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Summary

A consortium of partners, led by Arup, and including IBM, University of Bristol, Knowle West Media Centre, Hewlett Packard, Toshiba and Advancing Sustainability LLP, was commissioned by Bristol City Council to carry out a 12 week feasibility study into opening up and integrating systems in Bristol. This was in response to the Technology Strategy Board’s Future Cities Demonstrator Competition.

Through workshops, interviews, analysis, focus groups, reviews, research and expert opinions, the study aimed to:

- build on existing work;
- identify global best practice;
- engage with visionary thinkers in Bristol and beyond;
- assess the potential scale of impact;
- and develop Bristol’s concept for urban systems integration.

The Bristol Future City Demonstrator: Connect Bristol

Connect Bristol is the City’s vision for a Future City Demonstrator. Our proposal is to implement a world-class City Operating Platform and rapidly realise benefits across diverse uses relating to mobility on demand, personalisation in formal and informal health and social care systems, city governance and future workplaces. A citywide Living Lab, incorporating citizens and businesses, will drive innovation and value out of the City Operating Platform. We envisage that the new Mayor will be our primary, democratically accountable super-user. The overall aim is to create environmentally and socially sustainable jobs and growth for Bristol.

The Bristol context

Bristol has one of the fastest growing and changing populations in the UK, with a high birth rate, as well as an ageing population. We are a place where young people come to study, and because the City has a vibrant culture and a high quality of life, many choose to stay once they graduate. This addition to the home-grown talent pool makes Bristol an attractive location for knowledge-rich businesses and entrepreneurial activity. We have more businesses per capita and more patent registrations than any other Core City in the UK. The City is geographically well connected and draws commuters from a wide area, with the longest average commute in the UK after London.

At the same time, the City's success is not equally available to all; there are inequalities in health and wealth. The economic climate is creating pressure on jobs, while the growing population means more jobs must be created in Bristol just to stand still. In this context, the key challenge that Connect Bristol must seek to address is creating environmentally and socially sustainable jobs and growth.
Bristol’s challenges

Like all cities around the world, Bristol faces a wide array of challenges. Indeed many of the challenges are common to all the core cities, and range from inequality, to citizen engagement, climate change, population growth, economic recovery and changing demands on healthcare. Bristol must also manage significant congestion problems and a fragmented public transport system that citizens perceive as expensive and poor performing.

Whilst there will be no panacea, a range of multi-agency, multi-faceted programmes is needed to tackle these challenges and deliver Bristol’s vision.

Bristol’s vision

By the year 2020, Bristol will become one of Europe’s top 20 cities; it will appear at, or close to, the very top of the league tables measuring sustainability, quality of life and achievement among European cities – the Bristol 2020 Plan.

As part of this, Bristol aims to cut CO₂ emissions by 40% by 2020, provide more efficient and affordable transport, improve health and wellbeing, and create 95,000 new jobs by 2030. In this context, the key opportunity and challenge that the Bristol Future City Demonstrator must seek to address is creating environmentally and socially sustainable jobs and growth.

Connect Bristol – the City as a platform

This question of economic growth and the role of government lies at the heart of our approach to Future Cities. As cities around the world start to experiment with open data to create economic value, there is an increasing recognition that releasing data is not enough on its own. As John Tolva, Chicago CTO, has said, government is no longer the provider of end user experience but the provider of a foundation for others to build on.

The primary benefits of the proposed approach are economic growth, better service delivery and better civic engagement, while products and services developed on the platform could contribute to improvements in congestion, social care provisions, carbon emissions and so on.

Whilst much has been written about the economic benefits of open data – estimated at €27 billion across the EU for example – Bristol’s platform approach goes beyond open data by providing information tools and resources, so the potential economic benefit is even greater. The concept creates economic value by providing start ups and others with the resources to create new and innovative products and services for citizens. By driving innovation in public service delivery, and more efficient governance, wider economic value is created throughout Bristol’s economy.

Based on central government figures, transport experts and economists advise that if this programme could divert 8,220 daily journeys from single occupancy cars it could result in savings of £6 million. Congestion is expected to cost the West of England £600 million by 2016.

Many Local Authorities recognise that current rates of population growth and demographic change would mean that by the mid-2020s all current Council expenditure would have to go on maintaining current levels of health and social care for vulnerable adults and children. Supporting and bridging informal and formal care networks will increase the independence of vulnerable people. Improving their access and confidence in urban living and mobility will help them live more comfortably whilst reducing their reliance on carers. Increasing the
independence of those most vulnerable makes the community more resilient to external shocks, and allows the City to react faster to emergencies.

Integration is the answer

Creating a world class City Operating Platform that unlocks economic value and other benefits requires at its heart, the integration of City systems. Integrating City systems, technically and organisationally, allows more data and infrastructure to be put at the disposal of innovative organisations and citizens. The key success factors for this are twofold: access to useful data and infrastructure; and the capacity of citizens, the private sector including SMEs, the third sector, the Council and wider public sector to make use of it. Use of the platform within the Council will drive the most direct improvements in Council services and accelerate the shift to information-driven decision making. The citywide Living Lab will reinforce the value and drive the wider innovation potential of the platform.

Delivering this will require leadership and commitment. Bristol’s governance structure and existing programmes makes us well placed to deliver a successful Future Cities Demonstrator. The Bristol proposal incorporates three elements:

1. To build on Bristol City Council’s commitment to transforming the way it uses data through its existing Intelligent Council programme;

2. A technical platform, the Bristol City Operating Platform (B-COP), and;

3. A citizen and SME engagement programme, the citywide Living Lab.

We will focus engagement in the platform by involving local stakeholders (including SMEs, start-ups, academia, and citizens) through the Living Lab to address the key urban challenges of reducing congestion, improving health and social care provision, re-constructing the future workplace and increasing government accountability through transparency.
1 Introduction

1.1 Objectives

A consortium of partners, led by Arup, and including IBM, University of Bristol, Knowle West Media Centre, Hewlett Packard, Toshiba and Advancing Sustainability LLP, was commissioned by Bristol City Council to carry out a 12 week feasibility study into opening up and integrating systems in Bristol. This was in response to the Technology Strategy Board’s Future Cities Demonstrator Competition.

The objectives of the study were as follows:

1. To build on existing work to assess the potential to expand, enhance, integrate and open-up City systems (managed by the City council and others) to provide greater intelligence, added value and a platform for innovation.

2. To engage with visionary business, academic and community leaders in Bristol, as well as representatives from across Council departments, through workshops, focus groups and in-depth interviews.

3. To identify best practice of integrating city systems and creating connected collaborative city platforms from around the world.

4. To assess the scale of impact of creating a demonstrator for the integration of city systems in Bristol and across the UK in terms of the social, economic and environmental benefits over the short, medium and longer term.

1.2 Methodology

Between August and November 2012, our methodology was as follows;

1. To carry out a baseline analysis of the existing projects, assets and objectives in Bristol; carrying out semi-structured interviews with key individuals and looking at key integration points.

2. To carry out two workshops with a wide range of stakeholders from the public, private and third sectors. The first looked at the wider opportunities and challenges faced by Bristol today, whilst the second was focussed around generating ideas for Bristol as a Future City.

3. To carry out two focus groups with citizens to integrate their feedback into the stakeholder workshops.
4. To review best practice from around the world and understand it’s applicability to, and implications for Bristol, with a particular focus on options for future governance.

5. To engage with information curators and data holders within the City to test the technical feasibility of integrating data sources.

6. To develop recommendations for an approach to integrating systems in Bristol.

7. To analyse the impacts and benefits of such an approach, and refine the recommendations.

1.3 Report structure

This report is structured as follows;

Chapter 2 sets out the context for Bristol; the current situation in terms of people, economy, infrastructure, governance and smart City experience.

Chapter 3 sets out Bristol’s vision to 2020; it summarises key plans and policies for the City.

Chapter 4 describes the main challenges and opportunities for the City; this encompasses feedback from our workshops and focus groups.

Chapter 5 explains the City systems that need integrating in order to address the challenges set out in chapter 3.

Chapter 6 describes the proposed approach to integrating systems; based on stakeholder input, integration with existing projects and programmes, best practice review and technical feasibility analysis.

Chapter 7 presents our analysis into the likely benefits of this approach.

Chapter 8 explains barriers that would need to be overcome in order for the approach to be successful, and recommends ways in which to do this.

Chapter 9 presents the final conclusions and recommendations for next steps.
2 Bristol: The Context

2.1 The people

Bristol is one of the fastest growing cities in the UK, with a 31% rise predicted by 2028. With a population of 428,200, it sits at the heart of the West of England (population 1.1 million), which reaches from Bath to Weston-Super-Mare to Yate.

Bristol is one of the healthiest of the Core Cities (and also of comparable cities) but the overall picture can hide the disparity in experience for different areas and population groups within the City.

Bristol has a reputation for having a vibrant culture, strong community identities, with lots of people willing to volunteer their time to create a better place to live. There is a collaborative approach to problem solving in the City.

2.2 The economy

In 2009, Bristol generated £10.9 billion GVA and the West of England, £24.1b. Bristol has the most businesses per capita, most patent registrations, highest GVA per full time job, and the highest proportion of skilled people in the workforce of the eight Core Cities.

The City is home to three universities; University of Bristol, University of the West of England (UWE) and the Open University. We are a place where young people come to study, and because the City has a vibrant culture and a high quality of life, many choose to stay once they graduate. This addition to the home-grown talent pool makes Bristol an attractive location for knowledge-rich businesses. It also helps explain why the City is such a 'hive' of entrepreneurial activity.
At the same time, the City's success is not equally available to all. We are home to some of the most deprived neighbourhoods in the South West of England. Our ageing population brings challenges in relation to health and social care and some parts of the City remain distant from the creative, digital and low carbon business sectors that are flourishing elsewhere. Bristol is recognised to 'punch above its weight' economically. Advanced manufacturing, high-tech/microelectronics, creative digital industries, media, green technologies are all key sectors within the City.

### 2.3 The infrastructure

Bristol is well-connected, with an international airport, two mainline railway stations, a major port and easy access to two major motorways. People travel considerable distances to work, shop and play in Bristol. Outside London, people travel further to work in Bristol than elsewhere in the UK; an average of 38km\(^{iii}\). Twenty-seven per cent of the West of England population live more than 40 minutes by public transport from a major employment site\(^{iv}\), highlighting the inequality of access to opportunities as set out above.

### 2.4 The governance

Bristol will be electing its first directly elected Mayor in November 2012, providing a change in governance in the City. The first directly elected Mayor for Bristol will be looking to make an impact in their four-year term. It will help to re-define how the population engages with local politics, and it will mean that Bristol can expect greater political stability over the next four years. This should lead to a greater focus on delivery.

The West of England covers four Local Authority areas; Bath and North East Somerset, Bristol City Council, South Gloucestershire, and North Somerset. The West of England Partnership provides a governance structure for the four Councils to co-operate in areas where joint working is beneficial. For example on major transport schemes, the four Councils have recently been awarded funding under the Local Sustainable Transport Fund (LSTF).

The Local Enterprise Partnership (LEP) also covers the West of England area, and has an ambition to create 95,000 new jobs by 2030. This is led by business, with input from each of the local authorities, as well as key education providers in the sub-region.

### 2.5 Smart Bristol

Bristol is already helping to drive the smart City agenda in the UK and Europe. An early signatory of the Green Digital Charter, and the only UK City ever to have been shortlisted for the European Green Capital Award, Smart City Bristol was launched in 2011. This is a collaborative programme between public sector, business and the community that builds on our Smart City Report\(^{v}\); an analysis of how smart city technologies can contribute to Bristol’s carbon and economic objectives.
Bristol’s established Smart City Programme is implementing innovative projects on smart metering and smart grid, electric vehicles and open data. The City’s digital infrastructure is well-established; B-Net is a £9m City Council owned and managed citywide fibre network; the recently funded £20m Gigabit (GB) Bristol, a Digital Enterprise Zone (DEZ) that will ensure that gigabit connectivity is readily available to SMEs and that ultrafast broadband will be available to all consumers. Furthermore, GB Bristol will overlay an open access Wi-Fi network that will cover the DEZ and extend its reach to around 80% of public space in the City.

Bristol’s Traffic Control Centre brings together data from more than 200 camera feeds and systems that support real time information on passengers, car park occupancy, automatic number plate recognition and traffic flows. The Emergency Control room monitors 800 CCTV cameras, and also the wellbeing of 10,500 clients through remote domestic telecare sensors. Air quality stations provide real-time pollution data and the City Council network of 2100 energy meters produce 36.8m pieces of energy consumption data each year.
The Bristol 2020 Plan sets an overarching vision for the City;

By the year 2020, Bristol will become one of Europe’s top 20 cities; it will appear at, or close to, the very top of the league tables measuring sustainability, quality of life and achievement among European cities.

It will achieve this through four Strategic Outcomes which describe Bristol’s ambitions for the city economy, social wellbeing of citizens and the environmental impact of the City. These are:

1. Making our prosperity sustainable: The West of England Local Enterprise Partnership (LEP) has set ambitions for employment growth, (+95,000 new jobs by 2030 and over £1 billion of private sector investment over the next 3 years), to drive innovation and creativity, to assist start-up businesses, and to skill up the workforce and raise aspirations. Bristol City Council has a short-term target of 3,500 new jobs in 40 new businesses. We want to ensure that prosperity is sustainable and Bristol becomes a world leader in green and smart technology, helping to meet Bristol’s citywide target to reduce CO2 emissions by 40% by 2020.

2. Reducing health and wealth inequalities: Bristol is a prosperous City, with most people enjoying a healthy lifestyle. However, this overall picture hides levels of inequality and areas where people experience lower levels of income, health, education, crime and living environment. A Health and Wellbeing Strategy is currently being developed. Its emerging aim is ‘to improve and protect the health and wellbeing of all who live and work in Bristol, both now and into the future’.

3. Building stronger and safer communities: Bristol is an increasingly diverse City, with 13.5% of the population from Black & Minority Ethnic backgrounds31. It has proud communities across the City. Bristol aims for as many people as possible to be actively engaged and to participate in deciding how things are done.

4. Raising the aspirations and achievements of our children, young people and families: For quite a few years, Bristol’s young people have struggled to achieve the kind of academic results that they would want. The Children and Young Peoples Plan (2011-2014) will improve outcomes for children and young people in Bristol, and ensure that Bristol’s young citizens are supported to enjoy, learn, and develop to have successful futures.

This feasibility study involved input from a wide range of stakeholders (see Appendix A1). The first stakeholder workshop created a vision for the future of Bristol that reflected the policies and strategies set out above.
4 Challenges and Opportunities for Bristol

4.1 Challenges

A combination of stakeholder views and desk-based research were used to identify challenges that Bristol is facing. The main challenges identified are set out below:

- **Population change**: As a rapidly growing City, population growth and diversification is probably the greatest challenge facing the City. Bristol is expecting a 31% rise in population by 2028; we need to plan in partnership to meet the needs of those people.

- **Economic recovery and development**: Whilst Bristol survived the 2008 recession better than many cities, it has not been immune. With a rapidly rising population there is a need for more jobs, new skills and to increase inward investment into the City. Public sector funding cuts mean that public services are stretched, and new innovative models are being sought to deliver services with lower budgets.

- **Inequality**: Bristol is a prosperous city but also a city where the same opportunities are not available to all, particularly in terms of wealth and health. There are areas of Bristol that are very affluent, and areas that rank amongst the most deprived in the country.

- **Health and wellbeing**: Whilst Bristol remains one of the healthiest of the Core Cities, the Joint Strategic Needs Assessment (JSNA) reports that population growth means that the health needs in Bristol are growing and changing. In particular, demands on formal care services will soon outstrip the Council’s available funding. Also, inactivity is causing a growing number of health problems, and the incidence of mental ill health is growing.

- **Transport**: Bristol faces multiple transport challenges in terms of reducing congestion and improving journey times, promoting more sustainable alternatives to the private car and encouraging more sustainable patterns of travel behaviour which have less impact on climate change, air quality and quality of life.

- **Citizen engagement**: A smaller percentage of Bristol residents than average feel that they can influence decisions locally, with disconnection between people and decision makers. A new directly elected Mayor for Bristol will provide a new means for public accountability which Connect Bristol can build on.

- **Environmental**: Bristol is a leading green city and the only UK city to be shortlisted for the European Green Capital Award, but like most cities mitigating and adapting to climate change and increasing energy resilience, whilst ensuring sustainable growth, are big challenges.

While a Future City Demonstrator in Bristol would not be able to address all of these issues at once, it will be part of a wider programme of investment tackling
them. This will be a multi-agency, multi-faceted programme. It is therefore imperative that the demonstrator is developed from a systems-thinking perspective, where the relationships between programmes and their collective impact are understood and the benefits maximised.

Core Objectives and Challenges
Following consultation and discussion, it was agreed that the integration of systems will focus on addressing the first two outcomes of the Bristol Partnership:

- Making our prosperity sustainable
- Reducing health and wealth inequalities.

These challenges are interrelated, and depend on multiple city systems including mobility, healthcare, social care, education, and employment.

4.2 Assets and opportunities

A long list of assets and opportunities for Bristol was identified by stakeholders during a workshop. The key opportunities that Bristol can build on are outlined below:

**Partnerships:** Citizens are at the heart of our approach. We have engaged with them directly to input into this bid and they have been represented at wider stakeholder workshops. An established Smart City Consortium has worked to develop this bid including Arup, IBM, Toshiba, BAE Systems, Advancing Sustainability, Knowle West Media Centre and the University of Bristol, University of the West of England, SETSquared, Western Power Distribution and Accenture.

**Experience and assets:** Bristol has made a clear commitment to create a world-class and inclusive green digital economy with established Digital City and Smart City programmes that demonstrate smart, innovative solutions being deployed through a public-private-people partnership.

Connect Bristol will build on the experience of running smart city projects, and use the existing data and infrastructure created as part of these to support the City Operating Platform. We will build upon our existing communication infrastructure, including B-Net (the Council’s own £9m citywide fibre network) and Gigabit Bristol (a £20m programme for gigabit connectivity for SMEs and ultrafast broadband for all consumers and open-access Wi-Fi network).

**Governance:** The people of Bristol have already expressed a desire to change the governance structure of the City, voting to have a directly elected Mayor from November 2012. The new Mayor will have oversight of the Connect Bristol programme, and it provides an opportunity for the City to rethink how citizens, politicians and wider groups engage with each other and are held accountable.

The City Council is undergoing unprecedented levels of change. The Changing Bristol Portfolio is the collection of programmes and projects which will deliver business change. That is, change
concerned with people, processes, technology and information. The Intelligent Council Programme is part of this and designed to make the Council “Knowledge rich and intelligence led” and will achieve this by improving the ways we collect, process and distribute management information to make information more relevant and useable.

**Economic base:** Bristol was recently identified as an ‘innovation hub’ by McKinsey and the World Economic Forum\(^\text{viii}\), and has a world-class knowledge economy based on advanced manufacturing, high-tech/ microelectronics, creative digital industries, media and green technologies and the global reach of its outstanding universities.

Bristol boasts an existing ecosystem of innovative businesses and SMEs working together in this area, often collaborating with the City Council to deliver projects.
5 Which City Systems Need Integration?

5.1 Long list of systems

The proposal looks to integrate a wide set of urban systems, whilst also focusing further on a smaller group of systems targeted around Bristol’s four core challenges.

The previous section set out the multitude of challenges the City faces. These challenges directly and indirectly touch upon a vast array of city systems. A wide-ranging integration of these city systems is therefore necessary to deal with these challenges. Our platform approach (see Chapter 6.2) will enable Bristol to integrate the multitude of city systems in a structured way.
5.2 Systems focused on vision outcomes

In order to devise the systems that should be integrated, we followed the approach outlined by Cosgrave et al\textsuperscript{xix}. This approach argues that solutions should be derived from an understanding not only of the high level policy goals, but also of the unique challenges and opportunities of the city, as well as what constitutes public value in this context. The diagram below is the ‘grounded model of smart city policy and implementation concepts’ as described in the paper.

The Connect Bristol demonstrator will focus on integrating systems to address the first two outcomes of the Bristol Partnership (the City’s vision statement) as stated in Chapter 3.

- Making our prosperity sustainable
- Reducing health and wealth inequalities.

These challenges are interrelated, and depend on multiple city systems including mobility, healthcare, social care, education, and employment.

In order to deliver these components of the City’s vision, our focus will be on integrating and delivering innovative products and services in the following four city systems within the wider constellation of other city systems:

- Economy and job creation system
- Mobility system
- Health and social care system
- City governance system

5.2.1 The intended result

Integrating these city systems will help Bristol deliver on Vision Outcomes and address wider challenges, by bringing together information and infrastructure to drive entrepreneurship and service innovation. A platform approach and
citywide Living Lab will also create economic value, both directly and indirectly. Chapters 5 and 6 describe how this is achieved.

Bringing together ubiquitous computing, mobile communications and big data can help with the management, economic development, and solutions to social problems of cities. There is also a wider economic opportunity that extends beyond the boundaries of local governments. This marketplace relies on information from city systems as the core asset that SMEs, citizens, industry and other local innovators can use to build new products and services.

Urban innovation generated through the Connect Bristol platform can feed the wider innovation ecosystem to spur economic growth in the region. Bristol will build on its role as a pioneer in smart city applications and services, for its own benefit, and for export to other cities.

Hence our approach will bring together information assets with a citywide Living Lab in a directed way to address the first and second parts of the vision. The first part of the vision, creating sustainable prosperity, will be addressed through providing raw material and support to SMEs, individuals and business to create new products and services. The second part of the vision, reducing health and wealth inequalities, will be addressed more directly by focusing this effort on key areas including support for informal care networks and cooperative travel. The approach will be explained more fully in Chapter 5.

5.3 Three levels of city system integration

Urban system integration should involve both technical IT systems and people-based systems. In order to be effective, we believe that integration will need to take place across three levels:

- Hard integration (through the City Operating Platform)
- Soft integration (through engagement with citizens and other local stakeholders in the Living Lab)
- Organisational integration (through the Transformational Change programme, including budget and programme integration)

Each of these elements is necessary and mutually supportive in achieving our policy goals through the demonstrator. Our approach (Chapter 5) deals with all three levels of integration.
6 Approach to Integration

Here we explain our proposal for the Future Cities Demonstrator and how it delivers integration of city systems.

Integrating city systems, technically and organisationally, allows more information and infrastructure to be put at the disposal of innovative organisations and citizens. Furthermore, products and services developed through the platform will themselves integrate city systems to solve city challenges. Therefore, the Bristol proposal incorporates three elements:

1. Council Transformation: to build on Bristol’s commitment to changing the way it uses data through its existing Intelligent Council programme;

2. Technical Platform: the Bristol City Operating Platform (B-COP) with new data sources and infrastructure;


We will focus effort around the platform by engaging SMEs and citizens through the Living Lab to address the key urban challenges of congestion, improving formal and informal social care, improving transparency of governance and future of workplaces. The core elements of the Connect Bristol demonstrator are shown below:
6.1 Council transformation: Intelligent Council

The benefits of this project include better service delivery, better policy making, economic development and better civic engagement. Realising these benefits will require leadership and change within Bristol City Council.

A portfolio of change projects is in place that will transform the way public services are delivered through the creation of a new ‘one council’ Council Target Operating Model. The benefits of this will include cost effective service delivery, better performance management and resource allocation and more responsive policy making. Realising these benefits will require leadership and change within Bristol City Council. Bristol is already committed to transformation, with the Intelligent Council programme ensuring that information use is at the heart of its change programme. Bristol has a commitment to be ‘information rich and intelligence led’. This transformation will be implemented by creating a step change in the way the Council uses data and information. The Future City Demonstrator and City Operating Platform will ensure that Council improvements are connected into wider city systems and that the Council and the new City Mayor focus on outcomes for citizens and the City as a whole.

6.2 Technical platform: The Bristol City Operating Platform (B-COP)

Technical integration will be achieved through the Bristol City Operating Platform and associated “Community Communications Canopy”.

An overview diagram of the City Operating Platform is shown overleaf.
The B-COP will manage the integration, transformation and publication of data and information services. It will support the management and lifecycle of information in multiple diverse formats and publish it, with associated meta-data. The B-COP will provide a flexible array of custom information tools for others to innovate with, such as analytics, modelling, and visualisation tools. It will also accommodate new information feeds alongside existing sources, for example from new applications, crowd sourced information and using new sensor fabrics, such as the city streetlight enabled “Community Communications Canopy” (see below).

The B-COP will be future proofed against likely technology upgrades and innovations by being designed on open, published, scalable standards, permitting the integration of further systems in future and extending the life of the demonstrator platform far beyond the initial programme period. Where a real-time data feed does not conform to an open standard, the B-COP will transform the data in real time and repackage it to be publishable and consumable to an open standard. Data sources behind firewalls, where relevant, can be accessed by the B-COP, transformed and repackaged for consumption by a wider audience, protecting the original source of the information. Elements of the B-COP include:

- Modules and components for the Core Information Services. Access to information, apps and services will be managed through an already established open standards based
interface, accessible through the data portal, or through open Application Programming Interfaces (APIs).

- The hardware and software environment, again based on open data and interoperability standards, Commercial off the shelf (COTS) technologies and established open source products to minimise the amount of cost and effort needed to integrate the B-COP solution.
- Transformation of information in proprietary formats to open data standards through commercial off the shelf technologies.
- Creation of tailored interfaces for citizens, Bristol City Council, other public and third sector bodies, SMEs and businesses, developers. We will work with artists and users to make the interfaces as attractive as possible.

- **Community Communications Canopy**: This will be established by retrofitting existing photocells in Bristol’s streetlights with RF (Radio Frequency) enabled photocells, compatible with open standards existing power sources (NEMA). The RF transceivers within them will not only be able to operate as sensors for environmental information but also create a mesh connected network which will then be integrated into the City’s existing fibre network. This will provide connectivity to areas where broadband access is currently limited for wireless access by citizens as well as for the sensors themselves. The network will also be open to SMEs, academia, and the wider community groups (see section 6.3) to develop services based on sensor information and other devices that will exploit this network via the B-COP.

### 6.3 Citizen and SME engagement: The citywide Living Lab

The citywide Living Lab will be the key enabler of civic engagement and economic development through its engagement with citizens, universities, SMEs, start ups and others. Connect Bristol will build on the existing Knowle West Living Lab. It will develop this into a citywide citizen-centred ecosystem of open-innovation. It will help to foster the development of new products, services applications and experiences, creating and building a market for business to thrive. It will also ensure that citizens and communities are empowered to engage and co-create solutions. Citizens will be engaged in designing and testing solutions that meet their needs, as well as tackling the challenges Bristol faces.

The Living Lab programme will be made up of four elements:

1. **Information Marketplace**: working with SMEs and others to build new products and services.
2. **Digital Bristol cohort**: crowdsourcing data for the platform and testing new services.
3. **Digital co-creation**: facilitating co-creation of new services with the Digital Bristol cohort, SMEs, universities and others.

The elements are described below.

1. **Information marketplace:** This programme will be set up to build on existing Bristol networks and initiatives. It will work with SMEs and other developers to make the most of the platform, using open data and services provided by the B-COP. This will include competitions, hackathons and a catalyst fund to invest in innovative ideas.

   This will build on the good work done by the Bristol-based i-Shed and their sandboxes. They identified that due to perceived risk, a key friction in the UK media market is the difficulty for smaller producers to secure new commissions. Media Sandbox was set-up to bridge this gap, giving small, agile producers an opportunity to develop early stage ideas. Whilst the initial focus would be on working with developers and SMEs based in Bristol, the B-COP will be open source and available globally, meaning that national and international skills can also be harnessed.

2. **Digital Bristol cohort:** The Digital Bristol cohort will test and invent new services. Bristol will develop a community of "data providers" who sign up to provide their own data to the B-COP, and trial the products and services created. They will have sensors monitoring variables such as energy and water consumption, indoor air quality, indicators of well-being. It will also measure their as movement across the City which provides feedback on physical activity as well as travel patterns.

   Bristol will learn from existing cohort studies, such as the world-renowned Bristol-based Children of the 90s, to ensure that trust is built up and participants can see the return on investment from their data "investment".

   This anonymised information will feed into the data platform and shape the other elements of the demonstrator, as well as providing immediate, real-time feedback to the individuals signed-up. A programme will be developed to help ensure that individuals can interpret and use this data to enable sustainable lifestyle choices.

3. **Digital co-creation:** Initially, we will work with the Digital Bristol cohort, but also widen the opportunities out to other community groups. Working with skilled community engagement specialists across the City, we will bring together citizens and community groups with developers; giving them the freedom to identify the citywide problems to be addressed, as well as co-creating the solutions i.e. through hackathons. This could also be built on; developing competitions where the public or private sector set a specific problem to be solved.

   Younger people ("digital natives") will be particularly encouraged as co-creators, bringing a different
perspective to imagining possible futures. This highlights how we value young citizens, and will support them to think creatively about community generated data, consumption and the future of Bristol. We will also explore inter-generational co-creation and learning.

4. Digitally literate citizens: Bristol wants to ensure that the Future City is available and accessible to all. Therefore, a digital literacy programme will improve knowledge of digital technologies and data within a wide range of groups, building wherever possible on existing initiatives, such as Bristol Computer Reuse Scheme (provides low cost computers to citizens facing barriers to getting online), Accessible Bristol (the citywide, cross-sector group advocating technology designed to be accessible to all), Get IT Together (Bristol's digital inclusion programme), Age UK IT training, Knowle West Media Centre's work with schools and communities, as well as the interactive science centre, @Bristol.

6.4 Focus areas

In order to achieve the objectives, four initial focus areas have been selected. This will catalyse interest and activity in each area and ensure targeted progress is made. These four focus areas will be co-created by citizens, relevant Council departments and public sector bodies, local SMEs and other private and third sector organisations. They include:

- **Mobility on demand:** Through the ecosystem created by Connect Bristol, citizens will engage with a full range of mobility options. Information will be available to help people make informed decisions, including real-time information on suggested routes, costs, time estimates and environmental and health impacts. We will provide real-time delay information and route alternatives to help users avoid disruptions ahead. The service will be truly multi-modal incorporating bus, rail, private car, walking, cycling, taxi, taxi share, and car share. A particular emphasis will be placed on modelling and developing demand-based mobility solutions. These will be based on organic information about journeys and routes that people would like to make, as opposed to those limited journeys that are currently offered by traditional timetabled services. The aim of this is to enable and encourage modal shift away from single occupancy private cars.

- **Future workplaces:** Through the approach taken in this programme, we will already be helping to stimulate a different, more cooperative way of working. There are also existing
projects within the City to create more flexible workspace “hubs”, bringing together people with different skills to innovate and allowing work to be carried out in more flexible ways. The vision for the City’s Temple Quarter Enterprise Zone, our premier new business development district, recognises the need for collaborative space to underpin the development of the Creative and Digital Industries. The Council’s own £60m Workplace programme aims to transform the Council from an agency whose 6,500 staff operate out of 70plus HQ buildings to a mobile and agile organisation, which has fewer than 5 main offices. Connect Bristol will support the vision to create a LinkedIn style approach to the future of Bristol workplaces, which places collaborative networking tools and services at the forefront of the City’s innovative working culture.

- **Creating independence and personalisation in the health and social care system:** We will use the B-COP to support and bridge informal and formal care networks and to generate the market in personalised digital care services. This will increase the independence of vulnerable people, helping them live more comfortably whilst reducing their reliance on carers by improving their access and confidence in urban living and mobility. A particular focus will be on enabling carers to provide support through commercial, intelligence driven monitoring systems, based on real-time home and geo-locative information and alerts, as well as ensuring low threshold, easy to access services are available for people who might otherwise face digital exclusion.

- **Governance - City Dashboard aka “the Heads-Up Display”:** We aim to create stronger city governance, municipal accountability and citizen engagement by pulling in real-time data, information, analysis, models, and simulations from across the urban spectrum. We will display this in audience-specific views – including for the Mayor, citizens, council departments, will all have their own views. This provides the Mayor and their senior leadership team the ability to continuously and reliably track progress towards their city goals, making tactical changes or longer term policy shifts. By ensuring creative visualisation of complex city data, citizens can engage with their city’s performance more easily, and hold their elected Mayor to account. This innovation at the heart of city governance will take the City beyond the current model of ‘static’ governance, towards a more informed and engaged partnership between citizens and the municipality.

7 Benefits
The 2011 report, Information Marketplaces: The New Economics of Cities\(^4\) set out the different ways in which smart city projects and programmes can add value, across a range of city indicators. This is set out in the figure below, and demonstrates the added value that the combination of individual smart projects can have for a city such as Bristol. Our proposal intends to target this multiplier effect with each product and service that will be built on the Connect Bristol platform.

7.1 Benefits to Bristol’s economy

There will be both direct and indirect economic impacts as a result of the proposed Connect Bristol programme. Direct impacts of the programme will include a number of specific impacts related to the initial products and services developed. These include:

- Benefits for public, private and third sector organisations and citizens from: improvements to operations as result of the B-COP; e.g. reduced costs in building management, transport, and health and social care costs.
- Access to employment and income for a wider range of people.

Indirect economic impacts are wide-ranging, encompassing positive externalities as described above:

**Economic stimulation:** Much has been written about the economic benefits of open data. For example, a 2011 Deloitte Analytics Paper\(^{11}\) concludes that open data is the first crucial step in driving ‘big insights’ that have “the potential to capture the imaginations of citizens and entrepreneurs and reinvigorate a stuttering economy”. The EU Commission estimates an EU-wide potential from access to public data of €27 billion\(^{12}\). Factored down to a Bristol level, based on population, it could be worth over €23,000 million. And with Bristol’s platform approach going beyond simple open data, to a wider set of information tools and services, as well as
combining citizen and private sector data, the potential is even greater.

Bristol has a strong history of new businesses start ups. It is estimated that 3,735 new businesses started up in Bristol in the twelve months to the end of September 2012\textsuperscript{xiii}. This programme will build on the success of these and similar organisations in the City. There are a number of SMEs that have already engaged with Bristol City Council who might benefit directly from this programme. These include Esoterix, who are developing a transport on demand solution and others, such as Clean Energy Prospector, Cloud Amber.

**Transferable solutions:** The challenges faced by Bristol are by no means unique;

- **Mobility remains high on the list of priorities for many cities.** The 2011 Climate Action in Megacities report\textsuperscript{xiv} identified 248 actions planned to deliver low carbon transport across the 39 cities surveyed, and many more cities have the power to implement actions. Proving that solutions work in a city the size of Bristol will show that they can be applicable to many more cities than covered by the C40.

- **Employment and work remains high on the agenda of cities across the UK.** The Centre for Cities 2012 Outlook focussed on the weak performance of the UK economy in 2011, and the need to support private sector growth and jobs in our cities.

- **Ageing populations are a universal phenomenon.** Local Authorities across the UK must reduce the costs associated with health and social care, as made clear by the “Barnet graph of doom”\textsuperscript{xv}. Our early focus is on supporting informal care will work, and will reduce the demand on council services in this area. A recent report by the Local Government Association\textsuperscript{xvi} highlighted the need to continue to spread council funding across service areas used by all.

**Reduction in cost of congestion:** Congestion is expected to cost the West of England £600 million by 2016\textsuperscript{xvii}, and was identified by a Business West survey as the most significant disadvantage for businesses located in the sub-region. If our early focus on mobility on demand was able to result in 8,820 daily journeys diverted from single occupancy car drivers at peak times, it could result in savings of £6 million\textsuperscript{xviii}.

### 7.2 Benefits to citizen quality of life

Connect Bristol will help people to be more engaged with decision-making in their city, help raise aspirations and improve health and wellbeing.

Bristol’s definition of quality of life is linked to the overall aspirations for the City. It incorporates indicators on health and wealth inequality, sustainable prosperity, safer and stronger communities, and raising aspirations. In 2011, 26% of Bristol residents felt they could influence decisions in their neighbourhood. This does not compare well with other Core Cities, where the average is 30%. Engaging a significant number of citizens in the process of providing data and co-creating solutions though Living Lab activities will help to improve this indicator. It is anticipated that over the initial 15 month period we might engage with approximately 4000 people in an in depth and meaningful way.

Work with young people through the citywide Living Lab will help to improve aspirations, and the economic benefits will help to improve There is a strong link between active travel and health outcomes.
An estimated 3.2 million people die globally each year from diseases such as heart disease, diabetes and cancer. In Bristol, only 33% of residents regularly take moderate exercise. Even a switch from private car to public transport tends to improve amount of exercise taken.

Our early focus on enabling a better informal health and social care system will improve quality of life for those who need care, and for their informal care networks. As our ageing population continues to rise, this will be increasingly important.

7.3 Benefits to the environment

The Connect Bristol programme will help Bristol move further towards its goal of becoming a Green Capital. Local road transport (not including CO₂ from motorways and A-roads) accounted for 427,000t CO₂ in Bristol in 2010, approximately 20% of the City’s total. Assuming that through our early focus on mobility on demand the programme resulted in 8,220 daily journeys being diverted from single occupancy car drivers this would result in a CO₂ reduction of approximately 4135t. A modal shift will also have a positive impact on air quality within the City.

Providing open data across a wider set of city systems will create opportunities to improve environmental performance across a number of other indicators, including water use, energy use, waste and biodiversity. For example, by opening geospatial data on Biodiversity Action Plan habitats and species, local community wildlife groups could be more informed on the measures they could take locally to protect areas and species.

7.4 Improving Bristol’s resilience

Resilience to future shocks will be improved as a result of this investment in a number of ways. Future shocks expected include: climate change impacts; peak oil impacts; economic downturns; health pandemics; food shortages and other resource constraints. Connect Bristol will create the infrastructure and framework for the City to become agile-by-design. It will be poised and ready to move swiftly to capitalise on emerging trends, technology advances, modernised practices and new business models.

The B-COP and city dashboard will allow for better emergency planning, better city modelling, and will support organisations to see the interrelationships between different city systems. This means Bristol will be better prepared for unexpected impacts, and able to adapt to current and future city challenges.

The innovation programme created through the City working as a Living Lab will mean that the economic structure of Bristol will be more resilient, with more locally based businesses. These businesses will be less to external economic pressures, and which will lead to a more diverse business base for the City.

People who are most vulnerable to these kinds of shocks are often the most vulnerable in society generally, including those who may no longer qualify for care as Council budgets shrink. The early focus on formal and informal care support aims to help these groups on a path to increased independence, so that they will be more resilient in times of crisis. If people have increased confidence and wider social networks, they are likely to be able to respond faster to emergency situations.
8 Barriers

The barriers to successfully achieving a large scale integration programme are largely organisational rather than technical, relating to issues leadership, co-operation and organisational capacity. Some of the key barriers that Bristol will need to overcome are set out below.

8.1 Unlocking data

Our feasibility work has shown that the interoperability of existing data sets and applications is unlikely to cause significant technical problems (e.g. format compatibility or proprietary systems). However, city data and information is often managed by siloed teams or organisations. Understanding how data and information sources are collected and managed, and by whom, is no quick win. Work will need to take place to identify benefits and challenges for any particular data owner or information curator to allow access to their information.

Bristol is better placed than many other cities in this regard. There is an existing Bristol Research Network and Joint Intelligence Group which works across the public sector. This precedent of sharing information and intelligence will make this task easier. In addition, Bristol’s Intelligent Council programme is already looking to use data and information more effectively across the City Council. Working within existing structures wherever possible, and looking to ensure that sufficient resource is allocated to this task will help to overcome this barrier.

8.2 Ensuring citizen buy-in

In order for Bristol to operate as a citywide Living Lab, ensuring buy-in from citizens will be crucial. If citizens do not feel that they are able to engage, or feel that the programme doesn’t allow for them to really be part of creating solutions for their city, or that data security is too big a risk, then Bristol will not succeed.

Building on existing trust and relationships, working with organisations that have a reputation within the City to enable citizens to get involved in decision making, and in changing their lives for the better, are all critical success factors. This work has already begun, by involving citizens, and organisations such as Knowle West Media Centre directly in this feasibility study. Continuing to work with trusted partners across the City will help to overcome this potential barrier to developing a truly productive co-creating ecosystem.

8.3 Developing sound governance structures

A sound governance structure for Connect Bristol will be important for a number of reasons;

- To ensure that the Bristol City Operating Platform is used in ways that will have positive benefits for the City and for its economic, social and environmental objectives.
- To allay fears around data security and protection
- To ensure that the correct skills and expertise are involved in steering the programme.

Internal and external barriers to developing this governance structure might be legal, financial or political in nature. A sound governance structure for Connect Bristol will be instrumental in effectively
supporting culture change in the public sector in Bristol. Early, regular and genuine engagement is needed and has already started. Bristol’s portfolio of change projects leads the way for Connect Bristol to succeed.

8.4 Delivering a multifaceted programme

This study presents a vision for a highly multifaceted programme aiming to deliver a wide range of outputs, from organisation change to community activities and a technical platform. The programme will need to be designed to successfully deliver results for Bristol and the TSB within the timescales by carefully dividing work packages and using new and existing partnerships with highly capable organisations and individuals. Work to develop the programme in this way has already started. The programme also places emphasis on working with Bristol’s well-established wider community, engaging early and integrating with the council’s existing transformation programme.
9 Conclusions

Bristol faces significant challenges that are common to cities across the world. The complexity and connectedness of these challenges requires a systems thinking approach. Through a wide variety of stakeholder interviews, workshops, analysis, research and expert opinion, this study has shown that there are benefits to be gained across many city systems.

By integrating across these systems, Bristol can deliver on the overall aim to create environmentally and socially sustainable jobs and growth. The Connect Bristol approach can leverage the collaborative efforts of local stakeholders to deliver on Bristol’s 2020 vision outcomes by reducing congestion, improving health and social care provision, re-constructing the future workplace and increasing government accountability through transparency. The benefits of Connect Bristol are wide ranging, interrelated, and ongoing beyond the TSB Demonstrator timeframe.
Appendix A

Stakeholders
## A1 Stakeholders

Below is a list of the stakeholder organisations engaged in the development of this study.

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<td>White Design</td>
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Appendix B

Endnotes
B1 Endnotes

i Based on population stats from 2000 to 2010, Centre for Cities, Cities Outlook 2012
ii Census 2011
iii Centre for Cities, Cities Outlook 2012
iv West of England Joint Local Transport Plan 3
vi Bristol City Council, The Population of Bristol, April 2012
x The Climate Group, Arup, Accenture and Horizon, University of Nottingham, Information Marketplaces: The New Economics of Cities, 2011
xi Deloitte, Unlocking Growth: How open data creates new opportunities for the UK, 2011
xii Gartner, Innovative use of public data, report to the National IT and Telecom Agency, and the Danish Agency for Science, Technology and Innovation (Danish), 2009
xiii This is estimated from data from Banksearch (data from the major banks on new business accounts opened)
xiv Arup for C40 Cities, Climate Action in Megacities: C40 Cities Baseline and Opportunities, June 2011
xv Barnet Council projected that by 2022 more than 100% of the entire Local Authority budget would need to spent on social services (both Children and Young People and Adult Social Care)
xvi Local Government Association, Funding outlook for councils from 2010/11 to 2019/20: Preliminary modelling, 2010
xvii As set out in the West of England Joint Local Transport Plan 3, 2011
xviii This is based on a marginal external congestion cost of 20p/km, and an average distance of 10km. Data based on Webtag assumptions.
xix Based on data from the World Health Organisation
xx Based on 2011 Quality of Life survey
xxi Based on data collected by the Department for Energy and Climate Change (DECC)
xxii Data based on defra carbon conversion factors 2012 for average car journeys being replaced by a combination of bus, train, walking and cycling.