

## OXFORD - A 'LEARNING' CITY FOR THE 22<sup>ND</sup> CENTURY - INTERIM REPORT TO THE OXFORD ECONOMIC GROWTH STEERING GROUP

### INTRODUCTION

1. Cities are complex physical spaces filled with complex interacting 'systems'; systems that provide everything necessary for human community life - from housing, mobility, work-places, food, water, power, healthcare, education and entertainment. They are important; they drive the global economy, global creativity and toleration; they drive consumption of scarce global resources, climate change and insecurity - problems that are increasing as cities are forced to accommodate a rapidly growing proportion of the global population.
2. The idea that cities might become 'smart' has become almost ubiquitous in the last decade; driven by the emergence of new and affordable sensors, an increase in our ability to store and manipulate huge data-sets, the development of sophisticated modelling methods and the establishment of better and often almost instantaneous communication technologies.
3. The Smart Cities concept is founded on the opportunities for cities - their citizens and the authorities that serve them - to transform the way their city lives; making them more responsive to citizens' needs, more resilient to future challenges and economically prosperous - through harnessing the vast and increasing quantities of available data on every aspect of the city 'socio-ecosystem'; its infrastructure, society and environment, the interactions between them and how a city's citizens live and feel about that life; and the operations of businesses and institutions to provide intelligent solutions to current and future challenges.
4. In September 2014, following a period of consultation with members of the Oxford Strategic Partnership, a scoping report was commissioned, with the following aims to:
  - (i) Identify a unique position for Oxford in the Smart City space based on an analysis of programmes elsewhere in the world
  - (ii) Identify existing and planned projects in Oxford, within Oxfordshire and elsewhere in the region where strategically and practically appropriate, that could form the basis for an integrated Oxford Smart City programme (as the first phase in a broader and longer-term programme across Oxfordshire and the region, and in partnership, across the UK) that would enhance the success of each of these programmes and help to create a strong brand for Oxford going forward;
  - (iii) Develop a vision and project definition that would enable the creation of a 'smarter' Oxford and that would ensure local stakeholder buy-in, and attract interest and investment from individuals and organizations not currently based in Oxford; and

- (iv) Outline a communications strategy for any proposed Oxford Smart City programme

## INITIAL FINDINGS FROM THE ANALYSIS OF CURRENT SMART CITY PROGRAMMES

5. In order to put whatever Oxford might do into its appropriate national and international context, to ensure that Oxford builds on what has already been learnt elsewhere and most importantly, so that Oxford builds something innovative, internationally competitive and compelling, the most significant smart city projects globally were analysed (desktop research and interviews with people either directly involved in these projects or the smart city agenda more broadly (see Annex 2, Table 1). Five cities were considered in detail: Glasgow, Bristol, Milton Keynes, Barcelona and London. Overall the review examined most of the cities either in the UK or elsewhere in the world that are regarded as having 'set the pace' and which can be regarded as being Oxford's most important competitors in the smart city 'market'. The conclusions from this analysis form a robust foundation upon which Oxford can consider how to build a competitive position.
6. The analysis reveals that many smart city projects suffer from the following issues:
- No clear objectives, in particular, little clarity on how the project would benefit the citizens of the city in a meaningful way; This was believed to be mainly due to the manner in which the projects had been funded, either as a short-term research initiative or corporate 'technology-push' (for example, there is a view that Glasgow's initiative has suffered from having to deliver 'smart' for the Commonwealth Games deadline and consequently has been unable, to date, to deliver clear value to Glaswegians). A general conclusion is that because the projects were not driven by a fundamental 'need' of the cities, they have been much less successful than they might otherwise have been;
  - 'Build it and they will come' has driven the Open Data initiatives, with the core idea being that developers will build applications to solve city problems using this data. Of course, there are examples of this having happened, but it is also clear that it has not happened enough; availability of data is just not enough to stimulate the creation of a smart city. One reason is that many cities do not have and have not been able to create, the essential innovation and entrepreneurial eco-systems to support their initiatives. Of course, making data about all aspects of a city's daily activities is a necessary prerequisite for smart cities<sup>1</sup>, but it is clear that it is not sufficient and that sustained support (financial and strategic) is needed to drive the development of applications that can address city challenges and can form a vibrant and sustainable

development community that can significantly contribute to the economic success of a city;

- A lack of engagement with community, resulting from a failure to understand what is required to achieve such engagement (for example, it is clear that many projects have yet to use social networking technologies in an effective manner). For example, although a programme has been running in Milton Keynes for nearly a year the engaged community is about 100 strong. Obviously, a failure to engage stakeholders will inevitably result in projects becoming unsustainable;
  - Knowledge gaps within city organisations. Many smart city projects are devised and managed by external organisations with the cities themselves not being equipped to understand the underpinning systems and therefore once the project has been completed - the technology put in place - the city is unable to support it; cities are left with legacy systems and no on going management;
  - A lack of integration between the services<sup>ii</sup>.
7. These issues are, we believe, symptomatic of the fact that so far the main focus for many projects, particularly those driven by technology providers, has been on product development; the development and demonstration of technology platforms to a point to which they can operate reliably and efficiently in a city context - the objective being to build and drive the market as opposed to addressing the needs of the city itself. Consequently, as these are 'experimental' deployments there is no sustained commitment to them from the part of the providers and secondly little focus on the needs of a particular city's stakeholders.
  8. It is of course, entirely appropriate for companies to want to develop, demonstrate and market their technological solutions and to do so in ways that are both cost-effective and focused. It is also appropriate for this type of project to be undertaken as this is a necessary process to ensure continued corporate engagement and the development in due course of better specifications of what a 'standard' smart city technology platform might look like (It seems likely that any smart city deployment will be based upon the emerging Internet of Things (the concept of Internet connected everyday physical objects<sup>iii</sup>). However, it is clear that the technologies that will enable this concept are still being developed there being no agreement on standards<sup>iv</sup>). However, there is a need for a counter-weight to legitimate corporate objectives; a counter-weight that results in cities achieving their critical objectives through equal partnership with companies and other technology 'pushers'.
  9. This means that there is an opportunity for Oxford. For example, the city could create appropriate partnerships clearly focused on a programme of work that would take a leading role in defining and evaluating different protocols that would enable the creation of a 'good enough' smart city technology platform; to explicitly create an environment that is independent of any specific or propriety technology and is able to adapt to a rapidly changing technological environment.

10. Fortunately, discussions with companies with interests and capabilities in this area have realized that the current approaches to creating new products and services in this market are not adequate - that in some senses the smart city development 'curve' has flattened off or may even be turning downwards. The more enlightened of these companies are interested (see Table 5), therefore, in working with cities where all partners and stakeholders are:
- collectively committed to reducing obstacles; and
  - , willing to be experimental and to providing a platform that will enable those companies to create global brands relevant to this emerging market.

#### EXISTING AND PLANNED PROJECTS IN AND AROUND OXFORD THAT COULD FORM THE BASIS FOR AN INTEGRATED OXFORD SMART CITY PROGRAMME

11. Although Oxford has not, as yet, branded itself a 'Smart City' it is clear that it already has many of the characteristics of such a city. Projects related to this are summarised in Table 2 (Annex 2) projects that represent a very sizable investment. Annex 2 also presents; potential supporting smart infrastructure surrounding Oxford (Table 3); Organisations and institutions in Oxford (and surrounding area) that are already involved in smart projects (Table 4); Start-up and entrepreneurial smart support eco-system (Table 5); Corporations directly engaged with to-date on the Oxford smart city project (Table 6).

The tables in Annex 2 are incomplete, but they do provide a very powerful illustration of how Oxford and Oxfordshire is already adopting smart thinking and technologies; that the city can already claim to be a smart city and thirdly, that the city will not be starting from scratch if it were to launch a smart city project. An important element of any Oxford Smart City programme will be creating a single brand for the city; an important part of which will be to create a narrative that shows how the city has already been working 'smart', that it has created a robust foundation upon which to build the smarter Oxford for the 22<sup>nd</sup> century.

12. As has already been said, there is an opportunity for Oxford to be a leader in this arena. The advantages of taking this role are that the city will be able to address some of its critical challenges 'ahead of the curve'; its stakeholders will not have to wait until providers have created standard products and services and the cost of those products and services have dropped to affordable levels. Secondly, the city and Oxfordshire more broadly, can establish itself as a place where global companies can invest to create and demonstrate their products and services within a neutral and robust validation framework. Finally, the city can nurture a unique entrepreneurial ecosystem; an ecosystem that will create new companies and jobs for the city and the county.

DEVELOP A VISION AND PROJECT DEFINITION THAT WOULD ENABLE THE CREATION OF A 'SMARTER' OXFORD AND THAT WOULD ENSURE LOCAL STAKEHOLDER BUY-IN, AND ATTRACT INTEREST AND INVESTMENT FROM INDIVIDUALS AND ORGANIZATIONS NOT CURRENTLY BASED IN OXFORD

13. On the basis of the analysis summarised above, it is proposed that the Oxford Strategic Partnership launch a programme of activity that would transform Oxford into a globally recognized exemplar of a 'smart city'. Under the brand of **Oxford - *The Learning City***, this programme would demonstrate the Smart City concept underpinned by a rigorous intellectual framework and a scientific approach. For reasons given above, it is important that this is not, primarily (although an important element of the brand will be that everything done in Oxford will be about learning and about evidence-based decision-making), a research project, but a programme that addresses forcibly some of the city's most difficult challenges with rigour befitting of the city's heritage, and also plays to it's global brand appeal.
14. A case has been made that Oxford can aspire to be a world-leader and to building globally significant partnerships with companies that are already leading on various aspects of the smart city 'project'. The characteristics of the city that permit this aspiration include:
  - A relatively small population of 151,900, but rapidly growing with projected population of 165,000 by 2021;
  - A compact geometric footprint of 46km<sup>2</sup>;
  - A wide and diverse demographic at a relatively high density;
  - Globally competitive intellectual capacity that includes two universities (with globally recognized and complementary capabilities), a concentration of health expertise and an interesting and diverse corporate ecosystem (that includes a major manufacturing plant);
  - The highest population churn (25%) of any English city, mainly driven by the highest adult student population (24%) of any English city;
  - Severe housing pressures due to availability, demand and affordability - the highest price to wages ratio in the country both in ownership and private rental;
  - Areas of high deprivation, with one area in the lowest 10% in England.
  - Transport congestion in and around a fundamentally medieval city road network with approximately 30,000 net inbound commuters each day;
  - Below national average state educational attainment;
  - Environmental issues, in particular flooding and low air quality.

The vision is to use the diverse but compact conditions to the advantage of Oxford - The Learning City. In particular:

- Investment levels for deployment are not the same for a large city such as Manchester or Glasgow, making it attractive to external investors to participate, yet still deploy at meaningful scale.
  - The size and scope of the city lend itself well to instrumentation, modelling, and simulation, key to solving some of the city challenges.
15. The Learning City programme will consist of a set of projects that would tackle some of the City's challenges, with clear measurable outcomes (vital to the Smart aspect). It is important that these projects are aligned with the objectives of city stakeholders, represented in part by the Oxford Strategic Partnership<sup>V</sup>:
- Economic development, growth and regeneration;
  - Stronger communities;
  - Safer communities;
  - Low carbon city.
16. The projects would sit within a programme framework (defined in annex 1) that would sustain the wider programme and eco-system.
- The programme framework would be:
- **Flexible and scalable**- with an architecture that is distributed and modularised;
  - **Sustainable**- In other words the programme will be designed to ensure that new partners are encouraged and enabled to join within the context of clearly defined and agreed objectives and participation protocols;
  - **Engaged**- key projects will engage citizens and enable them to participate more effectively in the decision making. Local community groups should be fully engaged in defining and implementing all programme elements;
  - **An opportunity**- the programme will generate unique data sets that are currently unobtainable, enabling:
    - ✓ Significant improvement of understanding of cities as ecosystems - an essential prerequisite to evidence-based management and planning;
    - ✓ The development of long-term scenarios to underpin planning for a sustainable future for Oxford (and potentially to fundamentally changing the manner of planning - technically, legally and democratically); and
    - ✓ A global thought-leadership position for Oxford - with important consequential benefits related to inward investment.
17. Clearly, the programme will require an organisation to support, maintain and drive its success. Many of the concepts proposed for the 'Oxybeles' local catapult are directly applicable to the Learning City and already highlighted in

the Oxfordshire Strategic Economic Plan<sup>vi</sup>. It would make sense to extend Oxybeles into the hub for Oxford – The Learning City. It would include:

- Project Director, Smart City Inward Investment lead, Funding Officer (identifying and bidding for national, European, and other funding opportunities) and Technical Advisory role;
- An open data hub and platform coordination;
- An innovation hub to create and support the on-going Learning City ecosystem;
- Management of web site and communications.

#### EXAMPLE: AIR QUALITY

18. In Europe, 75% of people live in urban areas, increasing to 80% by 2020; European cities emit about 70% of Europe's CO<sub>2</sub>; urban transport in Europe accounts for 70% of the pollutants and 40% of the greenhouse gas emissions from European road transport; and European cities' have an activity 'foot-print' that is up to 300 times their own area. The European Union has agreed that transforming their cities into 'Sustainable Cities' is a policy priority. European cities, including Oxford, are consequently under intense political and public pressure to find ways to become sustainable in as short a time as possible; to reverse climate change trends and to adapt to those changes that are inevitable; to create sustainable and globally competitive communities.

19. For example, European cities share a commitment to reduce their Green House Gas emissions. With current technologies, cities cannot measure their *own* emissions directly or at a level of detail that would enable them to accurately assess where and when emissions are most serious, what is responsible for those emissions and whether their policy interventions are being successful. A prototype of a relatively low-cost, but dense network of *affordable* sensors has been deployed in California and has demonstrated that emissions can, for the first time, be studied in real-time, at the level of individual roadways and communities. It is possible therefore, with current technologies properly deployed, to:

- Accelerate the creation of an unbiased reference so clearly needed at the nexus of science and policy making to support the development of *evidence-based* policies and technical interventions and to ensure that strategies adopted for reducing emissions and improving air quality are effective and efficient;
- Accelerate the development and *deployment* of sensor networks in cities across the world (an important result if climate change is going to be successfully addressed);

20. The pollutants that contribute to poor air quality are emitted or created with CO<sub>2</sub> (and provide an invaluable 'signature' for each emitter class). It is also possible

to measure levels of CH<sub>4</sub>, CO, NO<sub>2</sub>, O<sub>3</sub> (ozone), and particulate matter in real time and at a level of detail not possible before. This is important because it is clear that, for example, over 60% of people living in cities have probably been exposed to concentrations of particulate matter, ozone or nitrogen dioxide above levels regarded as being damaging to human health. Better understanding of the patterns of air pollutants in cities will provide the cities with a more precise basis for air quality management policy development.

21. The benefits to Oxford (a city that recognises the issues around air quality and has already introduced a low emissions zone<sup>vii</sup>) of leading in this area include:
  - Earlier than expected achievement of emission reduction and air quality improvement targets;
  - Attraction of investment by major companies interested in working with the cities to develop globally deployable technologies;
  - Creation of a vibrant entrepreneurial environment based upon the development of new technologies and applications; and
  - Meeting social and health targets particularly for the more disadvantaged members of the city's community.

## BENEFITS

22. Estimates for the size of the 'smart' city market vary widely. It has been estimated that in 2012 about \$8 billion was spent on 'smart' programs around the world. With this figure rising to as high as over \$2 trillion in 2020. By undertaking a demonstrator project of the type outlined here Oxford will position itself as a world-leader in this market with all the associated benefits to its economy, such as inward investment by global companies that such leadership would bring.
  - **Conservative estimates based on potential market share analysis points to GVA uplift of around £500m for the county over the next 5 to 10 years and greater if we are at the forefront of smart city research and development initiatives;**
  - This will enable Oxfordshire to re-align and rapidly make up the value lost to Cambridge outlined in the Oxfordshire Innovation Engine Report<sup>viii</sup>.
23. The Learning City could be created explicitly as a basis for innovation. A key part of the program will be to make the data and the knowledge created from it freely available to anyone. Entrepreneurs will be able, as has happened for example on the foundation of Google's mapping technologies, to create new products and services; products and services that have not as yet been imagined. Such data

will therefore act as an innovation ‘engine’, driving entrepreneurship and inward investment.

## OUTLINE A COMMUNICATIONS STRATEGY FOR ANY PROPOSED OXFORD SMART CITY PROGRAMME

24. A driving principle for **Oxford - *The Learning City*** will be the active involvement and engagement of all the city’s stakeholders. They should be able to understand its tangible value by participation or by the visible effect it is having on the city itself. It is important for the stakeholders of Oxford to be able to say “I am glad we have an Oxford Learning City because...”.
25. Whilst some projects will deal with the more mundane elements (e.g. utility management etc.) a **showcase project** (sometimes referred to as a lighthouse project) will be required to capture the imagination of the city’s people, the press and potential external investors. It should exemplify the project’s core values, elements of the proposed framework and platform.
26. A branding strategy for **Oxford - *The Learning City*** will be developed - ‘Live, Learn, Transform.’ The new brand will convey the project’s key objectives - for example, that it is about the on-going transformation of Oxford through measurement, evidence-based management, inclusive engagement (enhancing the democratic intensity of the city for example) and strategic, evidence-based planning for a sustainable and economically vibrant future for all.
27. The brand will be supported through many channels. Obviously, there will need to be a dedicated website, which will be able to communicate the city’s vision, and strategy; progress and impact, and be a place where all stakeholders can access information, data and interact.

## NEXT STEPS

28. The purpose of this paper is to present to the Economic Growth Steering Group a summary of the case for Oxford implementing a coherent and integrated programme of activities that would accelerate achievement against the Oxford Strategic Partnerships key priorities:
  - Economic, development, growth and regeneration;
  - Low Carbon city;
  - Safer communities;
  - Stronger communities.
29. Implicitly, to achieve these objectives, it is clear that Oxford, along with all other communities in the UK and around the world, will need to think and act more cleverly - not only to get more from less, but also to address increasingly severe challenges - rising temperatures, population growth, aging, relatively smaller workforces etc. - every community is stuck in a looking-glass world where

standing still is not an option. To meet the needs of its citizens and ideally to improve their quality of life, Oxford must find the resources to keep moving. The idea underpinning the proposal outlined in this paper is that to win the significant investment needed, Oxford must out-compete other cities. The consequences of not doing so would be economic stagnation and social decline.

30. In an ideal world there would be plenty of resources from government, but at a time of increasing austerity such investment is unlikely to be available. The only other source of funding is the private sector, however, this funding is not easy to come by - not only is Oxford competing globally for such investment, but there is more work to do to convince industry that they can make money out of the 'smart city' market.

31. The proposal is that Oxford has a portfolio of assets that puts it into a powerful position to be ahead 'of the curve' and therefore to win early-stage investment; investment that will enable it to accelerate meeting its key goals. Winning this investment requires the city to create a compelling and globally competitive brand - '**Oxford - the Learning City**'; a brand that will support the following key messages:

- Oxford - its people, its politicians, and its major employers wants to work with you to create a vibrant and growing business related to sustainable, equitable and high-quality cities;
- Oxford - has the intellectual 'power' to help you to create a compelling business case; to create a global market for your products and services;
- Oxford - has put in place arrangements that will enable you to easily and in a timely way:
  - undertake critical research and development;
  - demonstrate at scale, your technologies, your products and services; and
  - create the partnerships, consortia and collaborations that will drive innovation in your company and in the market-place.

32. Given the above, the next steps are:

The first step must be for the Oxford Strategic Partnership to agree the principles of this proposal and to put in place a small, but dedicated team to ensure the following steps are efficiently implemented. This team needs to be in place by the end of January 2015 and should approximate to 3 full-time posts - a project director, a communications officer and a funding executive.

- i. within the next three months to create and launch the '**Oxford - the Learning City**' brand. As has already been described this brand would

- initially be built upon all the investments that have already taken place in Oxford that relate to the city thinking more cleverly about itself and how it does things. This brand and the messaging associated with it will create a 'buzz' and will start to attract partners;
- ii. in parallel a detailed strategy and business plan will be needed. This will need to identify key 'lighthouse' projects, that will build the brand, deliver value to the people of Oxford and attract additional investment;
  - iii. the rest of the world is not going to wait for Oxford, consequently, even before (ii) is completed the city (in this context any of the organizations that are members or affiliated with the OSP) must be opportunistic and make sure that it submits bids relevant to this ambition;
  - iv. ideally as part of (ii) consideration will be given to the governance structure for the programme. One attractive model would be for a joint venture, the work and the structure of which would have a major potential to provide efficiency savings to delivering services for the city, also the potential to expand to consultative services to other cities and thus realize income;
  - v. a key element of the programme must be consultation with the city's stakeholders. This is not a trivial exercise as, not only must this provide the programme with 'a license to operate', but will also be an on-going source of innovative ideas. The development of this activity should be part of both (i) and (ii). It is envisaged that the brand and consultation exercise will be launched at the same time and indeed as an integrated activity. Ideally this will take place in the early summer of 2015.
  - vi. the launch of the programme should take place before December 2015 and should be timed to coincide with, for example, the launching of the first major projects or the formal launch of the joint venture.

## FRAMEWORK

33. Cities are massively complex systems, and attempting to find a one-solution fits all approach we believe will struggle to work, leaving public bodies with unwieldy constrained systems in a rapidly changing technology landscape. We are proposing an open framework that will allow individual, innovative Learning City projects to be developed, but significantly contribute to the overall Learning City programme.
34. Each individual project will target objectives in the city. There are three considerations:
- A need to **quantify** desired outcomes, via KPIs or similar;
  - An approach for deployment, continuous data capture, analysis and optimisation - described by a **Systems based approach** (such as Lean<sup>ix</sup>);
  - A model for understanding **behavioural change** (such as energy cultures<sup>x</sup>).
35. The System based approach is key to the ‘smart’ Learning aspect of the programme, by continuously measuring and changing the working environment to understand the underlying systems model and how best to reach project objectives. Systems must also be able to adapt and cope with changing circumstances, something that continually happens in a city environment. The process will force projects to think about what properties can be measured and what can be changed dynamically to change operation (e.g. pricing, traffic light timing etc.).
36. Learning City programme is supported by a technology platform. The aims of the platform will be:
- Reduce the barriers to entry of participation;
  - Provide open data for innovation and development;
  - Enable integration across distributed city systems;
  - Attract external participation and potential investment;
  - Set up a unique data source for future research such as robotics which is one of the BIS “eight great technologies” research fields<sup>xi</sup>.
37. The platform will provide best practice guidance and reference systems for publishing open data and it is important that data exchange is carried out with industry standard protocols. This will align the Learning City with opportunities to work with potential partners such Innovate UK (on the Hypercat programme<sup>xii</sup>), the Connected Digital Economy Catapult (on personal data stores<sup>xiii</sup>) and the Open Data Institute (on best practise open data management<sup>xiv</sup>).

The support, tools and capabilities must be of sufficient quality to encourage participants into the programme. Data collection will require **active management** into the core city data hub.

38. All projects will be required to provide a web API to the access data being generated. The data will contribute to the central city datastore, which is key to enabling integration across services. It seems contradictory to have distributed and a centralised city datastore. However, there are good reasons for adopting such an approach:

- Gathering data from legacy systems which operations are currently (and will continue to be) dependent on;
- **Many data ownership and privacy issues can be tackled at the source of data collection;**
- Requirement for operators to have their copy of all data;
- Allows flexibility and innovation in projects.

39. The core components of such a platform would be:

- A full city-wide spatial open data database;
- Big data analytics capabilities;
- Spatial visualisation capabilities;
- A ubiquitous communications infrastructure around the city;
- An Internet of Things interface platform;
- Reference implementations of data stores and secure, trusted systems;
- A simulation framework, built on top of the spatial database.

It will need management and an eco-system to support it:

- Best practice open data programmes;
- Best practice systems programmes;
- A developer programme to encourage entrepreneurial participation and innovation.

## DATA TABLES

Table 1: Smart cities and projects reviewed				
Projects	Project name	Funding Bodies	Funding	Lead network partner
Manchester	Triangulum	EU Smart Cities and Communities	Portion of €21M	Siemens
Birmingham	Smart City Commission	Birmingham City Council	Undisclosed to date	N/A
Glasgow	Glasgow Future City Demonstrator	TSB Future Cities Demonstrator	£24M	Microsoft
Bristol	Bristol is Open	DCMS, LEP managed by BIS	£19.5M	Bespoke software defined network
Milton Keynes	MK Smart	HEFCE	£16M	BT
Peterborough	PeterboroughDNA	TSB Future Cities Demonstrator	£3M	Intel (Education)
London	Smart Airport Experience	TSB IoT Demonstrator	£150k	BT / LivingplanIT
London	Smart London Initiative, Datastore	Greater London Authority	£16k	N/A (ODI key partner)
San Jose	Smart Cities USA	Intel	Undisclosed	Intel
Barcelona	Smart Citizen	IAAC (Academic)	Crowd funded	N/A
New York	City 24/7	Cisco	Undisclosed	Cisco
San Mateo/San Carlos	Parker	Cisco/Streetline	Undisclosed	Cisco / Streetline
Barcelona	iCity	EU	E1.9M	N/A

		Competitiveness and Innovation Framework - -ICT Policy Support Programme Pilot Type B		
Hamburg	Smart City/smartPort	Public / Private partnership	Undisclosed	Cisco
Issy-Les-Moulineaux	IssyGrid	Steria / Microsoft	Undisclosed	Steria / Microsoft
Stockholm	Stockholm Royal Seaport Project	City budget surplus	€70M (across all smart projects)	Fortum
Malaga	SmartCity Malaga	Endesa	Undisclosed	Endesa/Enel
Rio	Centre of Operations	Public / Private Partnership	Undisclosed	IBM
Santander	Smart Santander	EU FP7	E8.76M	Telefonica
Los Angeles	Express Park Program	US Department of Transportation, Caltrans (Regional Transport Agency)	\$18.5M	Xerox
Masdar/Abu Dhabi	Masdar City	Mubadala Development Company & Government of Abu Dhabi	\$19B (whole development)	Seimens
Songo	Songdo International Business District	Gale International, Posco, Morgan Stanley Real Estate & City of Incheon	\$40B (whole development)	Cisco

**Table 2: Smart City projects**

Projects	Lead Partners	Description	Funding position
Mobox (part 2)	Zeta Automotive, Mark Preston Havas, University of Oxford, Oxford Brookes, Oxfordshire County Council	Transport project for Oxford, looking at intelligent integration of Park and Rides and multi-modal transport, coordinated data collection	Mobox part 1 funding was £80k from TSB Calls open in Jan - Closing March 25 <sup>th</sup> for Mobox 2 National calls for 2-3 projects with funding of £2-4 million, requires match funding Total funding £9million
Oxford Flood Network	Nominet UK/ LoveHz	Internet of Things community project generating environmental open data for local use. This project is interesting because it is smart, directly addresses environmental concerns and is citizen led. Nominet are sponsoring the project as an experimental platform.	Nominet UK funded
Digital Inclusion Programme	Oxford City Council, Oxford Internet Institute; and schools	City project designed to give deprived children access to digital learning.	Contribution from Oxford City Council: £14k 2014/15, £7k 2015/16 Oxford City Council and BT paying for connection and on line help / support Schools paying for laptops OII capacity building and monitoring outcomes
OxFutures (www.oxfutures.org)	Low Carbon Hub, Oxford City Council and Oxfordshire County Council	OxFutures is mobilising large-scale investment to develop renewable energy and energy efficiency projects across the city and county. The ambition is to position Oxfordshire at the forefront of low carbon innovation and lead on the UK's transition to a sustainable energy future.  The programme has been kick-started by a grant from Intelligent Energy Europe to leverage investment of £20 million into local energy projects by the end of 2015.  This is the start of the journey to make low carbon economic development mainstream and to bring £400 million of	Grant funding of £1.3m over three years (75% EU, 17.5% City Council and 7.5% County Council)  Target for investment through the project around £20m

		investment into Oxfordshire by 2020. OxFutures will secure the City of Oxford's target to reduce its carbon emissions by 40% by 2020, and to reach the Oxfordshire County Council target of a 50% reduction in carbon emissions by 2030, based on 2008 levels.	
<b>Oxybeles (Local Innovation Catapult)</b>	Oxfordshire County Council Oxford Brookes, University of Oxford, and local business and LEP	A local 'catapult' for innovation, centered around a transport and personal data hub with scope to widen spec to broader city services, Target to deliver dedicated building in centre of Oxford, to support innovation growth as well.	Included in Expression of Interest in the SEP.
<b>Super Connected City</b>	Oxford City Council	Free wifi concession throughout city centre and strategic corridors around Oxford  Free Wifi in free to enter public buildings (including museums, libraries, community centres and visitor centre and civic buildings)  Free wifi on all buses operating in the Oxford Smart Zone  Vouchers to SME's for up to £3k for increased broadband speeds.  This could form part of the Learning City Platform.	Government's Urban Broadband Fund - Super Connected Cities Project. Oxford City Council has been allocated up to £4.8m and the City Council has committed £325k and the LEP £325k
<b>Better Broadband Superfast Broadband (BDUK Countwide)</b>	Oxfordshire County Council with BT as lead partner	Countywide delivery of Superfast broadband to identified "final third" premises.  Predominantly rural focus but includes some Oxford premises. This could form part of the Learning City Platform.	£25million project to get to at least 90% coverage
<b>UrbanData2 Decide</b>	Oxford Internet Institute	Visualisation and tools project focussed on presenting information for urban decision making derived from social and city generated data. This could form part of the Learning City Platform.	EU
<b>Internet of Things platform</b>	Nominet UK	Nominet R&D research providing a platform and data management for Oxford Flood Network project. This could form part of the Learning City Platform.	Nominet UK funded

<b>TV White Space Trials</b>	Nominet UK	Part of Ofcom’s TV White Space trials bringing long range two-way communication into the city. This could form part of the Learning City Platform.	Nominet UK funded
<b>Science Transit</b>	Oxfordshire County Council, LEP	A strategic plan for transit across the county, involving new initiatives such as smart on demand transport and integrated payment systems	Some infrastructure funded through LGF with further bids identified.  Major innovation - Some private sector collaboration lead, some further Innovate UK and Horizon 2020
<b>Personal data hub using Oxford as a living lab</b>	Oxford Internet Institute/Digital Economy Catapult/Oxfordshire County Council	Early stage discussions on using Oxford as living lab for CDEC personal data store. Early discussions with Oxford industrial partner on involvement.	Too early in project definition to determine. Support from the Catapult will help the case for central government funding.
<b>Oxford as an IoT experimentation space</b>	Oxford Internet Institute/Digital Economy Catapult/Oxfordshire County Council/Oxford City Council	Early stage discussions with Digital Catapult on using Oxford as an experimentation space for Internet of Things technologies.	Too early in the project definition to determine. Part of the Digital Catapult plans to identify a UK city/region environment as a focus for IoT experimentation with their collaborators in the UK and Europe.
<b>IoT for vehicular networks and urban furniture</b>	Oxford Internet Institute/St Andrews University, Swedish Institute of Computer Science / Oxfordshire County Council, Volvo, Thales, Ericsson	Early stage proposal focussing on smart cities and in particular services to public and private urban transport users, and urban furniture such as street lights or bus stops	Too early in project definition to fully determine, but aims to secure Horizon 2020 funding.

**Table 3: Potential supporting smart infrastructure around Oxford**

Title	Organisation	Description	Funding
Cotswold Broadband	Cotswold broadband	GB Fibre to the premise network in West Oxfordshire,	Funded privately and with BDUK/Defra funding - supported by OCC
Gigaclear - Village GB broadband	Gigaclear	Oxfordshire based GB fibre to the premise network already delivered on commercial basis in a number of surrounding villages e.g. Appleton and Eaton	Commercially delivered through local "crowd" start up support
Bicester Ecotown	A2Dominion Cherwell District Council	Major housing development scope for energy experimentation and innovation ahead of wide market roll out	
"Culham City"	RACE and partners inc. Universities, business, OCC etc	Developing strategy to provide Culham as a closed but realistic environment for real world experimentations ahead of application in Oxford	Catapults Innovate UK - RAS, Horizon 2020 etc

**TABLE 4: Organisations and institutions in Oxford (and surrounding area) that are already involved in smart projects**

Group/institute	Organisation	Description
Mathematics Institute	University of Oxford	In particular Peter Grindrod's group is proposing the PUMA project which addresses city data analytics and the WICKED project covering energy use in commercial buildings.
Dept of Planning	Oxford Brookes University	The planning department is already active in a number of projects in virtual planning and assisted mobility, as well as energy management research (COBWEB <sup>xy</sup> )
The Oxford Academic Health Science Network	OAHSN Licensed by NHS England	The OAHSN bring together health resources from the whole region and already work with a number of partners on smart health projects.
Mobility Research Group	University of Oxford	The MRG group specialise in autonomous vehicles and capturing 3D point cloud data of cities

Oxford Internet Institute	University of Oxford	The OII are particularly interested in the personal data project and social science impact of smart cities
Satellite Applications Catapult - Harwell	Innovate UK	The catapult are already active in providing planning tools for the SmartMK project and working on satellite mobility applications
Msc Sustainable Urban Development	University of Oxford	The MSc and David Howard's group are highly regarded as thought leaders in sustainable development. They are keen to engage with the smart city process.

Table 5: Start-up and entrepreneurial support eco-system		
Title	Organisation	Description
SBS Launchpad	University of Oxford	Working space and incubator in heart of Oxford
The Hill	Private	Open Digital Health hub, creation space and incubator on Headington Hill.
Networks: Future Business Entrepreneurs Network, StartUp Meetup, Oxford Entrepreneurs, Brookes Entrepreneurs, Digital Oxford etc	Mixed	Regular networking meetings and events. Also Hackathons run by SBS Launchpad, Oxford Entrepreneurs, Digital Oxford, Oxford Internet Professionals etc
Entrepreneurship Centre / Skoll Centre at Said Business School	University of Oxford	Support for social and "for-profit" entrepreneurial ventures
Oxford Hackspace	Oxford Trust / Science Oxford	New premises being provided

List of companies consulted and contacted
Intel (Internet of Things. Smart Cities and buildings)
Bosch Software Innovations
Siemens
Cisco
IBM
GE
Orange
Sharp
EDF
Ericsson
Google
SAP
Facebook
BMW
TripAdvisor
Unipart
Tech Mahindra
Renault
Land Securities (Westgate Development)
Nominet

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- <sup>i</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/246019/bis-13-1209-smart-cities-background-paper-digital.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/246019/bis-13-1209-smart-cities-background-paper-digital.pdf); page15
- <sup>ii</sup> [https://sbri.innovateuk.org/competition-display-page/-/asset\\_publisher/E809e7RZ5ZTz/content/an-integrated-future-for-cities/1524978](https://sbri.innovateuk.org/competition-display-page/-/asset_publisher/E809e7RZ5ZTz/content/an-integrated-future-for-cities/1524978)
- <sup>iii</sup> [http://www.mckinsey.com/insights/high\\_tech\\_telecoms\\_internet/the\\_internet\\_of\\_things](http://www.mckinsey.com/insights/high_tech_telecoms_internet/the_internet_of_things)
- <sup>iv</sup> <http://www.networkworld.com/article/2456421/internet-of-things/a-guide-to-the-confusing-internet-of-things-standards-world.html>
- <sup>v</sup> <http://www.oxfordpartnership.org.uk/vision-priorities-2013.asp>
- <sup>vi</sup> <http://www.oxfordshirelep.org.uk/cms/content/oxfordshire-strategic-economic-plan>
- <sup>vii</sup> <http://www.oxford.gov.uk/PageRender/decEH/OxfordLowEmissionZone.htm>
- <sup>viii</sup> [http://www.sqw.co.uk/files/2613/8690/7243/Oxford\\_engine.pdf](http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf)
- <sup>ix</sup> Womack P. and Jones D., “Lean Thinking”, Simon and Schuster, 2003
- <sup>x</sup> Stephenson J. et al., “Energy cultures: a framework for understanding energy behaviours”, Elsevier, Energy Policy 38 (2010) 6120–6129
- <sup>xi</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/249266/robotics\\_and\\_autonomous\\_systems\\_infographic.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249266/robotics_and_autonomous_systems_infographic.pdf)
- <sup>xii</sup> <http://www.hypercat.io>
- <sup>xiii</sup> <https://cde.catapult.org.uk/creating-trust-in-the-use-of-personal-data>
- <sup>xiv</sup> <http://theodi.org/>
- <sup>xv</sup> <http://architecture.brookes.ac.uk/news/items/170214-cobweb.html>

## SMART OXFORD PARTNERSHIP PROJECT BOARD

This paper has been produced by the Smart Oxford Project Board:  
Sebastian Johnson (Chair) and Robert Hetherington - Oxford City Council  
Dr Hugh Aldridge (Project Director), Dr Phil Clare, Dr Stuart Wilkinson and Anthony Mtitimila - University of Oxford  
Llewelyn Morgan - Oxfordshire County Council  
David Hartley and Andrew Baxter - Oxford Brookes University  
Bill Imlah – Oxford Internet Institute  
Tony Hart – Oxfordshire Local Enterprise Partnership  
Dr Bryan Marshall and Nick Dillon – Nominet UK (R&D)

Contacts for more information:

Dr Hugh Aldridge E: [hugh.aldridge@devoff.ox.ac.uk](mailto:hugh.aldridge@devoff.ox.ac.uk) T: 01865 611699

Sebastian Johnson E: [sjohnson@oxford.gov.uk](mailto:sjohnson@oxford.gov.uk) T: 01865 252317

Llewelyn Morgan E: [Llewelyn.Morgan@Oxfordshire.gov.uk](mailto:Llewelyn.Morgan@Oxfordshire.gov.uk) T: 07881 268208