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Foreword

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The PD process enables a guide to be rapidly developed in order to fulfil an immediate need in industry. A PD can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Relationship with other documents

Acknowledgement is given to Urban DNA for their role in the development of the capability assessment/gap analysis at Annex A.

This PD is issued as part of a suite of BSI publications related to smart cities:

- PAS 180, *Smart cities – Vocabulary*, which defines terms for smart cities, including smart cities concepts across different infrastructure and systems elements and used across all service delivery channels;
- PAS 181, *Smart city framework – Guide to establishing strategies for smart cities and communities*, gives guidance on a good practice framework for decision-makers in smart cities and communities (from the public, private and voluntary sectors) to develop, agree and deliver smart city strategies that can transform their city's ability to meet future challenges and deliver future aspirations;

- PAS 182, *Smart city concept model – Guide to establishing a model for data interoperability*, which provides a framework that can normalize and classify information from many sources so that datasets can be discovered and combined to gain a better picture of the needs and behaviours of a city's citizens (residents and businesses);
- PD 8101 *Smart cities – Guide to the role of the planning and development process*, which gives guidance on how the planning and implementation of development and infrastructure projects can equip cities to benefit from the potential of smart technologies and approaches.

These publications are available to download at:
http://www.bsigroup.com/en-GB/smart-cities/

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Use of this document

As a guide, this PD takes the form of guidance and recommendations. It should not be quoted as if it were a specification or a code of practice and claims of compliance cannot be made to it.

Presentational conventions

The guidance in this PD is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Spelling conforms to *The Shorter Oxford English Dictionary*. If a word has more than one spelling, the first spelling in the dictionary is used.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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0 Introduction

0.1 General

Cities today are facing enormous challenges. It is no longer enough to simply make incremental improvements to the way cities are managed. Instead, city leaders are faced with the task of identifying and implementing radical and transformational solutions.

Fortunately, fresh approaches to city management and developments in technology are providing new and useful tools for city leadership, and creating greater opportunities for citizens, businesses and other organizations in the city to actively participate in implementing the changes that need to take place.

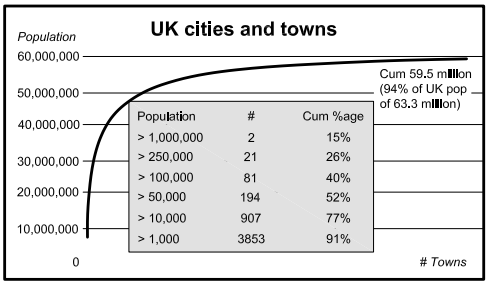
In short, technology can help cities become smarter.

Cities are important

Cities make up just 9% of the UK's landmass but account for 54% of population, 59% of jobs, 61% of GVA (Gross Value Added) and 72% of high-skilled jobs.

Of course, the smart city agenda is not just for the major and medium-sized cities; it is just as important for smaller cities and towns. When these are included, the places where 80% of people in the UK live are covered (Figure 1).

Figure 1 **UK cities and towns by population**



[SOURCE: Office for National Statistics data, 2013]

Benefits of integration

75% of the 60–90 million street lights in Europe are over 25 years old. Replacing them with LED lamps could potentially halve the energy bill and maintenance costs giving a return on investment (ROI) in around 6–8 years. Replacement would also enable them to be used as strategic assets for a Wi-Fi mesh network; a hub for smart parking and other sensors; a post for air quality monitoring; a stand for CCTV and the like.

The King's Cross development is one of the largest urban redevelopment projects in Europe, and will ultimately provide facilities for 45,000 people to live, work and study. A key feature is the integrated planning and operation of water, electricity, gas, heat and data services under a single asset owner. This integration will enable both substantial cost savings and the deployment of new technologies in energy supply, use of renewables, and other features that together will achieve high levels of sustainability and a targeted reduction in CO_2 emissions by over 50% relative to 2005 levels.

0.2 Challenges facing modern cities

The challenges cities face today include the following.

- **Challenges of resilience.** The increasing incidence of extreme weather conditions, growing food shortages and energy vulnerabilities around the globe, all have a profound impact on cities.
- **Emerging markets.** The growth of emerging markets, in particular the expected doubling of the middle class globally from three billion to six billion by 2050, is creating increased competition for resources and economic activity.
- **Global competition.** UK cities are no longer just facing competition from other UK cities for talent and capital but have to match the attractions of cities globally.
- **Migration.** The continuing inward migration experienced by many cities is leading to increased congestion, pollution and demand on service provision. The differing social norms of the many communities in a modern cosmopolitan city, while providing a richer cultural environment, can also affect social cohesion.

- **Industrial decline.** Some cities, in contrast, are having to deal with industrial decline and decreasing population.
- **Ageing population.** The ageing population is having an ever increasing impact on both the tax base and the costs of public services.
- **Persistent inequality.** There is a variation of life expectancy of up to 20 years between the richest and poorest parts of many UK cities. [1)]
- **Citizens.** The increasing use of digital technology in every aspect of life means that citizens expect public services to be delivered in a more customer-centric way.
- **Pace of service innovation.** The accelerating pace of change in the way people live their lives provides real challenges for long-term planning. For instance, the rapidly increasing use of online shopping is undermining the viability of retail districts and out-of-town shopping centres.
- **Ageing infrastructure.** A significant amount of infrastructure in UK cities is likely to require replacing or retrofitting over the next few years to make it fit for purpose.
- **Lack of overall control.** Many of the key decisions relating to city life are made by individual agencies with a narrow, compartmentalized focus, rather than in terms of their impact on the city as a whole. Many aspects of city life are also dependent on the decisions of regional or national governments or agencies.
- **Money.** In a time of stretched budgets, it is often difficult to get the investment funding needed to take a long-term approach to city challenges – particularly where new business models, service innovation, or new technology is involved.

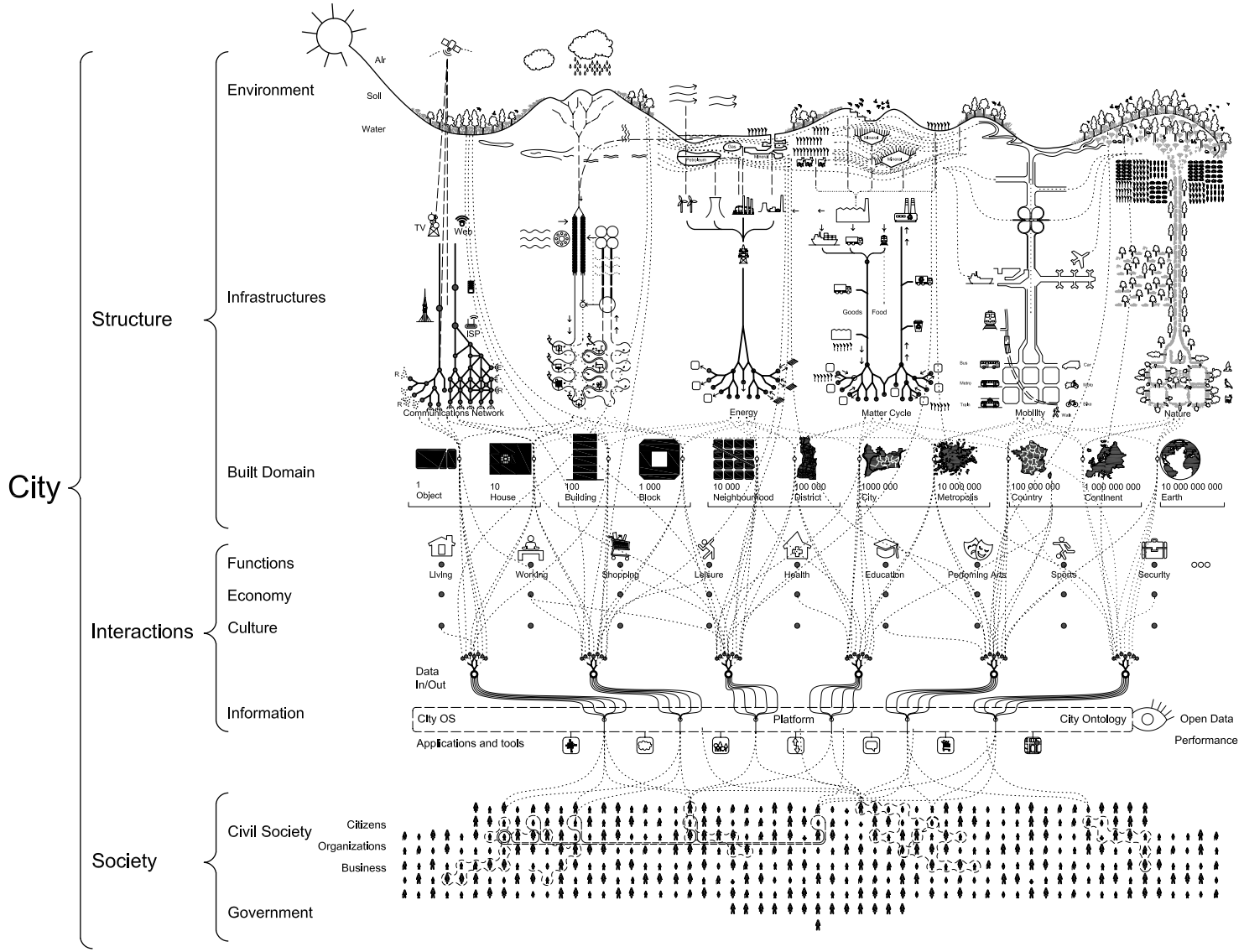
0.3 Challenge of managing the city

Cities can be viewed as complex organisms, with many organizations and infrastructures providing the services needed for them to function effectively. The local authority only directly manages a minority of the key city services and has to exercise its overall strategic management role through partnerships with the other stakeholders in the city.

Figure 2 maps out some of the systems and activities that make up a city.

1) See for example London: http://life.mappinglondon.co.uk/

Figure 2 **The City Anatomy (as developed by the City Protocol Society)**



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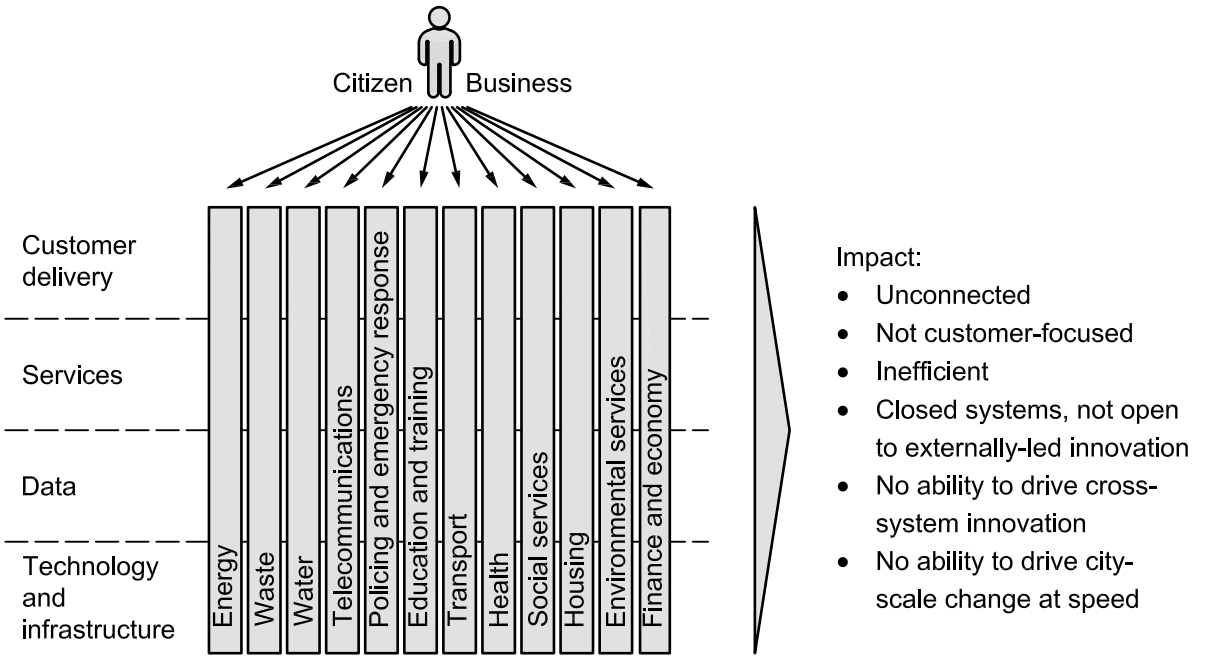
The number of independent stakeholders that have important roles in the overall functioning of the city makes it difficult for the city to act as a cohesive whole. To make matters worse, individual city systems are becoming increasingly complex and, at the same time, increasingly dependent on each other in often poorly understood ways. For instance, both the electricity and ICT systems are vital ingredients in every other city system and failure in one of these is likely to have a domino effect on all of the others.

PAS 181 reviews the traditional operating model of a city and identifies the problems caused by a lack of co-ordination and integration between city systems. Figure 3 illustrates this operating model.

Figure 3 **Traditional operating model – Where cities have come from**



[SOURCE: PAS 181:2014, Figure 4]

Equally challenging is the fact that every city has a unique history, set of characteristics and geographic context, which together provide a specific set of challenges and opportunities for city leadership to take account of. A city also needs to be managed in a way that takes account of its wider social context and the specific set of opportunities and challenges it faces.

0.4 Opportunities coming from technology and the use of data

The following changes in technology the use of data are providing city leadership with new tools and opportunities for effective change that can help them meet these challenges.

a) **Connectivity.** Digital connectivity is growing exponentially. No longer are we limited to the use of computers to connect to the digital world, but now we can also use smartphones, tablets, and televisions, enabling us to access information, provide feedback and connect with each other, wherever we are, and whatever activities we are engaged in.

b) **Sensors.** Sensors are increasingly built into smartphones and other digital devices carried by a growing percentage of the population, as well as being embedded into the built environment. This has the potential to allow city leaders to gain an increasingly detailed, real-time picture of what is happening within the city.

Linked to these changes are three other elements.

1) **Data.** The volume of digital data is effectively almost doubling every two years [2)]. The increasing use of Geographical Information Systems (GIS) is allowing data from different sources to be linked together, based on location, and thus provide a much richer picture of what is going on in the different neighbourhoods and areas within the city. This is supported through open standards from the Open Geospatial Consortium (OGC) and the Technical Committee 211 at the International Organization for Standardization (ISO/TC211). This ability to pinpoint a geographical reference, enable access and link data underpins the compelling case to share it between different departments, agencies, industry and research organizations.

2) **Analytics.** Our ability to analyse and draw insight from this data is also growing rapidly. Smartphone tools and apps are now able to proactively provide us with useful contextualized information as we go about our daily lives, while supercomputers are able to query vast quantities of unstructured data and suggest solutions to more complex problems.

3) **Collaboration.** The ever-increasing use of the internet is supporting a more collaborative relationship between customer and supplier, leading to, for instance, patients taking a greater role in monitoring and managing their own health conditions.

These changes are enabling tools to be developed that provide citizens, enterprises and city leaders with the possibility of faster, evidence-based, responses to the challenges they face. These tools:

- offer easier and cheaper access to data and the ability to visualize and analyse that data to enable better decision-making, both for real-time management of the city and for longer term planning;
- support collaboration between different agencies, between citizens and between citizens and agencies; and
- provide new methods of integrating city systems to enable a more holistic approach to city challenges and opportunities, to help simplify city management; and to enable integration to take place at a more granular level and so reduce vulnerability to catastrophic failure.

These examples relate to the technology changes that are important now. They will be followed by a continuous stream of other technology innovations, for instance the use of new materials, robotics, new methods of construction, and local manufacturing (e.g. 3D printing). The challenge to cities is to develop a culture of continuous innovation; taking full advantage of emerging technologies to benefit the citizen and enhance the life of the city.

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2) See, for example: http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm

1 Scope

This Published Document (PD) provides guidance for city leadership on the applicability of smart city approaches to their city. City leadership includes everyone in a strategic position within a city whose decisions have a significant impact on the way the city functions and develops, whether they be from the public, private or community sectors.

This PD aims to provide a balanced picture of the potential benefits of smart city strategies, and provides recommendations on how to identify first steps towards making a city smarter.

It covers the role of technology and data in providing tools in this process.

It also covers the role of standards, based on good practice from successful smart city initiatives, in providing building blocks that a city can use to develop and implement its own effective smart city strategies.

2 Terms and definitions

For the purpose of this PD, the terms and definitions given in PAS 180 apply.

3 Smarter city

3.1 General

Cities have a long history of adjusting to changes in society and to the requirements and needs of the citizen. The fact that cities have continued to function, through repeated financial crises and other challenges, demonstrates that they have always been able to change and re-invent themselves in order to continue to meet the needs of the citizen.

So what is a smart city?

> BSI defines a smart city as one where there is "effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens".
>
> [SOURCE: PAS 180:2014, **3.1.62**]

The smartness of a city is therefore not about technology as such, but rather about how technology is used, as part of a wider approach, to help the city function effectively, both in its individual systems, and as a whole. It builds on existing foundations within the city and enables it to set a more engaging vision and follow a new and more effective path into the future.

Smart cities are therefore the result of smart leadership, not only from the city leadership itself, but from all citizens and organizations within the city that seek to influence and support their city becoming a better place.

Of course, local authority leaders have a key role because the community leadership role of the local authority provides them with the overarching responsibility for the way the city functions. For local authority leaders in particular, smart leadership is about supporting the collaborative effort of all the organizations and citizens in the city to tackle the key priorities of the city in the most effective ways.

The role of technology in smart cities is as a tool to support this collaboration, for example to help gather and make available valuable information and evidence, and to automate some of the underlying processes.

3.2 Benefits of a smarter city

Individual city systems, i.e. the set of organizations, community facilities, technical systems and infrastructures that deliver a specific city function such as health or energy, are becoming smarter. Technology is increasingly being used as a tool to support better integration within the individual city systems, to enable them to work more effectively. Increasingly, for example, we are talking about smart mobility, smart grid and smart healthcare.

A smarter city takes this integration one step further. It is a city where these individual city systems are better integrated, not just within themselves but together, in order to seamlessly deliver on the city purposes. This increased connectivity allows cities to be managed more holistically and effectively.

For the citizen, the benefits of this integration of city systems include the following.

- **Personalized services.** The ability to have the services they use integrated around their needs, rather than around the convenience of individual service providers.
- **Access to information.** Better access to contextual information to support decisions relating to life in the city, helping them to navigate around the city and achieve their goals more easily.
- **Greater transparency** in public sector decision-making processes, making it easier to feed in informed ideas and opinions within consultation processes and to hold public sector organizations to account, leading to an increased sense of democratic participation.
- **Support in helping each other more effectively.** Citizens can use open data to develop and use new applications to manage their lives more effectively and to collaborate to tackle joint challenges together.

These benefits can result in a better run and more attractive place to live and work for the citizen, as well as providing them with improved services at lower cost.

For local business leaders, the benefits include the following.

- **More efficient management** by providing them with easier access to more accurate and detailed real-time data about city life and services. This could benefit their business in a variety of ways, for instance enabling more efficient logistics, more insight into customer needs, and more opportunities for collaboration.
- **New business opportunities,** to allow them to develop new and profitable services in the city using the widespread availability of usable data.

For service providers, the benefits include the following.

- **Greater synergies.** Closer integration with other service providers can enable potential synergies to be more easily exploited, leading to greater efficiency and control of the outcomes they aim to deliver.
- **Individualized service offerings.** Increased availability of data about the needs and circumstances of their customers can enable them to provide more tailored services, leading to greater efficiency and customer satisfaction.
- **New ways to meet customer needs** by providing them with opportunities to develop new services that deliver the outcomes they are responsible for in a way that better suits their customers, including self-service and peer-to-peer service options.

For city leaders, the benefits include the following.

- **More informed decision-making** by providing them with better evidence, enabling them to be more confident in their decision-making and to manage the city more effectively.

- **The facilitation of wider service provision.** The opening up of more useful data to the public can enable other agencies and businesses to develop a range of useful services for the citizen and enable citizens to provide effective peer support to each other.
- **Better collaborative processes,** enabling more efficient and integrated working between city stakeholders.
- **Better citizen engagement.** More transparent processes can enable stronger and more positive engagement with citizens and businesses.
- **More positive relationships with other cities.** The ability of the city to compare itself to other cities on a global stage can enable it to identify opportunities for collaboration with other cities, while maintaining a competitive edge.

In other words, increased connectivity can lead to the achievement of better results at lower costs for city leaders.

3.3 Importance of data

Case study: Smart traffic management in Stockholm

Researchers at KTH Royal Institute of Technology in Sweden are using IBM's streaming analytics technology, to gather real-time information from the global positioning system (GPS) devices on nearly 1 500 taxi cabs in the city and will soon expand to gather data from delivery trucks, traffic sensors, transit systems, pollution monitors and weather information. The data is processed using IBM's streaming analytics software, giving the city and residents real-time information on traffic flow, travel times and the best commuting options.

For example, a resident could send a text message listing their location and desired destination. The technology would instantly process the real-time traffic, rail and weather information and provide anticipated travel times via car and public transportation, giving people an accurate and instant view of the fastest way to get to their destination.

For the past year, IBM has worked with the city of Stockholm to monitor traffic flow during peak hours. The congestion management system has reduced traffic in Stockholm by 20%, reduced average travel times by almost 50%, emissions by 10% and the proportion of green, tax-exempt vehicles has risen to 9%.

A key factor in a city becoming smarter is its ability to exploit the power of data. The provision of accurate, timely and comprehensive information about what is happening in the city to those who need it can enable city leadership, planners and managers, as well as individual citizens and businesses, to make decisions that better meet their own needs, as well as supporting the overall functioning of the city.

In order for this to happen, the following recommendations should be followed.

a) The city should be **instrumented**. Every opportunity should be taken to deploy sensors, CCTV cameras and other such devices at strategic points around the city, to allow the collection of useful data about city life. This data should be supplemented by anonymized mobile phone data from the mobile phone operators and data from other devices, where relevant. In this way, data can be collected regarding vehicle and pedestrian movements, air quality, noise levels, or any other issue of relevance to the city.

b) **Data** collected by different agencies within the city for different purposes **should be opened up**, with due concern for privacy and security, to allow the needs of different communities and neighbourhoods to be better assessed. This should involve not only sharing data between different city agencies, but also opening up the data to citizens and businesses for appropriate use. The local authority should make its data open by default, only restricting access where it is appropriate to do so, in order to support a culture of sharing within the city.

c) **Data should be made easy to aggregate.** The data from different sources and city systems should be brought together to gain greater insight into what is going on in the city. This requires the alignment of terminologies and ontologies used in data collected by different agencies for different purposes. PAS 182 supports this need by describing and giving guidance on a smart city concept model that provides the basis of interoperability by allowing the alignment of the terminologies in use across different city sectors.

d) It should be **easy for the data to be visualized and accessed** by whomever might appropriately benefit from it. Data should be made available with clear and effective user interfaces and in a variety of formats, depending on the context and the person or technical system needing it, in order to make it more useful.

By following these recommendations **detailed, measureable, real-time knowledge** about the city can be available to any person or technical system that could use it to help fulfil their role or achieve their goals, within the context of the overall effective functioning of the city.

In addition, **analytics and decision-making systems** should be used so that this knowledge can be used by city leadership, planners and citizens, to support real-time decision-making and enable better planning to meet the future requirements of the city.

Following these recommendations could also enable **more open and inclusive decision-making processes**, allowing citizens, policy makers and businesses to work together to manage the life of the city, for the benefit of all.

3.4 Importance of people

Case study: Useful data through partnership with the citizen

Glasgow city council planned to develop a 3D software model of the city's buildings, with data on energy consumption, fuel type(s), building type, construction type, building age, roof type and pitch, etc. The model would allow energy planners to look at all aspects of energy consumption and building data and use this in planning energy solutions for the city.

From previous experience, it was known that it would not be possible to get access to energy consumption data at a domestic level, due to privacy issues, which would limit the effectiveness of the tool.

To circumvent this, the model was linked to a website that encouraged citizens to input their energy and building data in return for a bespoke energy efficiency report on their property, produced automatically using a software simulation tool. The report provided them with a list of possible interventions that could be applied to the building to increase its energy efficiency.

In this way, the citizen could both become smarter in the management of their own home and also help enable the city as a whole to be better managed.

The key challenge around smart cities is not technological but about people.

The performance of a city is the aggregate outcome of the daily lives of its citizens and workers. Currently, this bottom-up activity is not working sufficiently. City leaders therefore need to develop strategies and management processes that can help to coordinate the activities of everyone in the city around common goals, leading to effective transformational solutions.

A key opportunity is to harness the knowledge and energy of the citizen by providing win-win opportunities to gain their active participation in city transformation.

Progress towards making a city smarter comes when city leadership and institutions use the new tools provided by technology and data to put in place better policies, services and infrastructures (including, but not limited to, digital) that are sustainable and resilient, that provide opportunities and resources to people, communities and businesses more equally, and that enable their city to be more successful.

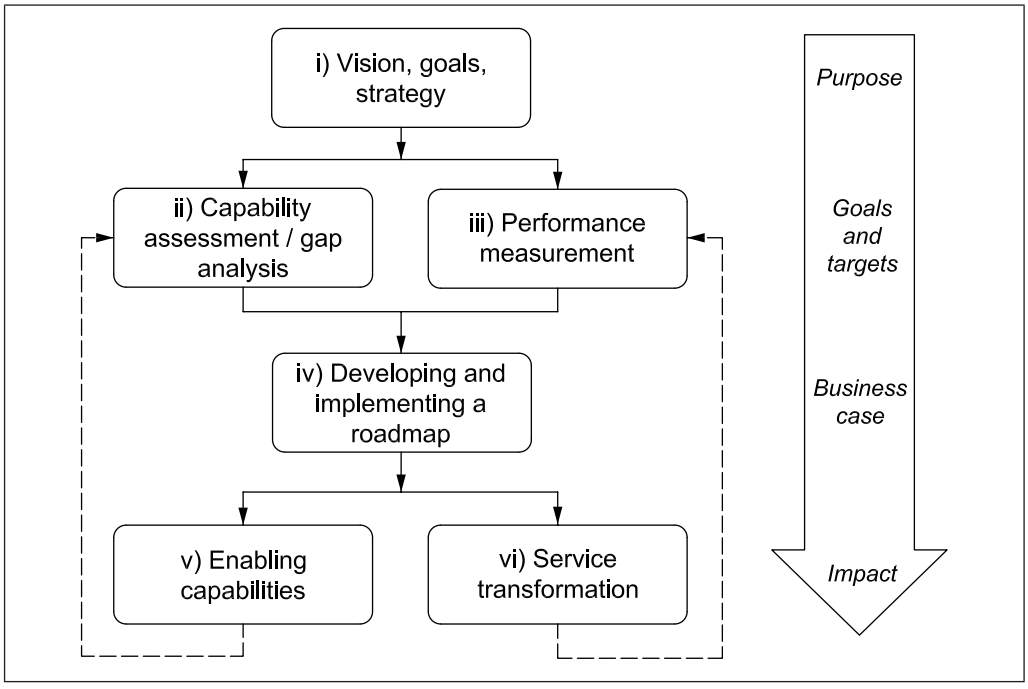
It is equally important to ensure that the technologies used within a smart city strategy are accessible to, and usable by, the people they are intended to benefit.

4 Becoming a smarter city

4.1 General

In order to take forward a smart city agenda, the city leadership should follow a simple process framework, as shown at Figure 4.

Figure 4 **Smart city process framework**



4.2 Vision, goals and strategy

Every city is unique. It has its own history that explains how it has arrived to where it is today. It has its own brand, i.e. the set of images and ideas that are evoked when people think about it.

Clearly there are many important characteristics of a city that need to be taken into consideration when developing its vision, goals and strategy. For example: Is it a metropolis, or a medium or small city? Is its population growing, stable or shrinking? Is its economy strong or weak? How skilled and educated is its workforce? Is its population predominantly youthful or elderly?

The city's vision, goals and strategy should be based on all of these characteristics and seek to tackle the challenges and, more importantly, grasp the opportunities the city faces. However, in order to be successful, the city's vision should also build on the strengths of its history, its brand and its values.

The work of developing the vision, goals and strategy should involve all the key stakeholders in a city, including the citizens and businesses. A good way to start is to focus on some key joint challenges that need to be tackled on a citywide basis. For instance, it is clearly in everyone's interest to find ways to make the city more resilient – whether this is against natural disasters or terrorist attacks, or even to cope with some of the normal stresses of city life.

Working together to tackle such challenges in a smart and transformational way can demonstrate the importance and value of partnership working. It can also help to identify the dependences that different city systems have on each other and build practical working relationships between key stakeholders.

A key factor in ensuring success is to set up a smart city team, directly accountable to the city leadership, to drive forward the process.[3)]

4.3 Capability assessment/gap analysis

Before developing the roadmap to deliver on the smart city strategy, the city leadership should assess where the city is now, in terms of its capability to benefit from the transformational opportunities that technology can offer, and to determine the gap between this and what is needed. This includes assessing:

- the strength of the partnership structures in place and the ability of the city to coordinate the planning, implementation and management processes effectively;
- how well key stakeholders, and particularly citizens, are engaged in helping make the city work well;
- how effectively the city is able to deliver the services that the citizen needs, including the ability to measure and monitor effectiveness;
- the quality of the connectivity assets of the city and the effectiveness of those assets in supporting collaboration and the collection and use of data; and
- how well the physical assets of the city can be used to support city management and citizen empowerment.

PAS 181 could be used by city leadership to assess the strengths and weaknesses of their city in order to determine which areas of city life they need to focus on.

A smart city capability assessment/gap analysis diagnostic tool has been developed, consistent with PAS 181, which allows city leaders to make an overall assessment of the delivery capabilities of the city. This has been tested in partnership with a number of UK cities, with positive feedback on its ability to quickly identify the key areas to focus on. Figure 5 provides an overview of the tool, which is covered in more detail at Annex A.

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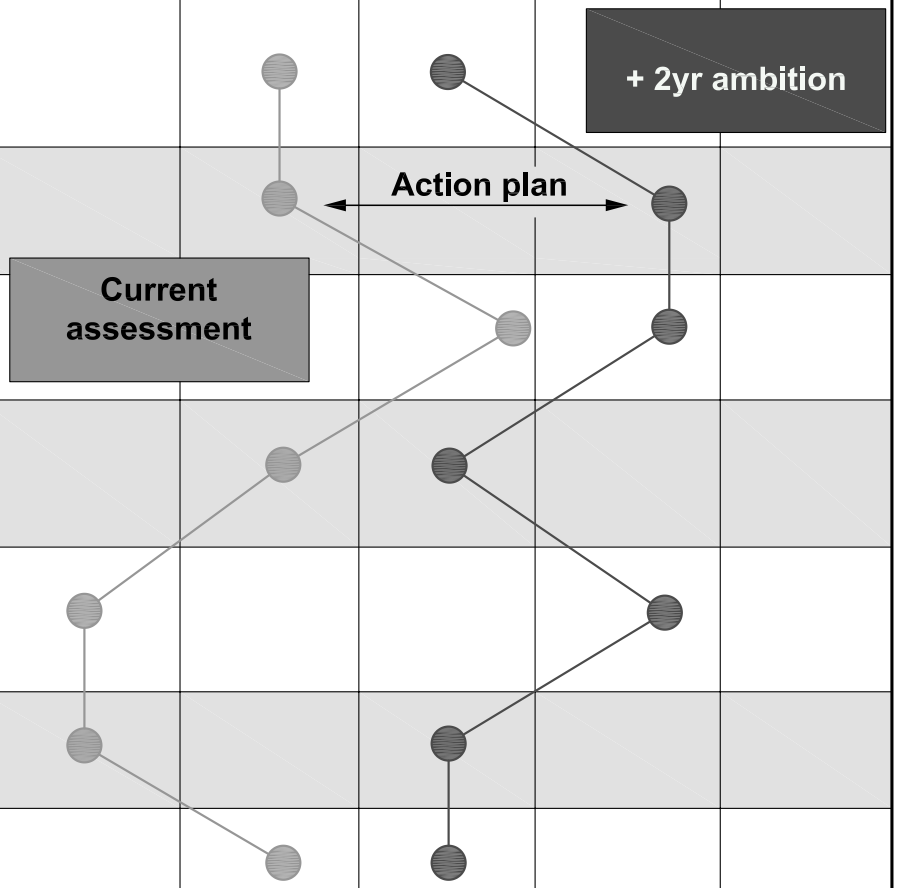
3) An example of this is the Smart London Board.

Figure 5 **Overview of the smart city capability assessment/gap analysis diagnostic tool**

Component	181 ref	Characteristics	Maturity assessment 1 Lagging	2 Developing	3 Competent	4 Progressive	5 Excelling
Leadership environment	A B1 B3 B8 D	Providing a strong city leadership network that advocates a common vision; operates as an effective leadership team; role-models open transparent style; sets priorities, creates and maintains a coherent roadmap; and ensures city success.					
Customer / stakeholder focus	B9 B10	A city that is built around its citizens, business community and visitors (as key stakeholders / customers); that truly understand them; engages them in an open and transparent relationship; and proactively ensures their active contribution to progress.					
Service enablement	B2 B3 B5 B7	Providing the enabling context for success; including policy, planning, common protocols; means of collaboration; capability / capacity management; financing; business models; procurement process; and an underpinning operating model.					
Service delivery		Offering and managing quality services to city stakeholders, through direct or indirect means. Selecting the most appropriate business models and delivery agents (including society) to deliver most efficiently and effectively.					
Digital asset management	B6 B13 B14 B11 B12	Exploiting the power of open data sharing and modern technologies (e.g. social media, analytics, mobile, cloud, sensors) through investment in and management of digital assets; including respect of privacy and digital abilities.					
Physical asset management		Inventorising and exploiting physical assets; for multi-purpose; managing life-cycles and investments; and integrating physical and digital assets; complete capture and open sharing of asset information.					
Performance management	C	Setting appropriate goals and targets; establishing measures and monitoring practices; ensuring a performance culture; predictive use of data; robust public value measurement; open reporting of value to stakeholders.					



4.4 Performance measurement

City performance is already assessed on multiple fronts; indeed the city leadership might feel that is has to report on too many performance measures. However, a city does need to be able to measure its performance in the areas it has identified as priorities and agree targets as to what it needs to achieve, to enable it to focus its efforts on implementing a smart city strategy. This can then provide the basis for a balanced scorecard method of tracking progress in a systematic way and of evaluating how effective the implementation of the roadmap is on delivering the goals that the city has set itself.

At the moment there are few usable, quality city performance measures. Part of the reason for this is that the understanding of words, such as smart, sustainable, and resilient is in a state of flux and so the targeting and monitoring of performance against such goals is also evolving.

However, initiatives are in place to improve matters. BSI has already developed some relevant measurement standards such as PAS 2070, *Specification for the assessment of greenhouse gas emissions of a city – Direct plus supply chain and consumption-based methodologies*, which supports the measurement of the greenhouse gas emissions of a city. The International Organization for Standardization (ISO) has recently published ISO 37120, *Sustainable development of communities – Indicators for city services and quality of life*, which defines and establishes methodologies for performance measurement across 100 indicators for sustainable cities. Cities are now implementing ISO 37120 through the World Council on City Data (WCCD) and additional indicators on resilient cities and smart cities are being developed. ISO is also undertaking ongoing work on measures for smart community infrastructures. The European Commission is also addressing the performance measurement of smart cities.

While this work progresses, cities need to pay increasing attention to target-setting and performance measurement in order to demonstrate that their activities provide real value. With the emergence of new business models, with financial investment and return coming from a broader range of more integrated sources, and with the complexity of public value and how it is perceived over time, the requirement on city leadership to evidence their performance is only likely to increase.

4.5 Developing and implementing a roadmap

Many cities already have a roadmap of some form, however few of these address specifically how the city can move towards becoming smarter.

The city leadership should develop a smart city roadmap collaboratively with city stakeholders, and include initiatives focused both on improving the **enabling capabilities** (see **4.6**) and on addressing areas identified in the city's vision, goals and strategy (see **4.2**), where **service transformation** (see **4.7**) is required, such as urban mobility, economic growth, air quality, security and affordable energy supply. It should include a portfolio of initiatives, ranging from simple, common-sense actions, through to, potentially, actions based on new or emerging technologies, e.g. autonomous vehicles, as well as actions providing immediate impact, along with others that are important for the long-term progress of the city.

PAS 181 provides some high-level guidance in this area. Figure 6 summarizes the phases in developing a smart city roadmap as detailed in PAS 181.

Figure 6 **Phases of a smart city roadmap from PAS 181**

PLAN

The preparation and planning needed to develop a tailored roadmap for the city, to ensure that the business case is fully articulated, and that all key stakeholders are on-board. Key outputs from this phase should include:

[A] guiding principles: the agreed set of principles that stakeholders and delivery partners seek to work towards in delivering the smart city roadmap;

[B1] city vision: a high-level document setting out the agreed future vision for the city;

[C] benefit realization framework, including:

- strategic business case, setting out the key costs and benefits associated with the smart city programme;
- a high-level benefits realization plan, setting out the action needed to ensure full downstream delivery of the intended benefits from the transformation programme.

[B8] smart city roadmap: a multi-year transformation plan, covering, among other things:

- embedding the **[B3] leadership and governance** processes;
- a **[B4] stakeholder collaboration** workstream;
- development and delivery of a smart **[B5] procurement and supplier management** strategy;
- plans for mapping IT and digital assets, and moving towards the **[B14] open, service-oriented, city-wide IT architecture**, and using this to enable **[B2] transforming the city's operating model**;
- any additional priority action identified as a result of **[B6] mapping the city's interoperability needs**;
- a risk management strategy, to ensure that the delivery process effectively addresses the smart city **[D] critical success factors.**

INITIATE
In this first phase of delivery, the focus is on building the maximum of momentum behind the roadmap for the minimum of delivery risk. This means focusing in particular on: a) quick wins to demonstrate progress and early benefits, using little or no technology expenditure, in order to accelerate belief and confidence across city stakeholders; and b) embedding the roadmap in governance structures and processes which will be needed to inform all future investments.

DELIVER
In this phase, some of the more significant investments start coming on stream - for example, an open data platform to support SME and community-led innovation with city data, one-stop customer-facing delivery platforms for public services, and the first wave of smart services and applications from champion or early adopter organizations within the city.

CONSOLIDATE
In this phase, the focus shifts towards driving take-up of the initial smart city services and applications, learning from smart data and user feedback, and using that feedback to specify changes to the business and technology architectures being developed as longer term, strategic solutions.

TRANSFORM
Finally, as take-up of smart city services reaches critical mass, the programme looks to build out the broader range of smart city projects, and complete the transition to the full strategic IT platform needed to guarantee future agility as business and customer priorities change.

[SOURCE: PAS 181:2014, Figure 7]

4.6 Enabling capabilities

4.6.1 General

In order for the city to move forward at the rapid pace needed to tackle the urgent challenges it faces, it is important that any weaknesses identified in the capability assessment/gap analysis are addressed. **4.6.2** to **4.6.8** discuss each of the seven assessment themes.

4.6.2 Leadership environment

4.6.2.1 General

City leadership not only includes local authority leaders, but involves actors from all sectors, although the local authority does have a substantive role.

The role of leading a city is diverse and complex, involving a wide range of activities. With the need to integrate across services there is an increasing need to alter the model of leadership towards increased communication and collaboration. This involves putting in place measures to, for instance:

- ensure that collaboration is not limited to formal partnership arrangements, but also includes practical and effective structures to support joint planning and implementation between the main stakeholders in the city;
- encourage a culture of innovation, and put in place workable frameworks for ad hoc and informal collaboration;
- identify, link up and support the many different kinds of cross-system initiatives that take place within the city in order to:
    - enable more of such initiatives to happen;
    - support the growth of existing initiatives; and
    - support linkages between different initiatives, where appropriate, to help them become more effective,
- set up systems that facilitate initiatives at many different levels, seeing each, no matter how small or large, as important building blocks of the smarter city while recognising from the beginning that not all of these will succeed;
- manage budgets with a greater attention to developing initiatives in partnership with other agencies and other sectors; and
- identify and access effective sources of financing.

Public agency leaders (political and professional) need to work more collaboratively and effectively:

- between tiers of government;
- between departments and agencies at a local level; and
- between public and private sectors.

Traditionally, the role of public bodies has been to design and deliver services. With the increase in commissioning and mixed service delivery, a key role for the sector is that of convener, and indeed there is an increasing need for public bodies to take a hands-off position.

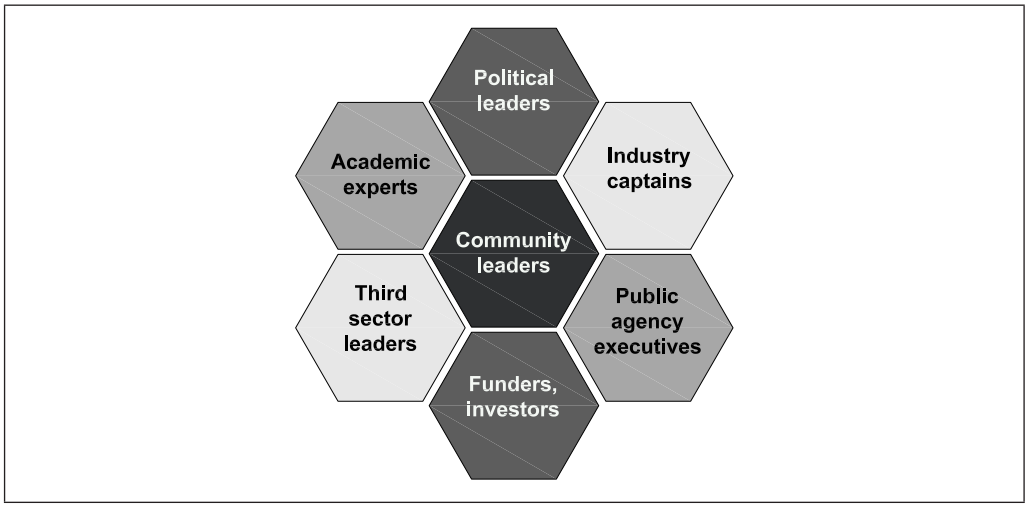
The relationship between private sector leaders, particularly those directly involved in city service provision, and public leaders needs to become more trusting.

Community leaders and leaders of third sector groups need to be more effectively integrated into leadership processes as, in many cases, providing the voice of society.

Academic experts should be used to help guide smart city initiatives, as they can bring a fresh perspective on city transformation and well-informed and objective advice about the feasibility of technology-based initiatives suggested by industry.

Increasingly as public budgets get stretched and private investors pick up a greater role in service provision, lead investors and funders need to be more actively involved in city leadership activities. Figure 7 shows the different stakeholder types which constitute a smart city leadership environment.

Figure 7 **Smart city leadership environment**



4.6.2.2 Benefit from outside expertise

One key aspect of developing the leadership environment is the building of links with outside agencies that can help. While we can never lose sight of the fact that every city is unique and has its own individual story of where it has come from and where it is going, it is just as important to acknowledge that every city has a great deal in common with other cities.

Because of this, city leadership should identify what they can learn from other cities and what opportunities there might be to work with them to develop common solutions. This can help shortcut the process and take much of the risk out of the process of making their city smarter.

An important resource for this is the Future Cities Catapult (https://futurecities.catapult.org.uk/) which can help the city benefit from state-of-the-art expertise and knowledge.

4.6.3 Customer/stakeholder focus

A smart city is one that can effectively involve all the stakeholders, and all of the resources that they represent, in tackling the challenges and grasping the opportunities that the city faces. This process should start with the development of the overall smart city strategy and roadmap, and those activities themselves can indicate whether any of the stakeholders and any sections of the community are not yet properly engaged with the functioning of the city. Failure to address any weakness in this area could limit how far the city can progress towards its goals.

4.6.4 Service enablement

Case Study: Challenge of the compartmentalized mentality

In 2009, a primary care trust (PCT) gave the local county council £500,000 a year for two winters to cover gritting extra paths and pavements, with the aim of improving the quality of life for elderly people, who often fall and fracture bones in icy weather. It also helped ensure additional road gritting, specifically the 35 miles of bus routes in the region, given the major health impacts of road traffic accidents.

The grant from the PCT was clearly aimed at achieving health outcomes, but because the money was provided to the local authority, and not used directly by health professionals, there was a strong reaction against it and one of the governors of the PCT resigned because of it. Changing these entrenched attitudes is one of the big challenges to be overcome in order to provide a culture that supports service transformation.

One of the fundamental transformational changes that can come from digital technology is the ability of the different systems and organizations within the city to work more closely together to achieve common goals. However, very often the compartmentalized nature of those systems can undermine any efforts to develop collaborative activity.

The city leadership should therefore ensure that their management processes are designed to support co-operation in tackling joint challenges, including identifying ways to incentivize collaborative solutions.

In a similar way, the potential to aggregate the actions of several cities to achieve greater savings or other benefits should be actively investigated whenever possible.

4.6.5 Service delivery

In a prolonged period of cutbacks it is easy to focus on doing the minimum necessary in terms of service delivery. Unfortunately, this would tend to simply support business-as-usual activities over a slow process of decline. It is better to maintain a strong focus on delivering services to the highest possible quality, and then to look for new ways to do this that enable the necessary savings to be made. Only in this way is it likely that truly transformational changes in services will be implemented.

4.6.6 Digital asset management

For a city to benefit from digital technology in its journey to become smarter there are a number of requirements that need to be put in place. The city leadership should have in place:

- a ubiquitous, high speed, wired and wireless connectivity infrastructure that can support not only internet access for residents and businesses, but also a wide range of other applications that benefit the city, such as traffic management systems, security cameras, and the exploitation of the Internet of Things (IoT);
- widespread sensor networks that are managed in a way that allows multiple agencies, as well as citizens, to gather the information they need;
- methods of handling the data generated that preserve any necessary security and privacy, in order to ensure widespread trust;

- methods of pulling together and understanding the anonymized information coming from the smart appliances used by citizens and the information they are sharing on social media; and
- processes to ensure that all citizens can benefit from digital services using the appliances and channels most appropriate to their situation.

These are all challenges that are best tackled on a citywide basis in order to fully exploit the transformational opportunities offered by digital technologies.

4.6.7 Physical asset management

Citizens and businesses in the city live their lives within the built environment – buildings, roads, public spaces, underground pipework, etc. However, these assets are in multiple ownership and management, which makes it difficult for them to provide a coherent environment to support the smooth and effective running of the city and to support the development of effective plans to ensure city resilience.

Digital technology can help by enabling a comprehensive asset management system to be put in place, and the use of digital modelling to enable long-term planning and speedy responses to short-term emergencies.

4.6.8 Performance management

In order to ensure that a city can continue to monitor and refine its progress towards achieving its goals, there should be effective and detailed systems in place to identify and use appropriate indicators – ones that both provide useful information as to the city's success and are also easy to measure.

The results of all of these measures should be made available by default to all interested parties, to ensure that corrective measures can be taken, as necessary, to keep the city on track to meet its goals.

4.7 Service transformation

There are many examples of where city services are in conflict with each other – leading to waste and inefficiencies, and poor results for the citizen, for example hospitals are under pressure to send patients home as early as possible, in order to ensure the best use of their assets, but this can result in extra strain being put onto the social care services provided by a local authority. Adult education services might close training courses popular with older people because they are poorly funded, but this might result in mental health problems for vulnerable people, who no longer have an opportunity to socialize.

Services are often provided and managed in a rigid, compartmentalized way, with no overall perspective about how changes to one service might impact on the effectiveness of others, as well as on the lives of the citizen.

Transformational thinking is about defining the outcomes required by services to residents and businesses in a holistic way and then effectively co-ordinating the work of the different service providers to ensure that those outcomes are delivered to the highest quality and the greatest cost-effectiveness.

The local authority has an important role in identifying areas where linking different city systems can enable service transformation and to support whatever action is needed to implement these.

Another key requirement is the recognition that becoming a smarter city is not simply about setting up a variety of small-scale pilot projects but rather about bringing smart approaches into the heart of how the city functions. It is easy for the implementation of exciting and high-profile pilots to become a substitute for the harder work of genuine transformation of mainstream services.

Of course, there might be value in trialling new smart city services to make sure that they are fit for purpose before a widespread roll-out. However, such trials should be carried out with the intention of citywide implementation from the start. The only exception is where a project is specifically tailored for a particular geographic location, but even here the intention should not be simply to pilot, but rather to implement it as an ongoing service.

4.8 Important opportunities

4.8.1 General

There are a number of opportunities that can be taken by city leadership to help speed up the implementation of a smart city agenda. By way of example three of these are considered here:

- using the local authority's own resources to catalyse change (see **4.8.2**);
- taking advantage of developments and infrastructure projects to gain the evidence and learning needed for service transformation (see **4.8.3**); and
- building a collaborative relationship with the citizen to make it easy for them to provide useful information to the local authority and other city agencies (see **4.8.4**).

4.8.2 Using the local authority's own resources

While the local authority has a key role in facilitating citywide collaboration, it is important to recognise that the local authority itself has significant budgets, is a key service provider and is a major employer. Taking action to use smart city approaches to support its own service delivery can have a much wider impact on the city as a whole.

Specifically, the local authority should identify opportunities for transformational innovation in areas such as service management and procure products and services in a way that opens up opportunities for innovative and local companies. In this way, the local authority can not only learn from its own experience what are the most effective strategies in collaborative service delivery, but it can also, through its procurement processes, be able to enhance the ability of local businesses to get involved in making the city smarter.

4.8.3 Opportunities of developments and infrastructure projects

Developments and infrastructure projects provide cities with important opportunities to help implement a smart city agenda in the following ways.

- It is easier and cheaper to put in place the foundations for a smart city within a development or infrastructure project at the planning and implementation stage.
- Developments and infrastructure projects often provide cost-effective opportunities to test and trial smart city products and services, along with the business models and processes required to fund and operate them, before rolling them out citywide.
- The smart use of data and digital modelling can not only enable neighbourhoods to be better designed for the people who use them, but can also enable significant savings in the implementation, ongoing management and service delivery stages.

PD 8101 provides guidance to city leadership and planners on five key areas where the planning and development process can support smart city aspirations and where smart city approaches can improve the planning and development process.

4.8.4 Collaborating with the citizen

Citizens know that it is in their best interest for their city to work well. While they expect the local authority to take on the overall responsibility, many are happy to help by providing useful information and feedback – especially if they gain something back in return, or at least are provided with information on what action is being taken to deal with the issue they have reported. This is a comparatively low-cost way for the city to gain useful information.

The example of Glasgow city council, and the way it is working with residents to gain information about their energy use to help it manage energy usage citywide, is covered in **3.4**.

Many local authorities are finding ways for citizens to effectively offer the use of their smartphone as a sensor to provide data to the city council, for example by developing smartphone apps that make it easy for citizens to report problems (e.g. potholes in the roads, graffiti, rubbish bins that haven't been emptied). The use of the smartphone means that the location of the problem can automatically be provided, and it is also easy for the citizen to send a photo to show the extent of the problem.

Case study: tackling potholes in Boston

A project of the Boston Mayor's Office of New Urban Mechanics, Street Bump [4)] helps residents improve their neighbourhood streets. Volunteers download the Street Bump app onto their smartphone and use the sensors in the phone to collect road condition data while they drive. Street Bump uses two of the smartphone's sensors: its accelerometer and GPS. The sensors detect bumps that are automatically uploaded to allow them to be mapped by the city.

Boston city council aggregates the data across users, to provide it with real-time information to fix short-term problems and plan long-term investments. If three or more bumps occur at the same location, the city inspects the obstacle and assign it to a queue for short-term repair or record its location to assist with long-term repair planning.

The key to making this work is to provide immediate feedback as to what the local authority is planning to do about the problem, with, as far as possible, a deadline as to when it will be fixed, and then to inform them when the problem has been dealt with.

This is not only a comparatively easy way to gain useful data and information to help manage the city, it is also helps build a positive relationship with the citizen.

5 Role of standards and guidance documents

5.1 General

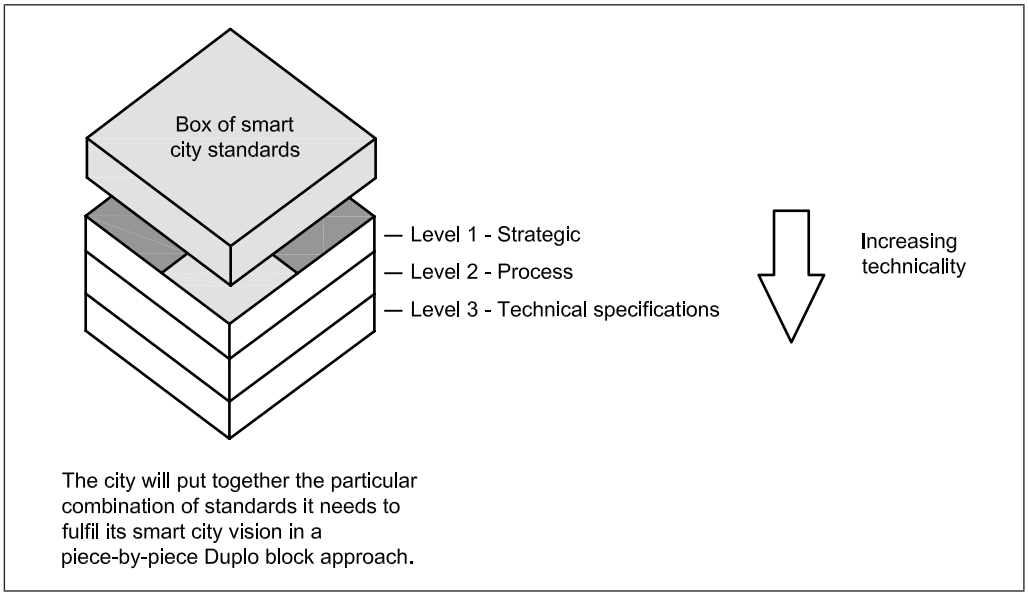
Standards and guidance documents can describe good practice in a way that makes it easy to know exactly what needs to be done to comply with it and, just as importantly, to know what to specify in procurements in order to be sure that what is supplied is fit for purpose.

4) http://www.streetbump.org/

Standards are developed by experts in a particular area of interest, using a transparent consensus-building process that allows a variety of stakeholders to provide input.

Figure 8 shows the three levels of standards relating to smart cities – strategic, process and technical specifications, each of which can play an important role in ensuring that the smart city is built on firm foundations.

Figure 8 **Levels of smart city standards**



Strategic-level smart city standards provide guidance to city leadership on the process of developing a clear and effective overall smart city strategy, identifying priorities, and developing a practical implementation roadmap and an effective approach to monitoring and evaluating progress.

Process-level standards cover good practice in procuring and managing cross-organizational and cross-sectorial smart city projects, including guidance on putting together appropriate financing packages.

Technical specifications cover the practical requirements for smart city products and services to ensure that they achieve the results needed.

Strategic-level standards are of most relevance to city leadership and process-level standards to people in management posts. However, even technical specifications are relevant to people in management posts as they need to know which standards they need to refer to when procuring technical products and services.

Annex B provides an overview of the portfolio of smart city standards in development.

5.2 Value of smart city standards

Standards can provide the following benefits to smart cities.

a) *Enable integration between systems*

One of the most important requirements of smart cities is the interoperability between separate systems and services. Standards can help to define how best to achieve that interoperability, not only at a technical level, but also at a strategic and process level.

b) *Enable integration between the physical and the digital*

Smart cities need reliable and resilient physical and technology infrastructures, working together. In particular, new integrations between technology and the

physical infrastructure are required, which can only happen if standards are developed and agreed.

c) *Underpin common understanding*

1) Shared language

Even within projects in a single industry, it is common for what is delivered to be different from what was required, simply because of misunderstandings between the parties involved. Standards can help to provide a shared language to minimize these misunderstandings, which will be critically important in smart cities because of the wide set of stakeholders. PAS 180 defines terms for smart cities for use across all service delivery channels in UK cities.

2) Shared purpose

The stakeholders within a city need to agree on what being a smarter city means to them in order to work together effectively. The kind of issues that need to be agreed include the following.

- Is it about efficient and coordinated civic services?
- Is it about social mobility and thriving communities?
- Is it about economic growth with a reduced carbon footprint?
- Is it about harnessing technology?
- To what extent is it about the design of the physical environment?

Stakeholders across a city cannot collaborate effectively to help their city become smarter unless they can harmonize their potentially diverse views on what a smart city is about. Standards can help define where there are differences and provide tried and tested methodologies to develop ways of handling these.

d) *Help to obtain funding*

Standards can enable city leaders to describe their aims and ambitions for the city to local and national government, and to the finance sector, in language that each of these different stakeholders understand. Standards can also make it easier to develop the evidence that finance providers need to underpin their investment.

e) *Help to prevent vendor lock-in*

When products and services are built to widely agreed standards, it makes it possible to break them down into smaller parts and find the best provider of each of them, rather than having to contract with a single company to offer the whole product. It also allows much easier substitution of one provider for another and thus maintains a competitive market.

f) *Enable scale*

The use of standards ensures cities are following a path taken by many others. Having many cities following a common path could itself stimulate the market to further support this path.

6 Conclusion – a big vision, implemented one step at a time

Smart cities are often thought about in the context of large and expensive smart city projects. While such projects may well provide enormous benefits, they are complex to manage and difficult to finance.

However, there are also comparatively small and simple changes to the way things are done that can provide immediate benefits, while paving the way for the implementation of the larger opportunities.

What is important is for the key city stakeholders to agree a common overall vision for how the city can become smarter, to assess its strengths and weaknesses in both its existing performance levels and in the quality of its enabling capabilities, to develop and implement a clear roadmap, and then to continually assess the effectiveness of its actions to achieve its goals.

At all of these stages, standards and good practice guides can provide vital assistance and BSI is committed to work together with all city stakeholders to continue to develop an effective portfolio of guidance to help city leaders maximize the benefits of smart approaches for their citizens.

Annex A (informative)

Capability assessment/gap analysis diagnostic tool

A smart city capability assessment/gap analysis diagnostic tool is referred to in **4.3**. This is aimed at enabling city leaders to make a quick overall assessment of the readiness of their city to take advantage of the transformational opportunities offered by smart city approaches, support internal dialogue on the findings, and provide pointers to guidance material that can assist in developing their forward plans. Table A.1 provides more detail on the requirements of the different levels of capability for the various themes dealt with.

The objectives of the diagnostic tool are to:

1) engage city leadership in a simple assessment process (personal or small group) that provides a coarse snap-shot of their city's current state of smartness;
2) help reposition and demonstrate the value of standards in the eyes of city leaders; and
3) enable city leadership to more easily benefit from the guidance contained in PAS 181.

The diagnostic tool relates to the smart city framework described in PAS 181 and overtly cross-references it. The 17-element structure of PAS 181, however, has been simplified and augmented for ease of application.

The diagnostic tool defines seven key themes that are needed as the foundation for the move to smart city approaches. The overall characteristics of each of the themes are summarized and five different levels of maturity are described for each, to allow city leadership to decide where the city is at present and where they consider it needs to be in the future.

The second column, headed "PAS 181 ref", indicates the sections of PAS 181 referenced by each of the seven themes.

In this way, it is easy to refer to the relevant section of PAS 181 to get extra help in determining the next steps in making sure the gaps are filled.

Figure 5 (**4.3**) shows a typical result for this exercise. Having assessed the current position and set a two- or five-year ambition for the city, an action plan can be put in place to address the gaps, and this will become part of the smart city roadmap.

Table A.1 **Capability assessment/gap analysis diagnostic tool**

Component	PAS 181 ref	Summary characteristics	Capability assessment *(honestly identify the current state, and a desired mid-term ambition for each component/row)*				
			1 Lagging	**2 Developing**	**3 Competent**	**4 Progressive**	**5 Excelling**
Leadership environment	**A B1 B3 B8 D**	*Providing a strong city leadership network that advocates a common vision; operates as an effective leadership team; role-models the desired style; sets priorities; creates and maintains a coherent roadmap; and ensures city success.*	– No recognized public leader(s). – Little/no community leadership. – No stated or implicit vision. – Unclear future ambitions. – No clear priorities or targets. – Fragmented decision-making. – Any plan is steered externally.	– City leader known but low in profile. – Internally developed vision. – Internally driven priorities. – Basic promotion of vision and priorities through website and printed media.	– Recognised leader high in profile. – Vision established collaboratively with other city leaders. – Consultation on city priorities. – Action plan including SMART targets to deliver priorities co-created by city leaders.	– Clear vision owned by society. – Smart plan established. – Priorities clearly influenced by external city-customer consultation. – Actions clearly allocated/owned by city leaders within respective organizations. – Competent leadership network.	– Respected competent leaders – … operate as a seamless team. – Sustain leadership performance. – Recognised as leader in smart city. – Collaborative informed decisions. – An integrated roadmap – … that is owned by all.
Customer/ stakeholder focus	**B9 B10**	*A city that is built around its citizens, business community and visitors (as key stakeholders/ customers); that truly understand them; engages them effectively; and proactively ensures their active contribution to progress.*	– Census-only societal insight. – Poor democratic processes. – No customer engagement. – Provider-led service design. – Internal customer. – No channel strategy and poor channel experience.	– Silo customer understanding. – Customer is citizen (cf business). – Limited quality customer feedback opportunities. – Reactive rather than proactive approach to customer needs. – Multi-channel strategy in place.	– Segmentation of customer/ need. – Multi-channel and cross-agency customer insight. – Social data available externally via user-unfriendly portals. – Engagement/ feedback at point of service delivery.	– Locally informed, cross-agency and up-to-date customer insight. – Data easily and freely available. – Easy environment for visitors. – Consistent cross-channel experience. – Multiple citizen consultation opportunities.	– Whole view of customer. – Dynamic customer insight. – Active participation of society (democratic/ service provision). – Engage early and solve at source. – Predictive service design. – Better than private sector feedback.

Table A.1 **Capability assessment/gap analysis diagnostic tool** *(continued)*

Component	PAS 181 ref	Summary characteristics	Capability assessment *(honestly identify the current state, and a desired mid-term ambition for each component/row)*				
			1 Lagging	**2 Developing**	**3 Competent**	**4 Progressive**	**5 Excelling**
Service enablement	**B2 B3 B5 B7**	*Providing the enabling context for success: including policy, planning, common protocols; means of collaboration; capability/capacity management; financing; business models; procurement processes; and an underpinning operating model.*	– Poor/short-term service planning approaches. – Inconsistent policies. – Poor cross-agency/sector work. – Limited use of standards. – Unclear process ownership. – Traditional procurement.	– Emerging integrated operating model, and service strategies. – Planning with "closed" consultation processes. – Generally common approach to financial planning and reporting. – Conventional business models.	– Identification of business process model and services architecture. – Planning is cross-discipline and includes smart initiatives. – Policies openly objectively challenge to improve services. – Cross-city financial perspective.	– Strong, citywide collaboration between public and private sectors. – Pan-city accurate financial planning. – Collaborative, efficient procurement processes. – Some common services, especially in back office and customer-facing.	– Clear aligned progressive policies. – Open visualization of city plans. – Leader in standards and protocols. – Multiple innovative business models. – Always challenging ways of working. – Excellent cross-city talent management. – Consistent applied operating model.
Service delivery		*Offering and managing quality services to city stakeholders, through direct or indirect means.*	– Poor service communication. – Inefficient service delivery. – Service performance is poor. – Services delivered in silos. – Poor integration between public and private service providers.	– Integrated service delivery strategy and roadmap in place. – Services still silo delivered. – Generally negative customer feedback, and low engagement. – Standards/ compliance-based approach to service delivery.	– Service integration patchy across city. – Service quality average to good, inconsistent but improving. – Self-help opportunities introduced in key service areas.	– Some integration across sectors with clear focus on developing further. – Strong integration across services within delivery organizations. – Multiple self-help opportunities.	– Majority of services shared with integrated cross-sector model. – Communities proactively involved in resource management initiatives.

Table A.1 **Capability assessment/gap analysis diagnostic tool** *(continued)*

Component	PAS 181 ref	Summary characteristics	Capability assessment *(honestly identify the current state, and a desired mid-term ambition for each component/row)*				
			1 Lagging	**2 Developing**	**3 Competent**	**4 Progressive**	**5 Excelling**
			– Customer feedback not sought.		– Customer feedback mixed.	– integrated multichannel service flow. – Positive customer feedback.	– (Inter) Nationally recognised leader in (visitor) service experience. – Outcomes achieved/ exceeded.
Digital asset management	**B6** **B13** **B14** **B11** **B12**	*Exploiting the power of data sharing and modern technologies (e.g. social media, analytics, mobile, cloud, sensors) through investment in and management of digital assets; including respect of privacy and digital abilities.*	– Ageing technical infrastructure. – IT seen as cost by leaders. – Silo IT decisions and IT management. – No clear ICT strategy or plan. – No data or information strategy. – Low use of cloud, or mobility. – Poor control of ICT budget.	– Technology strategy unclear. – IT director is member of executive. – Big/open data pilots in place. – Hackathons in mind. – Limited use of social media in service delivery. – Closed view of data security.	– Citywide technology strategy adopted and implemented. – Competent city technology architecture. – Data strategy in development. – Open/big data programme. – Social media/ cloud experiments.	– Emphasis on open data through user-friendly interfaces open by default. – Real-time service oversight. – Information management policy in place. – Data and Information audits normal. – Innovative forecasting and data analytics projects.	– Full understanding of city data value. – Active sharing of data cross-sectors. – Leading edge technologies in place. – Common/ shared-use IT assets. – Limited and reducing digital divide. – Predictive analytics and visualization. – Society-led informed security management.

Table A.1 **Capability assessment/gap analysis diagnostic tool** *(continued)*

Component	PAS 181 ref	Summary characteristics	Capability assessment *(honestly identify the current state, and a desired mid-term ambition for each component/row)*				
			1 Lagging	**2 Developing**	**3 Competent**	**4 Progressive**	**5 Excelling**
Physical asset management		*Inventorizing and exploiting physical assets; for multi-purpose; managing life-cycles and investments; and integrating physical and digital assets; complete capture and open sharing of asset information.*	– Limited/finance-bias asset view. – No cross-city asset overview. – Silo asset ownership and management. – Limited quality operational data. – Reactive maintenance activities. – Limited asset investment plans. – Investment steered externally.	– Assets managed by asset class (mostly in each department/ agency). – Department-level asset strategy. – Quality financial asset data. – Responsive operational asset management. – Emerging citywide asset register.	– Common cross-city asset data capture, kept current. – Asset strategy embedded in all public/ private owners/ operators. – Pan-service investment planning. – Focused management of critical infrastructure/ assets.	– Asset data opened across service providers to enhance services. – Elegant joint public/private investment and business models. – New business models using asset data (with private service providers). – Predictive critical asset management.	– Strategic view of publicly owned, and citywide assets. – Informed asset investment portfolio planning and decisions, based on quality asset performance data. – Real-time (e.g. sensors) asset management supports integrated service delivery.
Performance management	**C**	*Setting appropriate goals and targets; establishing measures and monitoring practices; ensuring a performance culture; predictive use of data; robust public value measurement; open reporting of value to stakeholders.*	– No, or unclear, goals and targets. – No clear cascade of measures. – Limited/no measures that are professionally managed. – Tactical silo reporting. – Poor performance incentives. – No culture of performance.	– Goals and targets focused on inputs cf citywide outcomes. – Mixed performance culture. – Closed service-based reporting. – Business case and performance not adequately linked. – Limited service reviews/audits.	– Open service-based reporting. – Little citywide agreement on measures and targets. – Clear metrics cascade in place (within service domains). – Performance culture programme in most city organizations.	– Citywide agreement on SMART targets focused on agreed priorities. – Innovative performance-based business models. – Near real-time mayor's dashboard. – Opening up for public transparency. – Forecasting exploiting quality data.	– Open transparent accessible metrics. – Effectively incentivized performance. – Wide stakeholder involvement in city performance monitoring process – ... with appropriate city response. – Customer-outcome-value managed city services.

Annex B (informative) Developing portfolio of smart city standards

B.1 The BSI smart cities portfolio

B.1.1 General

City leaders need to decide where to focus in applying new smart approaches. There are a number of routes that can be followed, and invariably the best answer may well be a mix of these.

The BSI portfolio presently includes a large number of service-specific level 3 technical specifications. Many are relevant to smart cities, though few, as yet, overtly address the integrated services agenda.

A number of level 1 and level 2 documents have been published or are in development, specific to the smart city agenda.

B.1.2 Level 1 leadership guides

- PD8100*, Smart city overview – Guide* – this document.
- PD 8101, *Smart cities – Guide to the role of the planning and development process*, which gives guidance on how the planning and implementation of development and infrastructure projects can equip cities to benefit from the potential of smart technologies and approaches.
- BS ISO 20121, *Event sustainability management systems – Requirements with guidance for use* deals with all pillars of sustainability with a focus on community level interventions.

Ongoing developments will continue to support city leadership:

- business case, business models and funding are topics presently being considered for standardization, in order to help decision-makers better understand how best to engage smart services;
- a city performance assessment method is also planned.

B.1.3 Level 2 process frameworks

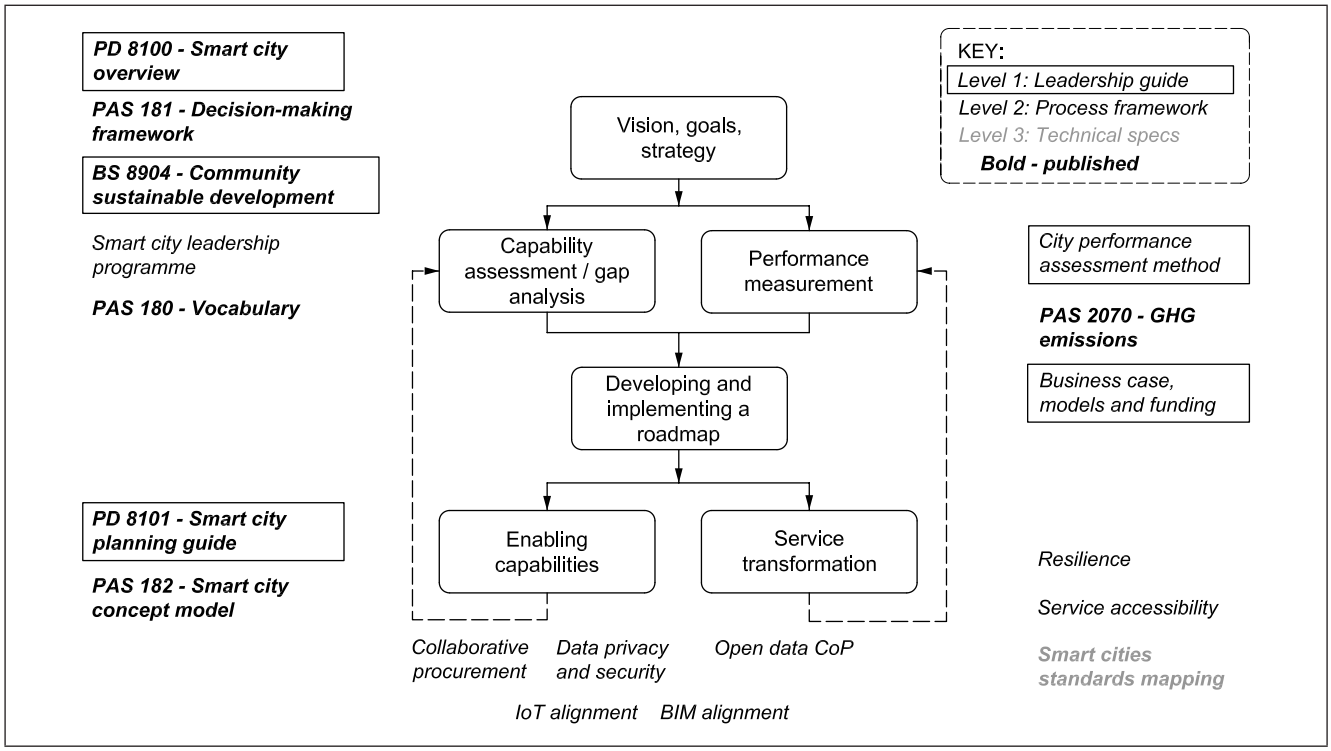
- PAS 180, *Smart cities – Vocabulary*, which defines terms for smart cities, including smart cities concepts across different infrastructure and systems elements and used across all service delivery channels.
- PAS 181*, Smart city framework – Guide to establishing strategies for smart cities and communities*, gives guidance on a good practice framework aimed at decision-makers in smart cities and communities from the public, private and voluntary sectors to help them develop, agree and deliver smart city strategies that can transform their city's ability to meet future challenges and deliver on future aspirations.
- PAS 2070, *Specification for the assessment of greenhouse gas emissions of a city – Direct plus supply chain and consumption-based methodologies* aims to provide a robust and transparent method of quantification, attribution and reporting of city-scale greenhouse gas emissions.
- PAS 182, *Smart city concept model – Guide to establishing a model for data interoperability*, provides a framework that can normalize and classify information from many sources so that datasets can be discovered and combined to gain a better picture of the needs and behaviours of a city's residents and businesses.

New work on a number of priority topics for level 2 standards is being investigated, including:

- collaborative procurement;
- IoT alignment;
- building information modelling (BIM) alignment;
- open data code of practice;
- data privacy and security;
- city systems resilience;
- service accessibility.

Figure B.1 shows the portfolio of strategic and process smart city standards being developed by BSI, mapped to the smart city process framework introduced in Clause **4**.

Figure B.1 **Smart city standards mapped to the smart city process framework**



B.2 Work of other standards bodies

Guidance is also being developed on a range of other smart city issues by partner standards bodies globally. BSI is centrally involved in this process, in order both to ensure that the developing international standards are suitable for UK cities and also to help open up opportunities for UK business within the developing global smart cities market.

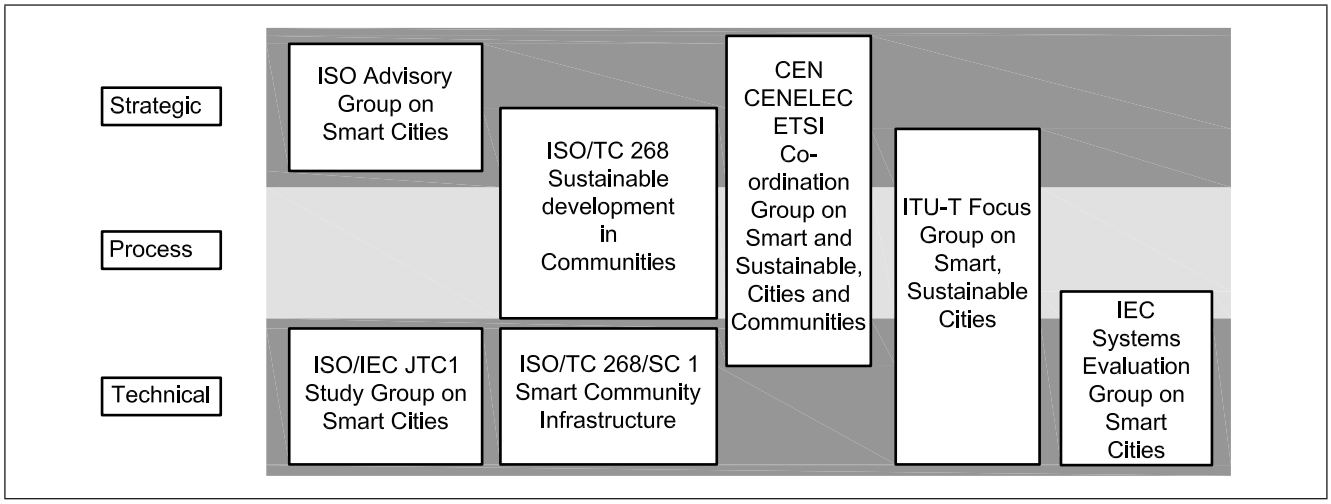
Specifically BSI is working with the following standards bodies.

- ISO – specifically in the work of TC 268, the technical committee that is working on standards related to sustainable development in communities, including indicators and management standards for smart community infrastructures.

- IEC – the International Electrotechnical Commission, specifically in the work of SEG1 that is looking at the electro-technical standards needed to enable the integration of city systems.
- ISO/IEC JTC1 – the joint technical committee of ISO and IEC that is responsible for ICT standards – that is looking at the role of ICT standards in smart cities.
- ITU-T – the Standards-making body of the International Telecommunications Union, through the focus group that has been set up to look at the telecommunications standards needed for smart and sustainable cities.
- CEN/CENELEC/ETSI – the three European Standards organizations and the joint co-ordination group they have set up to review the need and scope of European Standards for smart and sustainable cities and communities.
- ISO TMB Strategic Advisory Group for Smart Cities – set up to help facilitate better co-ordination internationally among standards bodies. BSI provides the chair for this group.

Figure B.2 provides an overview of international smart city standardization activities. It can be expected that over the next few years a great deal of useful standards and guidance documents will be developed through these different standards bodies that will help support the progress of UK cities in becoming smarter. BSI will act as a key information source to help city leaders identify those standards of most relevance to the path their city is following.

Figure B.2 **International smart city standardization activities**



Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS ISO 20121, *Event sustainability management systems – Requirements with guidance for use*

BS ISO 37120, *Sustainable development of communities – Indicators for city services and quality of life*

PAS 180, *Smart cities – Vocabulary*

PAS 181, *Smart city framework – Guide to establishing strategies for smart cities and communities*

PAS 182, *Smart city concept model – Guide to establishing a model for data interoperability*

PAS 2070, *Specification for the assessment of greenhouse gas emissions of a city – Direct plus supply chain and consumption-based methodologies*

PD 8101, *Smart cities – Guide to the role of the planning and development process*

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