

Cardiff Commitments role is varied and its work includes bringing employers to schools to do industry talks, work skills training, promoting apprenticeships in the area, as well as offering mentoring and support. The initiative has been hugely successful with over 190 employers pledging support. There are new employers being added on a daily basis

The main goal of Cardiff Commitment is to ensure that all young people in the city eventually secure a job that enables them to reach their full potential whilst contributing to the economic growth of the city. If you are an employer who is interested in pledging support then visit:

www.cardiffcommitment.co.uk

COMMIT TO PARTNERSHIP WORKING



Strategic partnerships are important to us as they allow us to share expertise and get access to a broader range of resources and expertise. It is important that we choose partners who share our values, and are committed to making Cardiff a better place to live, work and visit.

Cardiff will look to forge strong smart city partnerships to accelerate its smart city aspirations and achieve its common goal of improving the city. We already have a number of successful partnerships set up such as the Cardiff Partnership and Cardiff Public Services board.

Our universities and businesses have a vital role to play in making Cardiff a Smart city. They are often using and researching cutting edge technology which could help address the challenges that the city faces. Technology is progressing rapidly and it is difficult for local authorities to keep up with this rate of change. It is important that we set up partnerships with our universities and businesses so that we can work together to evaluate new digital technologies and determine if they can 'add value' to our smart city aspirations.

We will set up cluster partnerships where expertise and experience from across the city can get together to tackle specific smart city projects. Working in partnership will create evident and tangible benefits for the city.

ACTIONS:

- Set up common working arrangements to encourage successful strategic partnerships.
- Set up partnership clusters which will be committed to tackling specific smart city challenges.
- Set up common collaborative platforms which allow organisations to share information easily.
- Investigate external funding opportunities with our partners to bring improvements to the city and the wider region.





Cardiff Capital Region

The Cardiff Capital Region City Deal (CCRCD) partnership brought together the 10 South East Wales local authorities, the UK and Welsh Government to work together to improve economic outcomes for the South East Wales region.

The City Deal is building on the region's sectoral strengths, its current skills base and three successful universities, creating a regional way of working which has never been seen before in South East Wales, developing a region where people want to live and work.

This is an enormous undertaking, which has involved all authorities working closely with stakeholders to ensure that the aims and the objectives of the City Deal are met.



Mission 2

A Data-Driven City



Use data to improve
decision making, provide
better services and promote
innovation in the city

MISSION 2 - A DATA-DRIVEN CITY



How we manage data is important to the city. Data-driven decision making has become the 'norm' for most private sector organisations but many local authorities have not embraced this change. Cardiff already holds vast amounts of data but up until now the main focus has been using the data for a targeted purpose – the potential benefits have not been fully realised. We will look to change this and ensure that we use data to develop more efficient and effective services.

Being more strategic with data will not only benefit Cardiff Council, it will benefit our partner organisations, businesses and citizens. It will give us insight into what works well, allow us to make evidence-based decisions and will move us towards more proactive methods of delivery.

Cardiff aims to be a city that uses data to make informed decisions. To succeed in this area we will embark on the following:

- Use data more effectively
- Invest in and develop data skills
- Make data more openly available
- Develop public trust in the sharing and use of data

USE DATA MORE EFFECTIVELY



Cardiff holds vast amounts of data and it's important that we become effective in data-driven decision making. Cardiff Council provides numerous services and like most public and private organisations it is impossible to find one software application that meets all our needs, as a result this creates data silos – where information does not flow freely between different departments.

To ensure we are moving forward in this area we will be more pragmatic with data and investigate ways of combining key datasets to ensure we are using data more effectively. We will be transparent with our use of data and work in line with the General Data Protection Regulations (GDPR).

We will use digital tools to create reports and dashboards so that we are in a position to gain useful business insight. We will investigate how we can become more predictive and prescriptive with our services using data analytics, data science, machine learning and artificial intelligence.

Using data effectively will help us understand the city and its people's needs. It will provide us with an opportunity to create better, more relevant services and allow us to make informed decisions.

ACTIONS:

- Ensure leaders and senior managers support a data culture - where data and analysis are used to inform decision and policy making.
- Create data challenges to prioritise the linking of high value datasets that could quickly make improvements to services.
- Adopt an agile approach to gathering, analysing and interpreting datasets.
- Complete a Data Strategy which will act as a roadmap for all data related activity.
- Give employees the ability to visualise data using software.
- Investigate the use of a central integrated account as a gateway to services. This will prevent/reduce the duplication of data.



CONNECTING AND VISUALISING DATA - MAKING INFORMED DECISIONS

We are adopting an agile approach to working with data. This will provide us with an opportunity to forge stronger relationship between our ICT departments and our business areas. It will create a sense of 'joint ownership' and accountability. The breaking down of cultural barriers will ensure that both the business area and our ICT departments have a chance to sit in the same room and exchange requirements, ideas and actions.

We have started working on a pilot project using data that is associated with our mobile applications and websites. The data we are using in this project is varied and ranges from the number of users who have visited a site, to user reviews and feedback. This data comes from a variety of sources such as Google Analytics, Google Play Store and Apple App Store.

The main aim of the project is to migrate the data into a central repository, 'connect' the data and then explore the data using visual reports (dashboards). The insight from this data will allow us to improve existing services and will 'pave the way' to us providing better services in the future.

INVEST IN AND DEVELOP DATA SKILLS



The use of data will play a huge role in our economy and change the way that services are provided throughout the UK. Cardiff has an exciting opportunity to become an innovative, data-driven local authority who are pioneering with their use of data.

Our approach to using data more effectively starts with the acknowledgement that we have 'skill gaps' in this area. We intend to 'bridge' those skill gaps and demonstrate to employees the benefits of working with data.

We will look to identify staff who have a role in analysing data and then provide relevant staff training and development.

We will look to work with Cardiff University's Data Innovation Research Institute, Data Science Academy and Data Innovation Accelerator, and look for opportunities to collaborate with other organisations that are proactive with data with a view of learning from their experiences and getting greater creative input.

VIRTUAL ASSISTANT – MODERNISING CUSTOMER CONTACT & DELIVERING NEW SKILLS

The Virtual Assistant Project aims to modernise both internal and external customer contact and automate transactional services. A virtual assistant is able to perform tasks or services for an individual based on their commands. For instance, if a user wanted to know what day their waste and recycling are collected, the virtual assistant would be able to respond accurately and accordingly.

The proposals include:

- Two way conversations through a keyboard or smart device – driven by artificial intelligence.
- Voice recognition and speech synthesis – the customer's speech is analysed and responded to accordingly using synthesised speech.
- Fly-tipping vision recognition (proof of concept) – the identification of items dumped through visual analysis.

During the implementation phases of this project our ICT teams will receive technical training to continue with subsequent phases of development. It is important that employees are given the opportunity to work with innovative technology and 'keep up' with industry change. The training delivered as part of this project will ensure we have the skills and knowledge required to meet our

ACTIONS:

- Identify employees who have a role in analysing data and invest in training and development in areas such as data analytics, machine learning and artificial intelligence.
- Bring academia, the public and private sector together to improve how data is taught in schools and showcase how it is used in the wider world. The overall aim is to ensure children learn how to use and understand data effectively.
- Knowledge share with academia, public and private sector organisations who already use data to their advantage.
- Internally showcase products and projects where data has been used to make an impact.
- Create mentoring initiatives to further develop skills and knowledge in the use of data.

MAKE DATA MORE OPENLY AVAILABLE

Cardiff Council intends to publish open data to become more transparent and accountable. We see open data as an opportunity to engage with and empower citizens. The publishing of open data is also welcomed by businesses, entrepreneurial start-ups and academics as it allows them to exploit gaps across markets, identify business opportunities, create new products and services and develop new business models.

The amount of data that Cardiff Council collects is likely to increase with the rise of the Internet of Things (IoT) as just about everything can now be sensed and measured. The data gathered from IoT devices will enhance the data that we already hold and allow for better decision making. The publishing of this data could also give our businesses and citizens the opportunity to develop new products and services.

It is fair to say that producing and publishing open data comes with various challenges ranging from licensing issues to continually publishing accurate, up-to-date data. However, it has already been embraced by many government organisations and there is now a huge range of open datasets available from various government organisations.

The Open Data Institute¹ defines open data as:

“Data that anyone can access, use and share. For data to be considered ‘open’, it must be published in an accessible format, with a licence that permits anyone to access, use and share it.”

TRANSPORT FOR LONDON – OPEN DATA

Transport for London (TfL) have embraced open data and seen real benefits. They publish a variety of open datasets which include areas such as air quality, tube times and travel disruption.

TfL’s approach has been welcomed by software developers with thousands of them registering for access to their open data feeds. As a result developers have produced hundreds of innovative new transport services and apps which bring benefits to commuters across London.

TfL release of open data has produced economic benefits in London and beyond by supporting the creation of technology enterprises and generating employment. TfL have also seen wider benefits such as reduced pressure on their contact centre and better journey planning.²

ACTIONS:

- Work with stakeholders to investigate and prioritise high value open datasets that would be beneficial to the city.
- Create a data store repository which allows easy access to open data in a non-proprietary format, and encourage organisations to contribute their data.
- Work with our universities, public and private sector partners to share best practice around Open Data.
- Work with schools to investigate if data related projects could be fed into open data smart city projects. This would give young people an opportunity to be involved and help shape future thinking.

1. Open Data Institute (2015) Open data means business: UK innovation across sectors and regions. London, UK. Available at <http://theodi.org/open-data-means-business-uk-innovation-sectors-regions>. Accessed March 2019.

2. Deloitte report, TfL open data. Available at <http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf>. Accessed January 2019.

DEVELOP PUBLIC TRUST IN THE SHARING AND USE OF DATA



We have seen many smart city data projects ‘grind to a halt’ as local authorities and private sector companies have not been open or transparent with the way they are collecting, using or sharing data - Cardiff does not want to make the same mistake.

GDPR laws have strengthened the rights of data holders and have rightly made the public and private sector much more accountable to their residents, service users and customers.

If Cardiff is to succeed as a smart city it needs to gain public trust and show that it is transparent with its collection, use and sharing of data. There are already processes in place which look at various aspects of GDPR such as information governance and consent. However, the use of new digital technologies such as the use of sensors in public spaces and developments in artificial intelligence will need different ways of thinking as it brings with it a range of barriers such as trust, legal obstacles, ethical and moral dilemmas.

We will work with academics, businesses, public bodies and other cities to see how they have addressed public trust concerns and learn from their experiences. We will investigate the use of ‘data trusts’ frameworks. Data Trusts have been highlighted in the UK Industrial Strategy as a possible mechanism for the safe, secure and equitable transfer of data.

ACTIONS:

- Ensure citizens are informed of how we use their data through appropriate communication methods.
- Investigate the use of ‘data trusts’ and learn from Cities which have taken part in pilots.
- Investigate how we can improve data sharing in general by looking at a range of information sharing frameworks.
- Work collaboratively with academics, businesses, public bodies and other cities to investigate how they have improved public trust and learn from their experiences.

WHAT IS A DATA TRUST?

The Open Data Institute has been heavily involved in setting up a range of data trust pilots across different sectors including local government. Their aim is to find out if the data trust model can work in real word situations. They have adopted the following definition of a data trust:

“ *A data trust is a legal structure that provides independent stewardship of data.* ¹ ”

For example, a data trust could bring a range of stakeholders together who would be accountable for what information is shared. They would make key decisions on whether data can be released and who it can be released to. They would work in line with GDPR and could potentially help solve the overuse, underuse or misuse of data.

¹. Open Data Institute (2015) Defining a data trust. Available at <https://theodi.org/article/defining-a-data-trust/>. Accessed February 2019

Mission 3

A Connected City



Ensure connectivity is
future proofed, resilient and
improved so that our digital
infrastructure can compete
with the best in the UK

MISSION 3 – A CONNECTED CITY



The number of connected devices is expected to increase rapidly over the coming years. This will dramatically change how people and devices interact with content and services. As a result connectivity will have to be ubiquitous and capable of connecting both low powered and high throughput devices.

The Internet of Things has the potential to blur the boundaries between the physical and the digital world. It will allow us to constantly monitor and control our built and natural environments and will help us inform decision making. We need to ensure we have the necessary infrastructure in place to support these devices.

In order for Cardiff to prosper we need to look ahead and improve connectivity so that everyone benefits from the digital era. This will involve collaboration with telecommunication suppliers, landowners and public bodies to ensure that the city has the right digital infrastructure for the future.

In order for Cardiff to improve connectivity in the region we will:

- Improve fibre infrastructure in the city
- Embed Cardiff Internet Exchange into the region, to provide low latency services
- Ensure the smooth roll out of 5G and enhance mobile coverage
- Harness the power of the Internet of Things



IMPROVE FIBRE INFRASTRUCTURE



Fibre connectivity is vital to a modern city. It is used to transmit data to and from our citizens and businesses, it facilitates innovation, make services more accessible, reduces social isolation, enhances learning in our schools and is the backbone for 5G and the Internet of Things (IoT).

High speed connectivity will support the growth of new technologies such as telehealth solutions, mobile entertainment, virtual reality, augmented reality, virtual learning environments and new ways of working. It is important that Cardiff is planning for the future to ensure that its businesses and citizens reap the benefits of fast connectivity.

Over 97 % of premises across the city have broadband speeds of over 30M/bits per second. However, this level of service is not available city wide and is often delivered by copper as opposed to fibre.

We will explore and pursue new ways to increase the availability of affordable high speed fibre connectivity (also known as 'fibre to the premise' – FTTP) by investigating the use of open access infrastructure. This approach will promote competition, provide greater consumer choice and ultimately result in lower prices.

Telecommunication companies report that one of the biggest barriers to expanding coverage in the city are the costs associated with civil works involved in its delivery. To combat this issue we are actively pursuing the laying of additional ducting at new developments and new road schemes that take place throughout the city. This ducting will help telecommunication companies quickly roll out fibre connectivity in the Capital.

We will ensure that fibre connectivity around the city is improved and future-proofed so that everyone can benefit from fast, affordable and reliable connectivity.

ACTIONS:

- Identify areas with poor connectivity and work with telecommunication companies to encourage greater investment in these areas.
- Investigate open access infrastructure to increase competition and reach less commercially viable areas.
- Reduce costs for fibre installation by installing ducts in new developments and new roads schemes ('dig once' approach).
- Work with our Cardiff Capital Region City Deal and Welsh Government to explore opportunities for improving fibre connectivity across the whole region.
- Improve fibre infrastructure in key areas to support our growing creative, fin-tech and reg-tech sectors.

Cardiff broadband speeds



97% of premises have speeds of over **30M/bits per second** available.

71.2% of premises have speeds of over **100M/bits per second** available.

42.9% of premises have speeds of over **300M/bits per second** available.

2.8% of premises have speeds of over **1G/bits per second** available

EMBED CARDIFF INTERNET EXCHANGE INTO THE REGION



Cardiff's Internet Exchange places Cardiff in a strong position in terms of global connectivity and connecting to the outside world. IXC Cardiff is operated commercially by LINX and is Wales' only internet exchange.

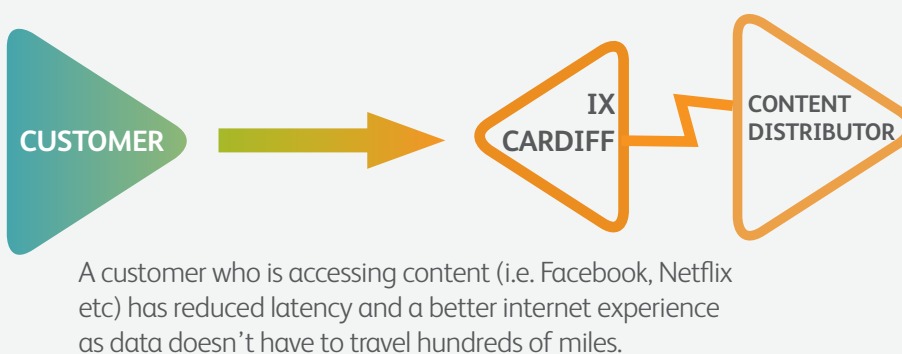
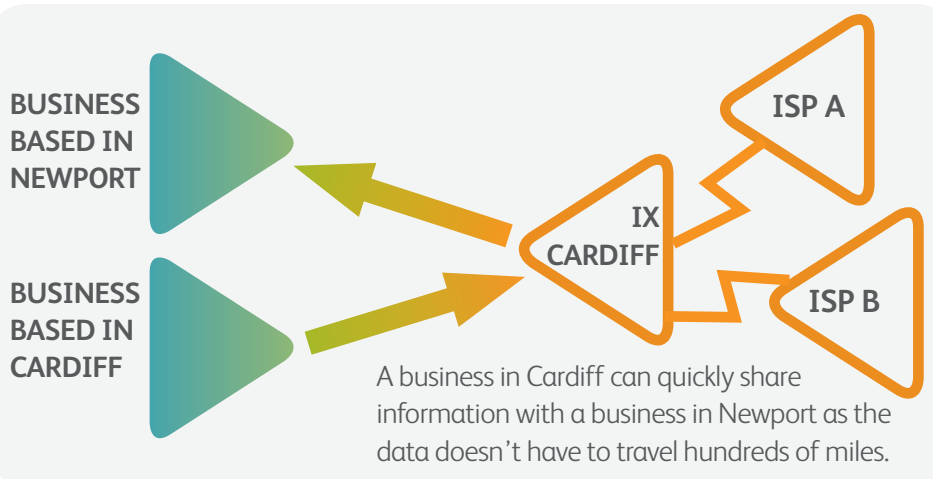
The presence of the Internet Exchange in Cardiff has the potential to boost employment in the area by attracting digital business. This will improve the digital economy and make Cardiff a more attractive place to live and work. For businesses, the Internet exchange can make a real difference as it can improve internet speeds, improve resilience and make sharing data and accessing online services faster and easier.

The benefit to customers are in terms of speed and reliability as data does not need to be sent hundreds of miles to internet exchanges outside of the region.

We will continue to embed IXC Cardiff into the region so that it attracts larger content providers, this will help deliver a richer internet experience to end users in the Region.

ACTIONS:

- Increase awareness and drive adoption of IXC Cardiff by engaging with businesses.
- Engage with content providers and Internet Service Providers (ISPs) to attract them to IXC Cardiff.
- Improve accessibility to IXC Cardiff.



ENSURE THE SMOOTH ROLL OUT OF 5G AND ENHANCE MOBILE COVERAGE

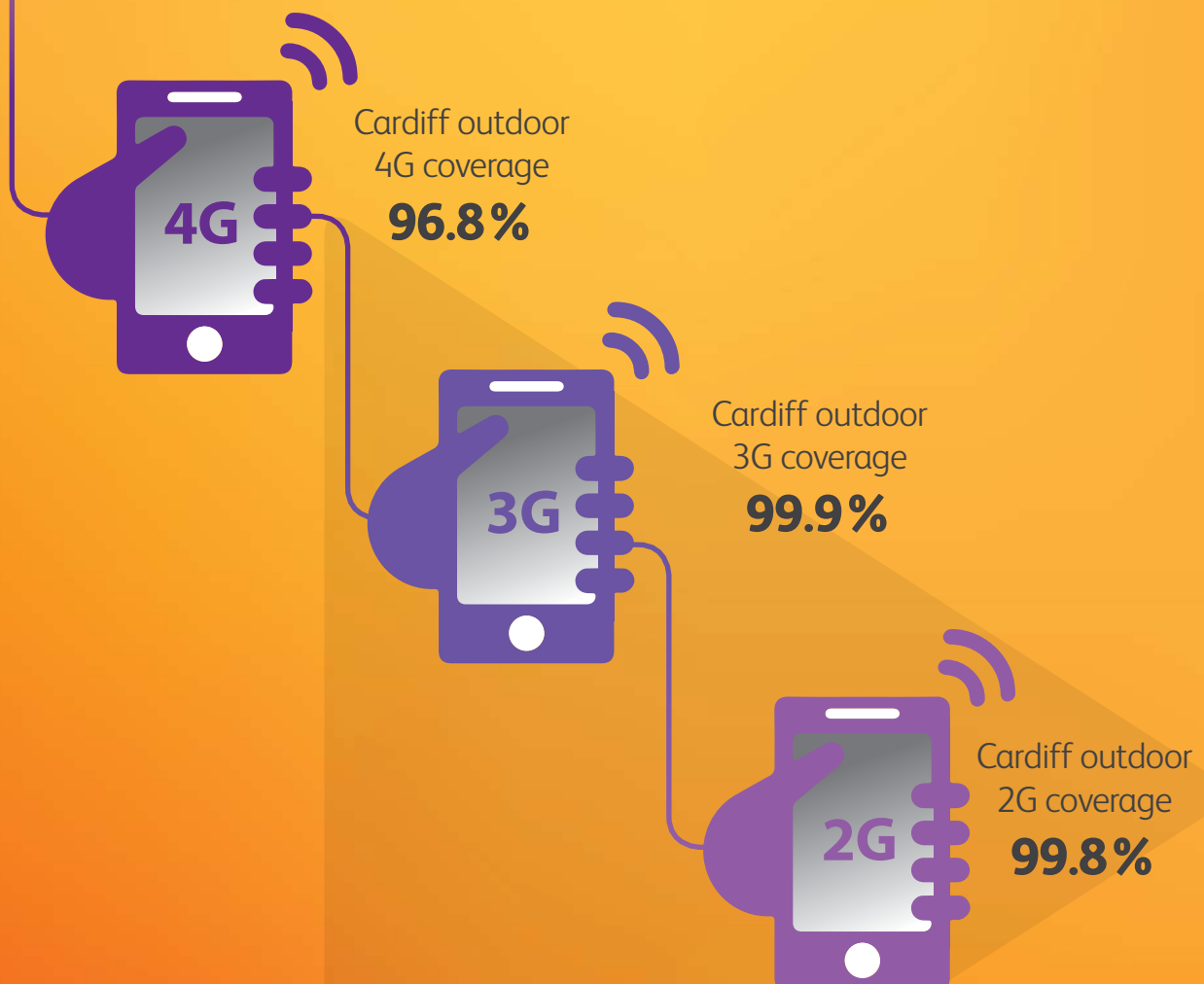
5G promises massively increased data speeds and low latency. 5G has been coined by some as a 'leap of faith' as it is difficult for us to imagine all the services and innovation that will take place over this spectrum in the next 10 years. However, we have seen some strong use cases in areas such as automated vehicles (AV), Internet of Things (IoT), augmented reality (AR) and virtual reality (VR).

We want to ensure that Cardiff is 'future proofed' so we will support telecommunication suppliers in their bid to roll out 5G in Cardiff. This should speed up 5G roll outs and allow our citizens and businesses the opportunity to innovate and invent new services.

Cardiff has excellent mobile phone coverage with 96.8% of the city having outdoor 4G coverage. However, there is still a small proportion of Cardiff with poor signal coverage. We will work with telecommunication suppliers to reduce mobile 'not spots'.

ACTIONS:

- Work with 5G telecommunication suppliers to support subsequent 5G roll-out throughout the city.
- Build stronger relationships with the telecommunication companies.
- Tackle mobile 'not spots' to improve mobile phone coverage by working closely with Central Government, Welsh Government and DCMS.
- Work with 5G innovators to test and pilot use-cases that will bring benefits to the city.



HARNESS THE POWER OF THE INTERNET OF THINGS (IOT)



The Internet of Things (IoT) has the potential to transform the world we live in. It offers us an opportunity to gather information from the physical world and process it in the digital world. The data collected from IoT devices can be used to make informed decisions, to automate processes and allows for predictive modeling. IoT can reduce operating costs, create efficiencies and provide opportunities to develop new products or services.

We have seen numerous local authorities harness the power of IoT. For instance, local authorities have used sensors on salt bins to warn when levels are low, and temperature monitors embedded into the road surface to determine if gritting is needed.

We will expand our use of IoT and investigate creative ways of solving problems. We will take an outcome based approach to using IoT so that a wide range of benefits are seen throughout Cardiff.

ACTIONS:

- Create IoT business cases which are outcome based and take into account social, environmental and economic benefits.
- Investigate city wide IoT platforms that can support a range of high throughput and low powered IoT devices, to tackle defined city challenges.
- Create a 'City Challenge' where innovators can help address particular problems in the city using IoT.
- Use IoT data to do predictive modelling and real time analytics to enhance social, environmental and economic outcomes.

“ Cardiff already has a network of Internet of Things (IoT) devices which are situated throughout the city. For example, we have 3,300 parking sensors which provides real time parking information to our smart parking application (ParkCardiff). ”



Mission 4

A Mobile & Sustainable City



Use technology and innovation to improve the city's transport infrastructure and support Cardiff in becoming a low carbon city

MISSION 4 – A MOBILE & SUSTAINABLE CITY

The city is expected to grow exponentially over the next 20 years. This growth will put pressure on the city's transport and energy infrastructure as well as its natural environment. Cardiff needs to ensure that the impacts of population growth are managed in a sustainable manner whilst ensuring that people can easily move around the Capital. Cardiff has a target of achieving a 50:50 modal split by 2026 (i.e. 50 % of journeys to be made by sustainable transport). To help achieve this target Cardiff needs to adopt smart technologies. These technologies will enable us to effectively manage the network, tackle air pollution, prioritise public transport and active travel provision, influence travel behaviour and provide data that will help us plan better.

Smart city approaches could also make Cardiff more sustainable - Understanding how people move, how energy is consumed, and how resources flow, can allow for better management of infrastructure, improve efficiency and reduce wastage. Bins can be collected when they are full; smart grids can balance energy supply and demand; lights can shine when and where people actually need them.

Digitisation of products and services can bring less demand for resources and fewer journeys. Just as Spotify replaces the trip to buy a physical CD, online learning allows the teaching to come to the student.

Smart city tools, can also enable more sustainable behaviours. Digital platforms are supporting the sharing economy - car clubs, co-working, and peer-to-peer exchange. Navigation Apps are designed to make walking or cycling options easier, which aims to encourage more sustainable choices. To ensure we keep Cardiff moving and grow more sustainably Cardiff is proposing the following initiatives:

- Use the latest technology to keep Cardiff moving.
- Explore infrastructure requirements for autonomous vehicles.
- Develop smarter infrastructure and smarter built environments.
- Implement smart energy infrastructure.



USE THE LATEST TECHNOLOGY TO KEEP CARDIFF MOVING



Cardiff's highway networks are like those in many cities in the UK – they get congested, especially at peak times. Traffic congestion has many different social, economic and environmental consequences including frustration, delays, reduced leisure time, increased fuel consumption and increased emissions which can affect the air that we breathe.

In order to reduce congestion and keep Cardiff moving we will take an iterative approach to traffic management. This will involve using parts of the network as 'living labs' where we can test, optimise and demonstrate how smart roads can be designed and maintained before they are rolled out city wide. We will ensure that we choose flexible solutions which are able to adapt to changing travel plans and strategies so that we meet the needs of the city in the future.

We will investigate how travel behaviour in the city could be changed by using a process known as gamification to encourage people to move around the city differently by offering incentives. Gamification uses parts of games to encourage certain behaviours by providing motivation and incentives. Other cities have used gamification to reduce congestion in the city. We will also explore how real-time information can be used to inform motorists of travel disruption through websites, apps and variable message signs.

ACTIONS:

- Work with other UK cities to share 'traffic management' best practice and investigate how they have improved public transport and enabled people to walk and cycle around their cities safely and easily.
- Set up 'living labs' which can be used to test, optimise and demonstrate 'smart' technology before they are rolled out city wide.
- Research how external data sources can be used to 'add value' to the highways network.
- Investigate technology which can prioritise public transport provision in the city.
- Explore how we can be more effective with real time traffic information to ensure accurate and up to date information is conveyed to motorists.
- Explore how gamification can influence mobility behaviour.
- Formulate a strategy for Intelligent Transport Systems (ITS).
- Investigate integrated ticketing systems for Cardiff and the wider region.

An artist's interpretation of how Cardiff's new bus Interchange will look. This is due to be delivered in 2021.



EXPLORE INFRASTRUCTURE REQUIREMENTS FOR AUTONOMOUS VEHICLES



Autonomous vehicle trials have taken place in various Cities around the UK. There is no certainty around what the future holds for autonomous vehicles but it is fair to say that we do not see fully autonomous vehicles becoming a reality within the lifetime of this roadmap. However, connected vehicles which allow vehicles to communicate information are already available. Through deployment of roadside equipment, connected vehicles are able to send and receive information. This information can be used to supply useful information to a vehicle and help the driver make more informed decisions. Data can also be communicated to transport departments which enables them to address real-time conditions such as traffic flow.

Fully autonomous vehicles have the potential to increase car dependency and if this is not managed correctly it could undermine our efforts to increase walking, cycling and the use of public transport provision in the Capital. However, it is important that we are pragmatic with our approach to autonomous vehicles as they could bring benefits to the city particularly around public transport provision and safety.

Over the next few years we will investigate the impacts that this innovative technology could have on the city. We will look to investigate how autonomous vehicles will change travel behaviour in the city and explore the potential interaction these vehicles would have with walkers, cyclists and traditional vehicles. We will also attempt to determine what physical and digital infrastructure requirements would be needed to facilitate autonomous vehicles so Cardiff is ready when autonomous vehicles become a reality.

ACTIONS:

- Investigate digital infrastructure requirements for autonomous and connected vehicles.
- Explore the possibility of setting up an autonomous vehicle test bed.
- Explore how we could make use of the data that is obtained from connected vehicles.
- Investigate the impact that autonomous vehicles would have on behaviour in the city.
- Investigate if physical infrastructure would have to change to support autonomous vehicles.

CARDIFF HEALTHY TRAVEL CHARTER – ADVOCATES OF HEALTHY MODES OF TRANSPORTS

A Healthy Travel Charter has been set up. The charter aims to get organisations to support and encourage their staff and visitors to use healthy modes of transport to get to their sites. A number of public sector organisations have signed the charter, including Cardiff Council, HM Revenue & Customs, National Assembly for Wales and Natural Resources for Wales.

The charter contains 14 ambitious actions which promote walking, cycling, public transport and ultra-low emission vehicle use. Collectively the organisations have committed to reducing the proportion of journeys made by car, increase the proportions of staff cycling to work and increase the proportion of vehicles during the day which are plug-in hybrid or pure electric vehicles by 2022.



DEVELOP SMARTER INFRASTRUCTURE AND SMARTER BUILT ENVIRONMENTS



Cardiff has already embarked on adding smart street lighting to its strategic routes which has helped with reducing energy costs and emissions. The smart street lights also have the capability to be fitted with extra sensors which could be used to gain valuable insight about the city.

There is continued growth in demand for smart buildings, infrastructure and workspaces. These areas includes technologies such as desk occupancy monitoring, building information modelling (BIM), sensing technology and intelligent lighting systems. These technologies generally focus on providing a better understanding of the physical environment and provide data insights. Smarter infrastructure has the potential to give us a better understanding of the city and provide more comfortable and efficient spaces and environments for employees, residents, commuters and visitors. We accept that it is generally difficult to retrofit this type of technology into existing buildings. However, smarter infrastructure needs to be considered in our new buildings and when buildings are due to be refurbished.

We will look to investigate the use of sensors in our smart street lights and look to transform our building assets into more energy efficient buildings. We will change the way we use energy data to optimise comfort and efficiencies in our buildings.

ACTIONS:

- Look for opportunities to deploy smart infrastructure in new buildings and during refurbishment of existing buildings.
- Use technology to real-time monitor the environment to help make improvements to our streets and spaces.
- Work with Cardiff University to create a smart model of the City which has the ability to use and visualise city data to remotely control certain city management systems.
- Expand coverage of smart lighting into residential streets and investigate the use of street lighting sensor technology to gather data about the urban environment.
- Expand coverage of our real time air quality monitoring devices.

SMART METERS – IMPROVING ENERGY USE WITHIN COUNCIL BUILDINGS

Cardiff Councils Energy Management Department are using energy data (gas and electricity) obtained from smart meters in order to use energy more efficiently across our Council Buildings. The Energy Management Team identify unusual energy usage and work with their facilities management partners to optimise energy usage in our building stock.

Our Energy and Facilities Management Team have already delivered a range of projects that deliver significant improvements across our building stock, including:

- automatic meter readers on the vast majority of gas and electricity supplies
- the installation of more efficient LED lighting at a number of sites
- increased generation of renewable energy through the installation of roof-mounted solar PV
- boiler replacement programmes, including the addition of centrally linked smart controls

IMPLEMENT SMART ENERGY INFRASTRUCTURE



As Cardiff grows, the generation and storage of renewable energy will be key to improving the resilience of the city and its natural resources to the potential impacts of climate change. More people, more businesses, and more homes will lead to an increase in the demand for energy. Cardiff will need to invest in energy infrastructure and zero/low carbon alternatives in order to keep up with the demands of the city.

Welsh Government have set out their ambitions to make the Welsh public sector carbon neutral by 2030. We will explore opportunities which have a positive impact on the environment, which reduce energy costs and stimulates the low carbon economy in Wales.

We will investigate the use of renewable energy sources, battery storage initiatives and take steps to have better controls of energy management systems. The uptake of zero/low emission electric vehicles is set to increase rapidly in the UK and it is important that Cardiff has the necessary infrastructure in place to make them an attractive alternative to petrol and diesel vehicles.

New, innovative, more efficient energy infrastructure solutions are becoming available on a daily basis so we need to fully understand the costs and benefits of deploying smart energy infrastructure.

ACTIONS:

- Expand the use of Building Energy Management Systems (BMS/BEMS) and increase the understanding and use of the data gained from these systems.
- Investigate the use of battery storage within schools and other public buildings so that renewable energy or more off-peak power can be stored on-site and used during peak periods.
- Complete work on the 8.7MW Lamby Way Solar Farm and look to maximise storage and use of the electricity generated at certain times of the day.
- Deliver publicly accessible electric vehicle charge points in areas across the city.
- Deliver electric charging infrastructure at key council sites to support the adoption of zero/low emission Council fleet vehicles.
- Look to deliver a district heating network that has the ability to heat public and commercial buildings.

LAMBY WAY – RENEWABLE ENERGY

Cardiff Council is currently undertaking work to complete a renewable energy development at Lamby Way. The development will involve the installation of 30,688 individual solar panels (ground mounted) with an expected output of 8.7 megawatts (MW).

Energy generated from the solar farm will be sold to a near-by business, the National Grid and potentially utilised by our own assets. By 2030, 70% of all energy consumed in Wales has to be sourced from Welsh renewable energy generators.



Mission 5

A Healthy City



Ensure that public services
are joined up and that people
stay healthy and independent

MISSION 5 – A HEALTHY CITY



Health, care and well-being has always been a challenging area with reduced budgets, demographic challenges, a rising demand for care and a requirement for more citizen-centred services. All these challenges open up some real opportunities to accelerate Cardiff in becoming a smarter city.

We want to nurture an ecosystem that looks at new ways of gathering, analysing and presenting data - via new and established technologies such as wearables, machine learning, virtual assistants, sensors, telecare and telehealth solutions. Innovative digital technology with the effective use of data will allow citizens to lead healthier and more independent lives. It will also promote preventative and early intervention methods which will create efficiencies and reduce financial pressures on all parts of the health care system.

We will work with partners to:

- Use digital technology to support users to remain independent.
- Co-design health technology.
- Join up Public Services.
- Use technology to promote physical activity and improve well-being.



USE DIGITAL TECHNOLOGY TO SUPPORT USERS TO REMAIN INDEPENDENT



Over the next 20 years the number of older people living in Cardiff is projected to rise significantly. A growing older population will place increased demand on budgets and put pressure on our hospitals, general practitioners and health and social care professionals.

The 'Digital Health and Social Care Strategy for Wales' details Welsh Government's ambitions to transform the health and social care sector in Wales. In order to meet these ambitions we need to question old ways of working, embrace change and look at cost effective, innovative technologies that will ease the strain on services and support the elderly and disabled to live as independently as possible.

There are a wide range of different technologies in this space which can help people remain independent and allow individuals to take control of their own health. These technologies include mobile apps/devices, smart technologies, video conferencing, telecare and telehealth services, and an array of sensors and devices which can help collect important data and manage and control the physical environment. For instance, telehealth can allow an individual to measure their vital signs at home. This information can then empower the individual to take more control of their own health, but importantly their vital sign information can also be transmitted to medical professional for them to diagnose and monitor conditions. This could potentially reduce hospital admissions and unnecessary visits to health and care professionals.

We aim to expand the use of smart and assistive living technologies to give people the freedom to look after their own well-being and allow them to remain living independently for as long as possible.

ACTIONS:

- Investigate the use of smart and assistive technologies which support well-being and independent living.
- Aim to reduce social isolation by investigating better ways to keep people connected.
- Explore the use of virtual assistants to signpost users to services.
- Use apps and websites to amalgamate services that offer support and advice.
- Upgrade 'Telecare Cardiff' from an analogue to a digital service to take advantage of new IP solutions on the market.
- Work with our health boards to investigate Telehealth options.



CO-DESIGN HEALTH TECHNOLOGIES

Our service users and employees need to play a part in designing health technologies for the future, as they will ultimately influence if new technology is embraced and implemented successfully.

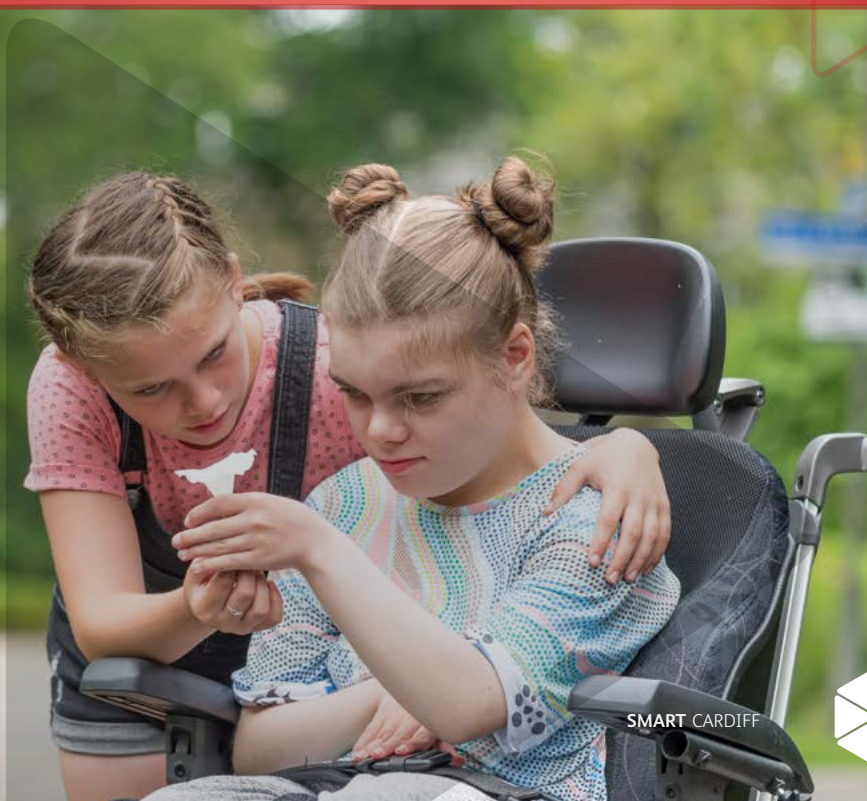
Many of our service users and employees use different types of digital technologies and online services on a daily basis, they use it to stay in touch with family members, to access social media or to shop, bank or read online. However, using technology as a means of improving health and social care provision is not always explored - this needs to change so that it becomes mainstream.

We need to ensure that service users as well as health and social care professionals are given the opportunity to see and use new digital technologies. By exploring these digital technologies they will get a better understanding of its technological capabilities and grow confidence in their own abilities. We will ensure that the people using these new technologies are involved in the decision-making process – service users and professionals can express their views and determine what they want from their technology solutions.

In order to break down barriers we need to encourage and support service users and employees so that the transition to digital is seamless. We will work with suppliers to look at ways of prototyping and piloting new technology to ensure they meet the needs of service users as well as health and social care professionals.

ACTIONS:

- Facilitate showcase events that will provide service users as well as health and social care professionals with the opportunity to explore new technology.
- Work with suppliers to investigate prototyping new health and social care technology so that we can quickly determine if it will meet our needs.
- Pilot digital technologies with small user groups to understand how 'everyone' will benefit.
- Involve service users and health and social care professionals in the decision making process so that they can help shape future technology and services.
- Support service users as well as health and social care professionals when adopting new digital technologies by providing post implementation support.



JOIN UP PUBLIC SERVICES



Public Services information is held in various IT systems throughout Wales, making it difficult to share information across public services. This particularly effects areas such as health and social care and the emergency services. This inability to easily share information causes a number of issues such as data silos, service inefficiencies and makes it difficult to make informed decisions.

To join up services we will look to move towards interoperability. This will enable systems and employees who work in or with the care sector to share information easily. We will investigate a range of different techniques to improve data sharing and look for opportunities to purchase new solutions that can enhance services and improve outcomes for service users and our public services. This will involve collaboration, open standards, data sharing agreements and new ways of working together.

We will look to harness the information that is held in these different IT systems so that we are in a position to analyse and better understand service user journeys. This will allow us to adopt preventative, predictive and tailored care for our citizens and create more efficient services.

We will also look to set up a Digital Health Board which will oversee work in this area and create a digital health and social care strategy that set goals and objectives for the future.

ACTIONS:

- Establish a 'Digital Health Board' with key stakeholders.
- Create a digital health and social care strategy for Cardiff.
- Ensure newly procured health & social care software or systems have the ability to exchange information across different organisations. This will allow them to share information easily (interoperability).
- Use health & social care data more effectively to improve outcomes for citizens.
- Investigate funding arrangements for specific health and social care challenges to increase and speed up innovation in the sector.



USE TECHNOLOGY TO PROMOTE PHYSICAL ACTIVITY & IMPROVE WELL-BEING

People already use a wide range of technologies to improve their health and well-being. There are a range of applications which use GPS to track exercise and wearable devices which track your activity levels, exercise and sleep patterns.

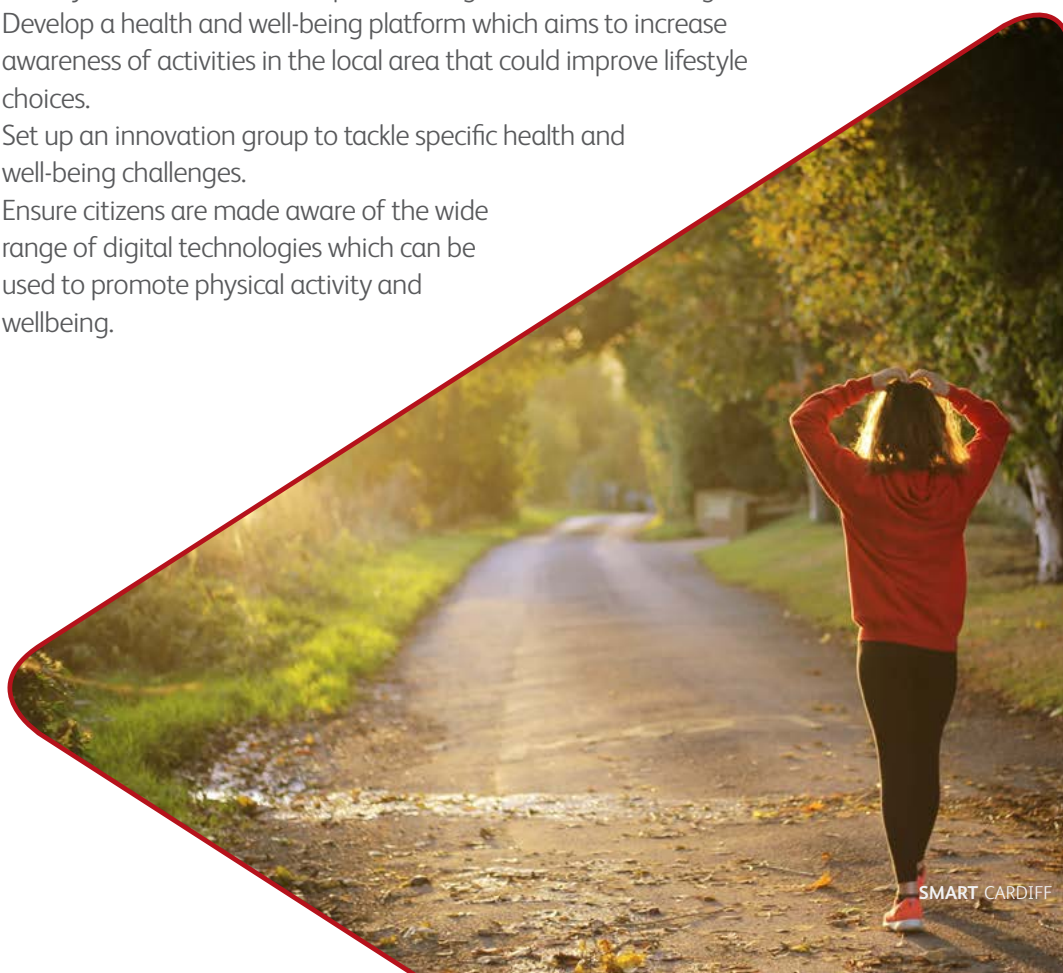
The Internet of Things (IoT) has brought further developments in this area. For instance, there are IoT solutions which clip on to existing asthma inhalers, allowing medical professionals to track when and where the puffs are being taken by users. This data can then be used by medical professionals and users to monitor inhalation technique and frequency. This allows for better management of the respiratory condition.

We will investigate ways that technology can promote activity and improve well-being such as gamification which can act as a motivation tool that looks to change or influence behaviours through incentives - Pokémon Go and Geotagging apps are good example of how games can improve physical activity and wellbeing.

In order to be successful in this area we need to work closely with our public services partners and local innovators to develop ideas on how we can influence behaviour through IoT, mobile apps and wearable technologies. We need to ensure that digital technology is promoted for physical activity and ensure we are not 're-inventing the wheel' as there is already a wide range of apps, IoT sensors and wearable devices out there.

ACTIONS:

- Investigate gamification options to promote physical activity and improve well-being in the city.
- Investigate how technology can be used to improve health and well-being in the city and work with health partners to get initiatives off the ground.
- Develop a health and well-being platform which aims to increase awareness of activities in the local area that could improve lifestyle choices.
- Set up an innovation group to tackle specific health and well-being challenges.
- Ensure citizens are made aware of the wide range of digital technologies which can be used to promote physical activity and wellbeing.



APPENDIX 1 – ROADMAP TIMELINES



MISSION 1: A COLLABORATIVE CITY	Indicative Timeline		
Collaborate and explore better ways to engage with the city	2020	2021	2022
Host events to promote the 'Smart Cardiff Roadmap' and obtain feedback and views.			
Set up website functionality which allows innovators to submit 'smart' ideas to improve the city.			
Host and participate in workshops, hackathons, question and answer sessions and focus groups to identify and solve smart city challenges.			
Engage with the city using online platforms and social media to share best practice, to innovate and facilitate networking.			
Investigate funding mechanisms to support smart innovation in the area.			

MISSION 1: A COLLABORATIVE CITY	Indicative Timeline		
Engage with employees to maximise outcomes	2020	2021	2022
Internally promote our smart city aspirations so that employees understand why we want to become a smart city.			
Create innovation groups to find areas where smarter approaches can dramatically improve outcomes in the city.			
Encourage, support and bring about cross-departmental collaboration to ensure projects are delivered smoothly.			
Obtain feedback and views from employees and use this to shape the future of Cardiff.			
Ensure employees have the necessary support to deliver smart city initiatives.			

MISSION 1: A COLLABORATIVE CITY	Indicative Timeline		
Tackle digital exclusion and digital literacy	2020	2021	2022
Ensure that when we are designing digital services we remove barriers that prevent people from accessing services.			
Work with our Cardiff Commitment Team, schools, universities and the private sector to ensure that pupils are getting the opportunity to explore their own potential through technology.			
Investigate how smart city initiatives can be used as a cross-curricular topic of study in Wales' new school curriculum.			
Collaborate with our public bodies and private sector partners to showcase digital technology in the area.			
Provide support to local community groups who are working to improve digital inclusion in the area.			

MISSION 1: A COLLABORATIVE CITY	Indicative Timeline		
Commit to partnership working	2020	2021	2022
Set up common working arrangements to encourage successful strategic partnerships.			
Set up partnership clusters which will be committed to tackling specific smart city challenges.			
Set up common collaborative platforms which allow organisations to share information easily.			
Investigate external funding opportunities with our partners to bring improvements to the city and the wider region.			

APPENDIX 1 – ROADMAP TIMELINES



MISSION 2: A DATA-DRIVEN CITY	Indicative Timeline		
Use data more effectively	2020	2021	2022
Ensure leaders and senior managers support a data culture - where data and analysis are used to inform decision and policy making.			
Create data challenges to prioritise the linking of high value datasets that could quickly make improvements to services.			
Adopt an agile approach to gathering, analysing and interpreting datasets.			
Complete a Data Strategy which will act as a roadmap for all data related activity.			
Give employees the ability to visualise data using software.			
Investigate the use of a central integrated account as a gateway to services. This will prevent/reduce the duplication of data.			

MISSION 2: A DATA-DRIVEN CITY	Indicative Timeline		
Invest in and develop data skills	2020	2021	2022
Identify employees who have a role in analysing data and invest in training and development in areas such as data analytics, machine learning and artificial intelligence.			
Bring academia, the public and private sector together to improve how data is taught in schools and showcase how it is used in the wider world. The overall aim is to ensure children learn how to use and understand data effectively.			
Knowledge share with academia, public and private sector organisations who already use data to their advantage.			
Internally showcase products and projects where data has been used to make an impact.			
Create mentoring initiatives to further develop skills and knowledge in the use of data.			

MISSION 2: A DATA-DRIVEN CITY	Indicative Timeline		
Make data more openly available	2020	2021	2022
Work with stakeholders to investigate and prioritise high value datasets that would be beneficial to the city.			
Create a data store repository which allows easy access to open data in a non-propriety format, and encourage organisations to contribute their data.			
Work with our universities, public and private sector partners to share best practice around Open Data.			
Work with schools to investigate if data related projects could be fed into open data smart city projects. This would give young people an opportunity to be involved and help shape future thinking.			

MISSION 2: A DATA-DRIVEN CITY	Indicative Timeline		
Develop public trust in the sharing and use of data	2020	2021	2022
Ensure citizens are informed of how we use their data through appropriate communication methods.			
Investigate the use of 'data trusts' and learn from Cities which have taken part in pilots.			
Investigate how we can improve data sharing in general by looking at a range of information sharing frameworks.			
Work collaboratively with academics, businesses, public bodies and other cities to investigate how they have improved public trust and learn from their experiences.			

APPENDIX 1 – ROADMAP TIMELINES



MISSION 3: A CONNECTED CITY		Indicative Timeline		
Improve fibre infrastructure in the city		2020	2021	2022
Identify areas with poor connectivity and work with telecommunication companies to encourage greater investment in these areas.				
Investigate open access infrastructure to increase competition and reach less commercially viable areas.				
Reduce costs for fibre installation by installing ducts in new developments and new roads schemes ('dig once' approach).				
Work with our Cardiff Capital Region City Deal and Welsh Government to explore opportunities for improving fibre connectivity across the whole region.				
Improve fibre infrastructure in key areas to support our growing creative, fin-tech and reg-tech sectors.				

MISSION 3: A CONNECTED CITY		Indicative Timeline		
Embed Cardiff Internet Exchange into the region		2020	2021	2022
Increase awareness and drive adoption of IXCardiff by engaging with businesses.				
Engage with content providers and Internet Service Providers (ISPs) to attract them to IXCardiff.				
Improve accessibility to IXCardiff.				

MISSION 3: A CONNECTED CITY	Indicative Timeline		
Ensure the smooth roll out of 5G & enhance mobile coverage	2020	2021	2022
Work with 5G telecommunication suppliers to support subsequent 5G roll-out throughout the city.			
Build stronger relationships with the telecommunication companies.			
Tackle mobile 'not spots' to improve mobile phone coverage by working closely with Central Government, Welsh Government and DCMS.			
Work with 5G innovators to test and pilot use-cases that will bring benefits to the city.			

MISSION 3: A CONNECTED CITY	Indicative Timeline		
Harness the power of the Internet of Things	2020	2021	2022
Create IoT business cases which are outcome based and take into account social, environmental and economic benefits.			
Investigate city-wide IoT platforms that can support a range of high throughput and low powered IoT devices, to tackle defined city challenges.			
Create a 'City Challenge' where innovators can help address particular problems in the city using IoT.			
Use IoT data to do predictive modelling and real time analytics to enhance social, environmental and economic outcomes.			

APPENDIX 1 – ROADMAP TIMELINES



MISSION 4: A MOBILE & SUSTAINABLE CITY	Indicative Timeline		
Use the latest technology to keep Cardiff moving	2020	2021	2022
Work with other UK cities to share 'traffic management' best practice and investigate how they have improved public transport and enabled people to walk and cycle around their cities safely and easily.			
Set up 'living labs' which can be used to test, optimise and demonstrate 'smart' technology before they are rolled out city wide.			
Research how external data sources can be used to 'add value' to the highways network.			
Investigate technology which can prioritise public transport provision in the city.			
Explore how we can be more effective with real time traffic information to ensure accurate and up to date information is conveyed to motorists.			
Explore how gamification can influence mobility behaviour.			
Formulate a strategy for Intelligent Transport Systems (ITS).			
Investigate integrated ticketing systems for Cardiff and the wider region.			

MISSION 4: A MOBILE & SUSTAINABLE CITY	Indicative Timeline		
Explore infrastructure requirements for autonomous vehicles	2020	2021	2022
Investigate digital infrastructure requirements for autonomous and connected vehicles.			
Explore the possibility of setting up an autonomous vehicle test bed.			
Explore how we could make use of the data that is obtained from connected vehicles.			
Investigate the impact that autonomous vehicles would have on behaviour in the city.			
Investigate if physical infrastructure would have to change to support autonomous vehicles.			

MISSION 4: A MOBILE & SUSTAINABLE CITY	Indicative Timeline		
Develop smarter infrastructure and smarter built environments	2020	2021	2022
Look for opportunities to deploy smart infrastructure in new buildings and during refurbishment of existing buildings.			
Use technology to real-time monitor the environment to help make improvements to our streets and spaces.			
Work with Cardiff University to create a smart model of the City which has the ability to use and visualise city data to remotely control certain city management systems.			
Expand coverage of smart lighting into residential streets and investigate the use of street lighting sensor technology to gather data about the urban environment.			
Expand coverage of our real time air quality monitoring devices.			

MISSION 4: A MOBILE & SUSTAINABLE CITY	Indicative Timeline		
Implement smart energy infrastructure	2020	2021	2022
Expand the use of Building Energy Management Systems (BMS/BEMS) and increase the understanding and use of the data gained from these systems.			
Investigate the use of battery storage within schools and other public buildings so that renewable energy or more off-peak power can be stored on-site and used during peak periods.			
Complete work on the 8.7MW Lamby Way Solar Farm and look to maximise storage and use of the electricity generated at certain times of the day.			
Deliver publicly accessible electric vehicle charge points in areas across the city.			
Deliver electric charging infrastructure at key council sites to support the adoption of zero/low emission Council fleet vehicles.			
Look to deliver a district heating network that has the ability to heat public and commercial buildings.			

APPENDIX 1 – ROADMAP TIMELINES



MISSION 5: A HEALTHY CITY		Indicative Timeline		
		2020	2021	2022
Use digital technology to support users to remain independent				
Investigate the use of smart and assistive technologies which support well-being and independent living.				
Aim to reduce social isolation by investigating better ways to keep people connected.				
Explore the use of virtual assistants to signpost users to services.				
Use apps and websites to amalgamate services that offer support and advice.				
Upgrade 'Telecare Cardiff' from an analogue to a digital service to take advantage of new IP solutions on the market.				
Work with our health boards to investigate Telehealth options.				

MISSION 5: A HEALTHY CITY		Indicative Timeline		
		2020	2021	2022
Co-design health technology				
Facilitate showcase events that will provide service users as well as health and social care professionals with the opportunity to explore new technology.				
Work with suppliers to investigate prototyping new health and social care technology so that we can quickly determine if it will meet our needs.				
Pilot digital technologies with small user groups to understand how 'everyone' will benefit.				
Involve service users and health and social care professionals in the decision making process so that they can help shape future technology and services.				
Support service users as well as health and social care professionals when adopting new digital technologies by providing post implementation support.				

MISSION 5: A HEALTHY CITY	Indicative Timeline		
Join up Public Services	2020	2021	2022
Establish a 'Digital Health Board' with key stakeholders.			
Create a digital health and social care strategy for Cardiff.			
Ensure newly procured health & social care software or systems have the ability to exchange information across different organisations. This will allow them to share information easily (interoperability).			
Use health & social care data more effectively to improve outcomes for citizens.			
Investigate funding arrangements for specific health and social care challenges to increase and speed up innovation in the sector.			

MISSION 5: A HEALTHY CITY	Indicative Timeline		
Use technology to promote physical activity and improve well-being	2020	2021	2022
Investigate gamification options to promote physical activity and improve well-being in the city.			
Investigate how technology can be used to improve health and well-being in the city and work with health partners to get initiatives off the ground.			
Develop a health and well-being platform which aims to increase awareness of activities in the local area that could improve lifestyle choices.			
Set up an innovation group to tackle specific health and well-being challenges.			
Ensure citizens are made aware of the wide range of digital technologies which can be used to promote physical activity and wellbeing.			