

Strategy to reality:

Getting smart cities to deliver
for the environment





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Foreword



In 2014, EIC published: *'Getting the Green Light: will smart technology clean up city environments?'*. This was perhaps the first analysis of how the nascent smart revolution could give cities new opportunities to tackle seemingly intractable environmental challenges such as carbon emissions, recycling rates and air pollution. The report saw real potential for the development of a market in smart environmental technology and for smart tech initiatives to become an important element in cities' green policies.

Over the last five years, EIC has sought to play a part in stimulating this market. A website, www.SustainableSmartCities.org, has been created to act as a portal for global case studies and knowledge sharing. In the UK, EIC has used its broad business membership to work with local authority place-making directors through a series of workshops exploring how the private sector can work more closely with public sector leaders in this field.

This new report takes stock of where this exciting agenda has got to. Since 2014, environmental issues have become ever more prominent, with many cities around the world now having Net Zero targets and setting ambitious goals across topics such as resource use and the circular economy. Development of bespoke smart and digital strategies has become increasingly commonplace. Yet despite many individual smart environmental initiatives, it seems that in most cities, smart strategies consistently underplay the value of smart green tech. There are different reasons for this, which the report explores, including the distinct drivers for environmental policy compared to, say, transport, and public procurement systems which are often unsuited to capturing the innovation we see in the smart environmental world.

For its part, EIC will continue to champion the potential of smart environmental innovation, guided by our Smart Cities Task Force which includes representatives from technology companies; consultancies; local authorities; universities; and the legal profession. Promoting new thinking around procuring smart environmental solutions will be a particular priority for 2020, and this work will tie in with EIC's sister organisation ACE's Future of Consultancy campaign which is exploring the procurement implications of the emerging business models that are transforming the consultancy sector.

Bird & Bird is delighted to support this initiative.

Michael Rudd
Co-Chair, EIC Smart Cities Taskforce
Partner, Bird & Bird LLP

Cities are under pressure to tackle environmental challenges

As the world urbanises, how successful cities are in protecting and enhancing their ecosystems and natural capital will determine both whether global challenges such as climate change and biodiversity loss can be met, and also whether citizens enjoy a good quality of life. In 2014, EIC began an initiative to explore whether the growing enthusiasm for 'smart city' approaches would have a meaningful impact on cities' efforts to tackle entrenched environmental problems such as urban air pollution, low recycling rates and rising carbon emissions.

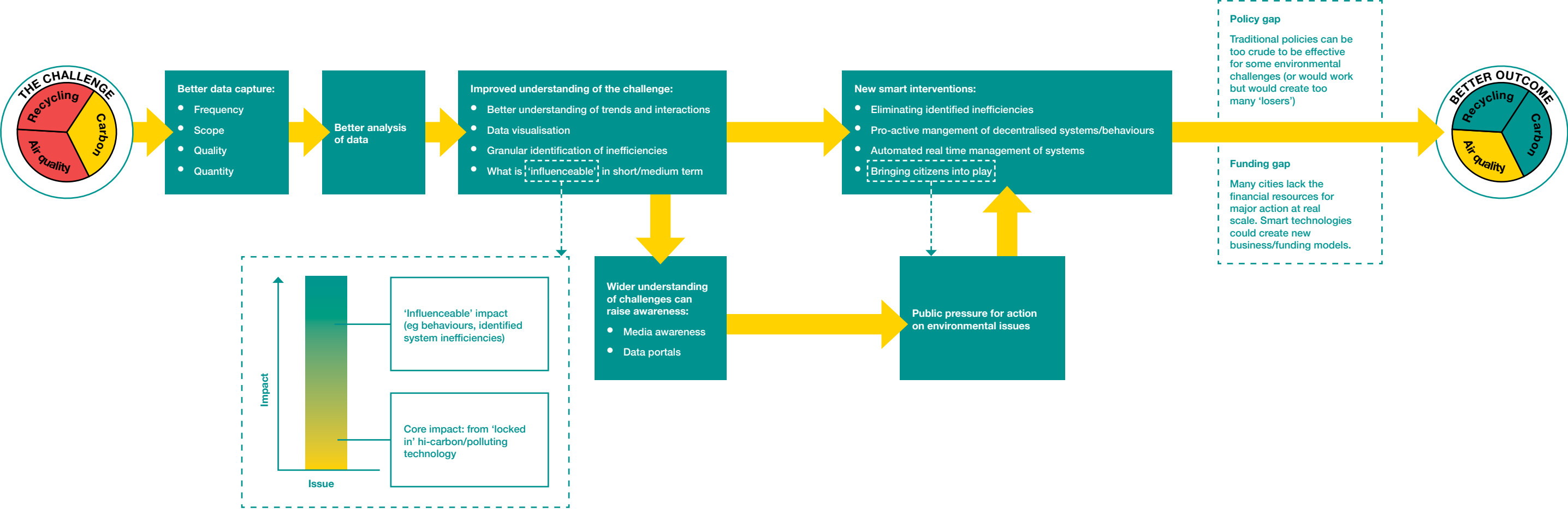
Our work showed that there were clear opportunities (See Exhibit 1)¹, along with a good number of individual city initiatives in this field, which we continue to collate on our industry portal www.SustainableSmartCities.org. However, only a small proportion of smart city activity was focused on environmental issues, which seemed a missed opportunity. The EIC Smart Cities Task Force² judged this to be caused by a combination of factors, including silo thinking within cities; lack of business models for smart environment initiatives; and inappropriate procurement systems.

Case study: Glasgow smart canals

The pioneering Smart Canal project (the first of its kind in Europe) is aimed at mitigating flood risk with a new digital surface water drainage system. The project uses sensor and predictive weather technology to provide early warning of wet weather before moving excess rainfall from residential and business areas through a series of newly created sustainable urban drainage systems (SuDS). Water levels can be lowered by as much as 10cm, creating 55,000 cubic metres of extra capacity for floodwater - equivalent to 22 Olympic swimming pools. It is expected that the scheme will unlock 110 hectares across the north of the city for investment, regeneration and development.

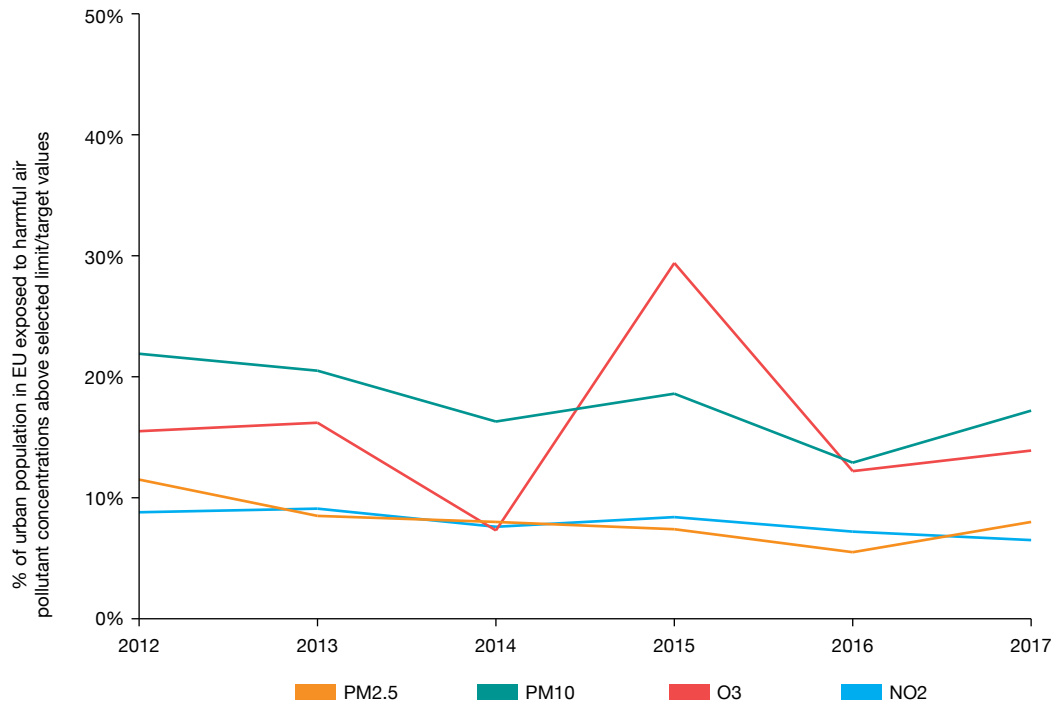
For more information, visit: <https://www.scottishcanals.co.uk/placemaking/glasgow-canal-project/glasgows-smart-canal/>.

EXHIBIT 1: THE SMART ENVIRONMENTAL OPPORTUNITY



Since 2014, the environment has become ever more prominent as a social and political issue. The 2015 Paris Accord and resultant move towards ‘Net Zero’ targets; the realisation of the appalling health costs of urban air pollution; and the mounting scientific evidence of an ecological crisis have led to a renewed urgency. Yet on most indicators cities are still struggling to make significant progress in tackling intractable environmental challenges [see Exhibits 2 and 3], and analysis of the commitments made by cities through the Carbon Disclosure Project³ shows that with barely a year to go cities are still on average 47% short of their 2020 emissions reduction targets.

EXHIBIT 2: LIMITED PROGRESS ON URBAN AIR POLLUTION⁴



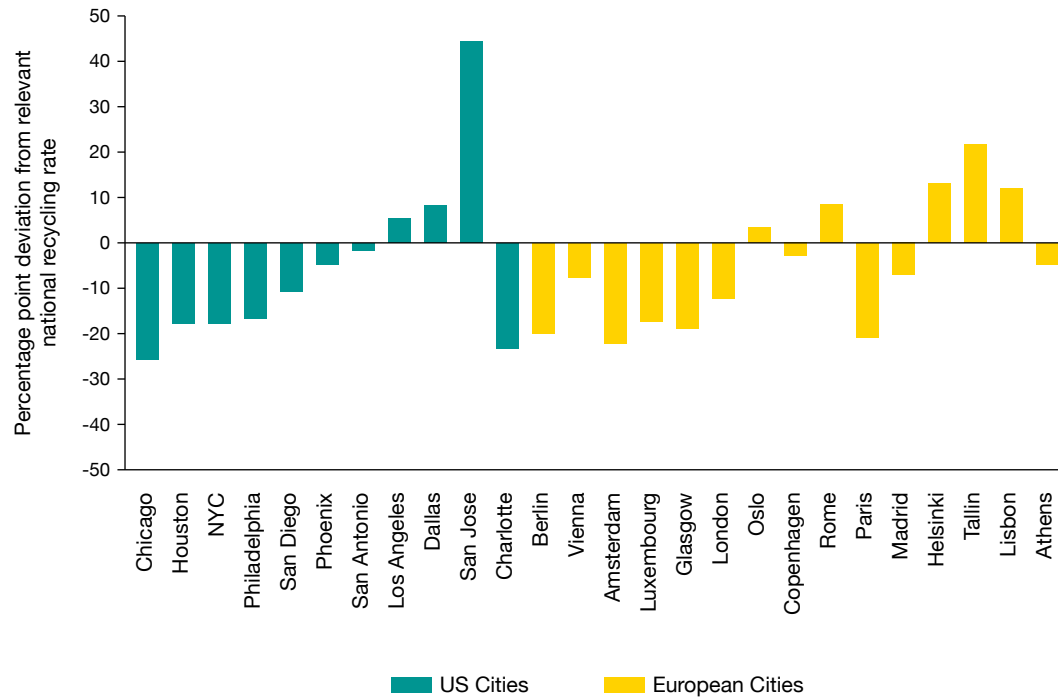
Source: European Environment Agency

“

Analysis of the commitments made by cities through the Carbon Disclosure Project shows that with barely a year to go cities are still on average 47% short of their 2020 emissions reduction targets.

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EXHIBIT 3: MOST CITIES CONTINUE TO UNDERPERFORM ON RECYCLING



Source: EIC primary research

Case Study: Breathe London

Breathe London combines state-of-the-art sensor technology with new data analytics to better understand Londoners' exposure to air pollution. Measuring harmful pollution at thousands of locations informs data-driven solutions to clean up the city's dirty air. Three complementary projects are taking place to help citizens understand what's happening at ground level:

- The installation of 100 sensor pods on lamp posts and buildings throughout the city, continuously transmitting air quality measurements. This is then mapped in real time on the Breathe London website.
- Specially equipped Google Street View cars are using mobile sensors to measure air pollution on a variety of London roadways, taking readings approximately every second in representative areas of the city.
- A linked study with King's College London (funded by the Greater London Authority) is using wearable sensors that will allow schoolchildren and teachers to monitor air quality during their journey to and from school.

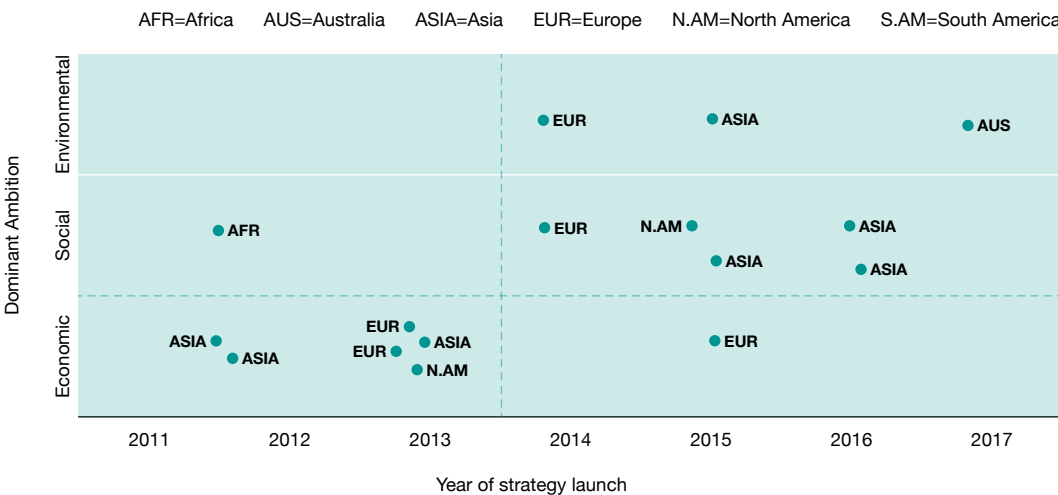
For more information visit: <https://www.breathelondon.org/>

Smart technology approaches can help but are under-utilised

On the face of it, therefore, exploitation of the potential of smart technology to meet environmental goals is needed more than ever. But are we getting any closer to it?

A 2017 analysis by the Future City Catapult⁵ (FCC) did show some movement toward environmental priorities being incorporated in smart city strategies. In the report, the FCC argued that their analysis “shows that the main ambitions of strategies have changed over time. Before 2013, the focus of strategies tended to be economic, while after 2013, social and environmental ambitions were key for seven of the [21] cities studied”.

EXHIBIT 4: ENVIRONMENT APPEARING MORE IN RECENT SMART STRATEGIES



Case study: Melbourne Urban Forest Visual

The City of Melbourne maintains more than 70,000 trees. In order to better manage this important natural capital asset, the city has set up a free-to-access online map that provides the user with individual data of each tree within the city, including genus and useful life expectancy. The data provided on this map can be used to better manage planting schedules by factoring in considerations such as community priorities, the life expectancy of existing trees and the type of tree being planted.

For more information, visit <http://melbourneurbanforestvisual.com.au/>.

To understand whether the trend identified by the Future Cities Catapult was strengthening, EIC has looked at the smart city/digital and environmental strategies of 13 cities – reflecting a spread of geographical location and city size – and assessed their coverage of core environmental challenges and whether the relevant initiatives were smart technology based or not. The results are shown in the matrix below.

EXHIBIT 5: ENVIRONMENTAL ISSUES IN SELECTED CITY STRATEGIES

CITY	STRATEGY	AIR QUALITY	WASTE	WATER	CARBON	GREEN TRAVEL	GREEN INFRA
City 1 Population: 8.6m N. America	Smart						
	Environmental						
City 2 Population: 860k N. America	Smart						
	Environmental						
City 3 Population: 680k N. America	Smart						
	Environmental						
City 4 Population: 2.9m N. America	Smart						
	Environmental						
City 5 Population: 3.7m Europe	Smart						
	Environmental						
City 6 Population: 336k Europe	Smart						
	Environmental						
City 7 Population: 8.9m Europe	Smart						
	Environmental						
City 8 Population: 626k Europe	Smart						
	Environmental						
City 9 Population: 130k Europe	Smart						
	Environmental						
City 10 Population: 965k Europe	Smart						
	Environmental						
City 11 Population: 13.9m Asia	Smart						
	Environmental						
City 12 Population: 5m Australia	Smart						
	Environmental						

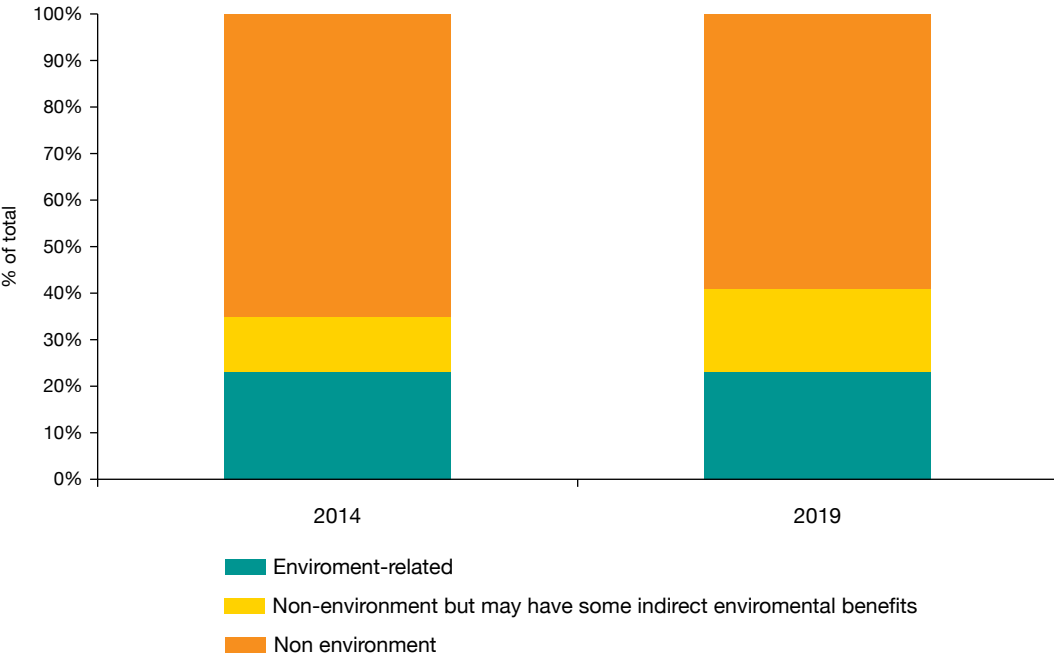
= smart environmental approach = traditional environmental approach

Source: EIC analysis from published sources and primary research
Note: Analysis should be seen as illustrative

The results show that while, as one would expect, most cities have well developed environmental strategies that cover most relevant topics, the instances of smart tech approaches to meet environmental problems – either embedded within environmental policies or in smart city strategies – are far less common. It may well be the case that work in this space is happening within the selected cities, but this has not necessarily been communicated (effectively) in the public realm. This is important from the perspective of citizen engagement, and bringing citizens on the ‘smart journey’ (even more so for smart initiatives that have citizen participation as a key outcome).

This is echoed by analysis we initially carried out in 2014 and have updated for 2019, looking at the proportion of smart city initiatives that have a clear environmental focus. While only a snapshot over time, the data suggest that the opportunities around smart tech and the environment are only slowly being exploited.

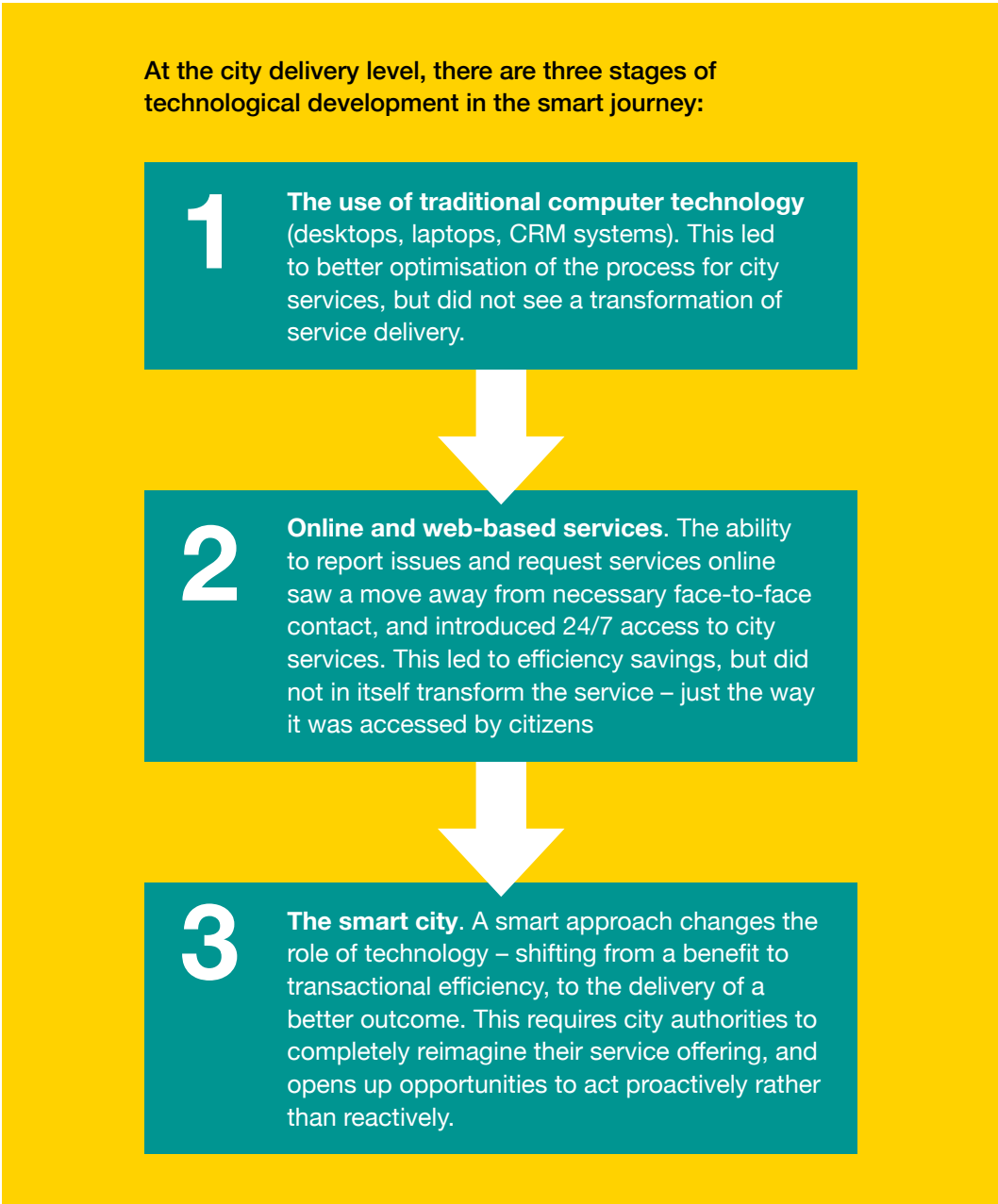
EXHIBIT 6: ENVIRONMENTAL SMART INITIATIVES STILL A SMALL PROPORTION OF TOTAL



Source: EIC research from published sources including www.smartcitiesworld.net

Interestingly, while the proportion of smart city initiatives that focus on the environment has changed little, some of the emphases have done. Growing concerns over the health effects of air quality has led to a rise in the number of smart initiatives relating to air quality being announced (though this is not yet showing up in the content of smart strategies due to the time lag to develop and publish or revise these).

EXHIBIT 7: THE THREE STAGES OF A SMART CITY



Smart environmental opportunities face specific barriers

No one doubts that many city leaders are determined to improve their cities, environments. Thirty five Mayors who are part of the C40 network recently pledged to *'set ambitious [air] pollution reduction targets within two years that meet or exceed national commitments, putting them on a path towards meeting World Health Organization guidelines.'*⁷

So what is holding back the full scale harnessing of smart technology to the environmental cause?

The environment suffers disproportionately from 'siloed' thinking: Citizens experience their local environment as a whole. If you live on a congested street you will probably have poor air quality, noise and lack of green space all at once. Yet the public sector and the environmental community has historically treated the environment as a series of separate issues. Air quality, waste, biodiversity, carbon emissions – in most countries all have separate legal frameworks and targets, and different experts. In addition, environmental policy and smart or digital policy are usually completely separate departments within city governments, with separate budgets and reporting structures. In researching this paper and approaching numerous cities around the world, our requests for engagement were often passed back and forth between separate 'digital/smart' and 'environment' teams with no internal clarity on who is responsible for the more holistic 'smart environment' agenda. In contrast, transport systems, are more commonly viewed by cities as single systems so are seen as suitable for smart tech networked approaches.

Environment policy is often compliance-led: A need to upgrade transport network efficiency or public healthcare is often driven by a recognition that these systems must function properly to avoid social collapse. While a poor environment has huge long-term implications, this is less true in the short-term, and cities will often take action only in response to the need to achieve legal compliance. For example, many UK cities have only been ordered to set up Clean Air Zones and been given funding to do so after a series of legal judgements about their failure to comply with the Limit Values in the EU Ambient Air Quality Directive. This tendency leads to urban environmental interventions being blunt, sporadic and often hard-engineered (as opposed to smart tech-led) due to a legally-driven need to achieve rapid results.

Environmental data sets are often rooted in analogue methods: Traditionally, environmental data sets have often been created and operated for legal reporting requirements. The current data infrastructure which underpins the UK climate emissions in the UK had its origins in the early 1990's and comprises over 600 spreadsheets, while data on waste and recycling is extremely poor even in advanced economies. This is changing as cities start to open up their data, and there are some great examples of real time open environmental data, such as Melbourne's Urban Forest Visual⁸ site and the London air quality site Breathe London⁹, but there is a long way to go in many cities.

Procurement methodology can be unsuited to smart solutions: Public procurement processes often do not lend themselves to smart environmental initiatives. Traditional procurement is based on individual tenders for specific products, whereas some smart environmental opportunities work better if purchased as commissioned outcomes, allowing for better cross-disciplinary collaboration. Further, technological innovation often moves faster than local authority procurement practices. Procurement of these existing individual tenders, and their budgets, happens within individual local authority departments. The current system is not set up to acknowledge or capitalise on the cross-silo benefit of smart technologies.

Business models can be hard to develop for smart environment innovations:

Environment is traditionally a public good which can mean both that citizens may be less willing to pay for specific environmental benefits and that it can be difficult to monetise environmental solutions. For example, one European city experimented with an innovative pilot initiative combining real time traffic and air quality data to enable traffic-routing to avoid the creation of pollution 'hot spots'. The pilot was discontinued however as no way was found to make it financially self-sustaining.

Collectively, these challenges can slow the development of a vibrant market for smart technology environmental innovations. When combined with the lag between the pace of technological development and the time required for public authorities to develop an overarching, coherent smart city strategy, the result can be missed opportunities. As New York's Deputy Chief Technology Officer Jeremy Goldberg commented: "Technology is developing so rapidly that if you spend too much time on strategic planning you [risk] designing a plan that may not be relevant in a year".¹⁰

An agenda for action

The pressure on cities to deliver a better environment is only going to grow, and maximising the opportunities from using smart technologies that we know are there is essential. The following actions that can be taken by cities would help achieve this:

- **Maximise the amount of open environmental data:** The amount of open environmental data in cities is currently variable. The falling cost of sensor and satellite technology is leading to a rapid increase in the amount of earth observation and local environmental data. Making this available, and in usable formats, to citizens and businesses is vital. It will engage the public, spur behaviour change and create opportunities for commercial smart innovations.
- **Develop ambitious environmental strategies covering all relevant topics:** This will help avoid the risk of silo-thinking and a sole focus on compliance - the European Environment Agency found that a focus on compliance with specific air quality Limit Values has undermined progress on air pollution). The Canadian approach of requiring Continuous Improvement in pollution levels under its Keeping-Clean-Areas-Clean strategy is a good example of a better policy¹¹.
- **Link smart city and environmental city strategies:** This could be done by creating a joint team from both smart and environmental departments with city staff, or ensuring an environmental section in any smart or digital strategy and vice versa. The creation of a 'smart environment' champion within cities could also help.
- **Reform environmental procurement:** We need to move away from environmental public procurement based largely on purchasing either specific pieces of environmental technology or consultancy services paid for by the hour. Better pre-procurement dialogue between the public and private sectors will help clarify where the public sector client sees the value from the procurement, which might be in terms of a specific environmental outcome. This in turn may open up the scope to use smart innovations and the lead to more outcome-based rather than input based business models and procurement approaches. EIC is exploring the feasibility of developing a procurement toolkit to provide support for public authorities in this regard.

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Core sponsors:



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1. EIC report 'Getting the Green Light: will smart technology clean up city environments?' (2014).
2. EIC's smart cities work is guided by an industry task force, comprised of senior public and private sector representatives. See <http://www.sustainablesmartcities.org/about-us/smart-city-task-force/>.
3. The Carbon Disclosure Project is a not for profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. www.cdp.net.
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The Environmental Industries Commission (EIC), founded in 1995, represents the businesses which provide the technologies and services that delivery environmental performance across the economy. In short, we are the voice of the green economy. Our members are innovative and the leading players in their field, and include technology manufacturers, developers, consultancies, universities, and consulting engineers.

Front cover: City of Melbourne Urban Forest Visual. An interactive website visualising individual data on the city's 70,000 trees – including their genus and useful life expectancy – enabling citizens to better engage with the management of a natural capital resource at the local level.