



BSI Standards Publication

Smart city framework – Guide to establishing strategies for smart cities and communities

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 54, an inside back cover and a back cover.

Foreword

This PAS was sponsored by the UK Department for Business, Innovation & Skills (BIS). Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It came into effect on 28 February 2014.

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Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

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This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a guide to be rapidly developed in order to fulfil an immediate need in industry. A PAS 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 publications

This PAS draws on the approach developed by OASIS, the international standards consortium, in its *Transformational Government Framework* (TGF; a global open standard for IT-enabled change programmes in the public sector) [1]. Acknowledgement is given to OASIS for permission to build on the approach recommended in the TGF for the purposes of this PAS to fit the needs of UK smart cities.

This PAS 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 182, *Smart city concept model – Guide to establishing a model for data interoperability*, which will provide a framework that can normalize and classify information from many sources so that data sets can be discovered and combined to gain a better picture of the needs and behaviours of a city's citizens (residents and businesses);¹⁾
- PD 8100, an overview document that will provide guidance on how to effectively communicate the value of smart cities to key decision-makers;¹⁾
- PD 8101, *Smart cities – Guide to development*, a smart city planning document, which will provide guidance to local authorities on what they need to require or incentivize new infrastructure developments to support the overall smart city plans for their area.¹⁾

In addition, examples and case studies of the good practices recommended in this PAS will be built up over time by the Future Cities Catapult at <https://futurecities.catapult.org.uk/>.

Use of this document

As a guide, this PAS 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 standard is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is "should". Key recommendations are provided under the heading "Recommendations".

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.

Compliance with a PAS cannot confer immunity from legal obligations.

¹⁾ In preparation.

0 Introduction

0.1 Context: the challenges cities face

Smarter cities are essential if the world is to respond effectively to the critical challenges it faces. As of 2008, and for the first time in human history, more than half of the world's population now live in cities. The UN predicts this will rise to 70% by 2050. Here in the UK, more than eight out of ten of us already live in cities. Yet cities increasingly need to be able to do more with less, to compete in a globally-interconnected economy, and to provide for the well-being of their citizens in a truly sustainable way. In short, to become smarter.

Here in the UK, the Government has identified the following challenges in particular that are driving change in UK cities [2]:

- *economic restructuring, combined with the economic downturn, has raised levels of unemployment, particularly among young people, and so economic growth and building a resilience to further change is a key priority for city authorities;*
- *the urban infrastructure has grown piecemeal and rising urban populations are putting pressure on housing and transport;*
- *concerns about climate change, and the fact that 80% of the UK population live in cities, inevitably means that cities have a key role in improving energy efficiency and reducing carbon emissions, while promoting energy resilience in terms of security of supply and price;*
- *the paradigm shift towards online entertainment and online retail/consumer services is beginning to change the nature of the High Street;*
- *an ageing population is placing an increasing burden on adult social care, to the point where it is absorbing an ever-increasing proportion of local authority budgets;*
- *at the same time, the pressures on public finances have seen local authority budgets reduce, on average, by an estimated 12-15% in real terms over the past three years, with many reporting 20-30% cuts;*
- *notwithstanding recent flexibility accorded to Local Authorities in relation to Council Tax and Business Rates, grants from Government Departments are still the main source of local authority funding, especially for cities, and local authorities consider this to limit their ability to provide integrated responses to the challenges they face.*

The scale of the challenges is forcing cities to rethink their strategies and to innovate in order to maintain service levels, in particular:

- *outsourcing services using outcomes based contracts;*
- *service integration, both back office and increasingly front line services;*
- *online service delivery;*
- *releasing data to enable new services to develop and citizens to make informed decisions e.g. providing real-time information on traffic to assist citizens in planning journeys; and*
- *reducing demand on services, for example, promoting independent living allows older people to live much longer in their own communities with less statutory support.*

However, the complexity and the pace of change, combined with the need for integrated and systemic solutions, are presenting a major challenge to local authorities who, traditionally, have developed responses in a "siloed" fashion.

0.2 Background to the smart cities standards strategy

The UK Government is committed to helping cities respond to these challenges, by supporting the development of smarter cities. Both because of the social, economic and environmental benefits for cities and citizens here in the UK and because the smart city market globally represents a major export opportunity for UK businesses.

In 2012, the Department for Business, Innovation & Skills (BIS) therefore commissioned BSI to develop a smart cities standards strategy: to identify where standards are needed to accelerate the rollout of smart cities and support UK providers of smart city solutions.

The strategy development involved research into current thinking on smart cities; a gap analysis to identify where standards are needed; stakeholder consultation events; and a proposed work programme for the delivery stage.

0.3 Purpose of this document

The smart city framework (SCF) is a guide intended for use by leaders, at all levels and from all sectors, of smart city programmes. It provides practical, "how-to" advice, reflecting current good practice as identified by a broad range of public, private and voluntary sector practitioners engaged in facilitating UK smart cities.

The document breaks down into the following clauses:

Clause 1: Scope

- The purpose of the SCF
- The content and nature of the SCF: that is, what it does and does not seek to cover
- The intended audience for the framework

Clause 2: Terms and definitions

Clause 3: Overview of the smart city framework

- High level description of the key components of the SCF
- Summary of recommendations from across all components of the SCF

Clause 4: Component A: Guiding principles

Clause 5: Component B: Key city-wide governance and delivery processes

Clause 6: Component C: Benefit realization framework

Clause 7: Component D: Critical success factors

Supplementary information on guiding principles and critical success factors is detailed in Annexes A and B.

1 Scope

This PAS gives guidance on a 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 cities' ability to meet future challenges and deliver future aspirations.

The smart city framework (SCF) distils current good practices into a set of consistent and repeatable patterns that city leaders can use to help them develop and deliver their own smart city strategies.

The PAS does not intend to describe a one-size-fits-all model for the future of UK cities. Rather, the focus is on the enabling processes by which innovative use of technology and data coupled with organizational change can help deliver the diverse visions for future UK cities in more efficient, effective and sustainable ways.

This means, in particular, a focus on enabling cities to:

- a) make current and future citizen needs the driving force behind all city spaces and systems;
- b) integrate physical and digital planning;
- c) identify, anticipate and respond to emerging challenges in a systematic, agile and sustainable way;
- d) create a step-change in the capacity for joined-up delivery and innovation across organizational boundaries within the city.

Although many of the principles and methodologies established by the SCF are relevant within specific vertical sectors of cities (smart grids, smart mobility, smart health, etc.) the focus is very much on the issues and challenges involved in joining all of these up into a whole-city approach. Central to the SCF is therefore a strong emphasis on leadership and governance, culture, business model innovation, and the active role played by all stakeholders in the creation, delivery and use of city spaces and services.

This PAS is aimed at UK city leaders. It can also be helpful to leaders of communities other than at city-scale – including both smaller urban areas and larger, regional-scale initiatives – and for city leaders outside the UK. However, the prime intended audience, with which the guidance has been developed and tested is UK city leaders, including:

- policy developers in city authorities – both those responsible for the authority's service design, commissioning and delivery role, and also those responsible for its community leadership role, in particular:
 - elected leaders;
 - senior executives of local authorities (including chief executives, chief information officers and directors of key departments);
 - senior executives of other public bodies with a city-wide remit;
- other stakeholders interested in leading and shaping the city environment, including:
 - senior executives in the private sector who wish to partner with and assist cities in transformation of city systems to create shared value;
 - leaders from the voluntary sector organizations active within the city;
 - leaders in the higher and further education sectors;
 - community innovators and representatives.

2 Terms and definitions

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

2.1 smart city

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]

NOTE 1 This definition is deliberately presented as a working definition rather than intended as a definitive definition which all cities are to follow. While there is a strong degree of commonality among the smart city strategies that are being developed around the UK, there is also significant diversity. All cities embarking on development of a smart city strategy can define their own reasons for doing so, in their own language; the process of discussion and debate between stakeholders to define what, for them, is meant by "Smart Aberdeen", "Smart Birmingham" or "Smart Cambridge" is an important one.

NOTE 2 This definition deliberately avoids describing a perfect end-state for cities. As discussed in Clause 1, that is not the purpose of the SCF. All cities are different: the historical, cultural, political, economic, social and demographic context for each city is different; as is the legacy of business processes and technology implementation from which it starts; as are the brand values and unique selling points with which each city seeks to position itself within the UK and global economy. So the SCF is not a one-size-fits-all prescription for what a city might look like in future, but focuses on the enabling processes by which new technologies coupled with organizational change can help deliver the diverse visions for future UK cities.

NOTE 3 The word "citizens" in this definition, and throughout this PAS, is used to include residents, businesses, visitors and commuters to the city.

NOTE 4 For all practical purposes, the term "smart city" here is synonymous with the term "future city" as used by, for example, the UK's Technology Strategy Board. The focus however is more on the process of integrating the physical, spatial, digital and human worlds, rather than on the specific vision of the future for a city.

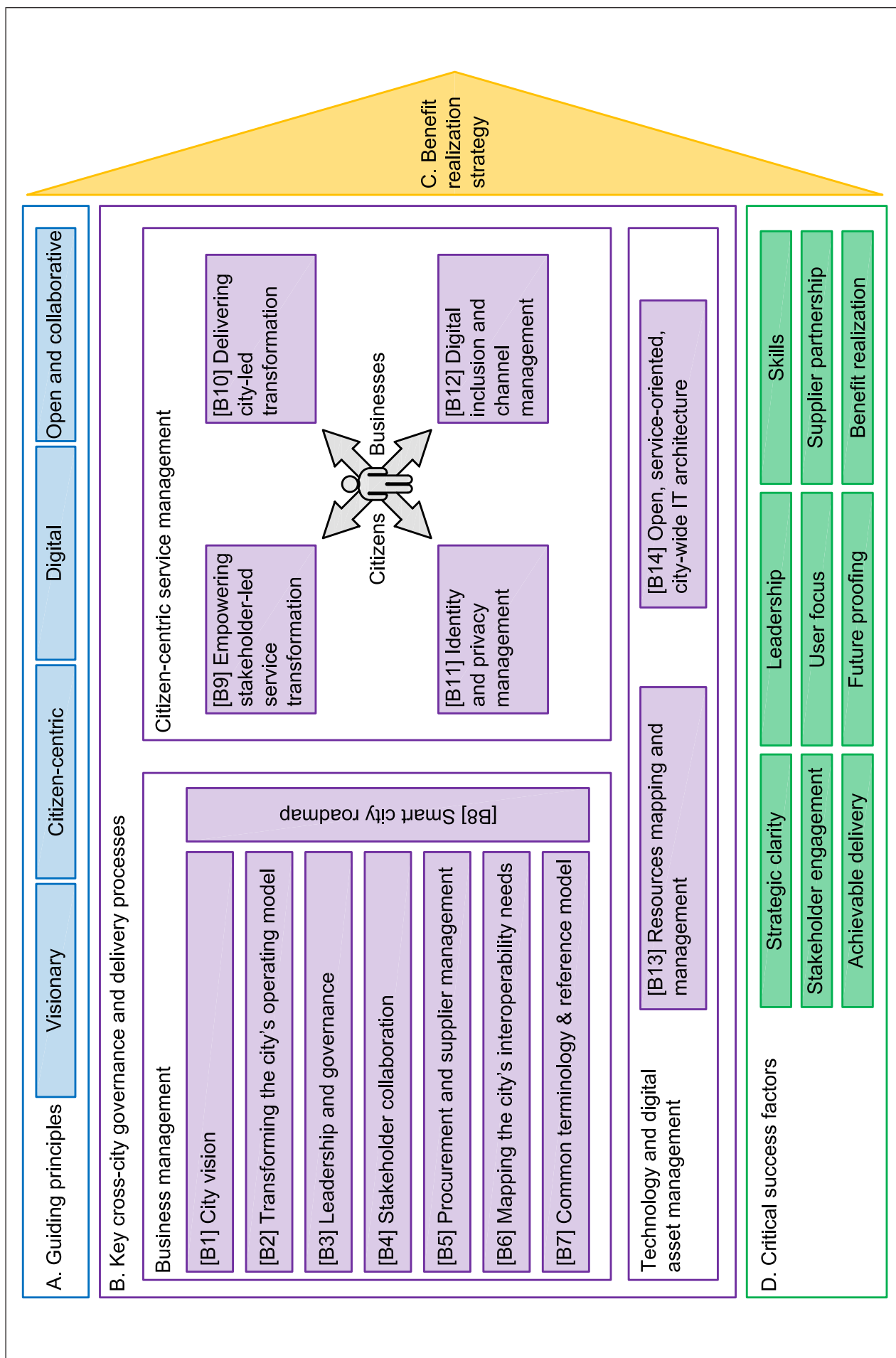
3 Structure of the SCF

3.1 Overview

The SCF can be seen schematically in Figure 1. At the top-level, it is made up of four components:

- [A] **guiding principles:** a statement of values which city leaders can use to steer business decision-making as they seek to implement a smart city strategy;
- [B] **key cross-city governance and delivery processes:** a set of practical guidance notes on how to address city-wide challenges of joining-up across city silos;
- [C] **benefit realization strategy:** guidance on how to ensure that the intended benefits of a smart city strategy are clearly articulated, measured, managed, delivered and evaluated in practice;
- [D] **critical success factors:** a checklist of issues which a city should regularly monitor to ensure that it is on track in the successful delivery of its smart city programme, and that it is managing the major strategic risks effectively.

Figure 1 High-level structure of the SCF



These components are described in more detail in Clauses 4 to 7. Detailed guidance notes are given on each of the sub-components illustrated in Figure 1, with each guidance note structured using a common pattern language. Further details on the pattern language approach and why it is has been selected to structure guidance in the SCF are provided in Annex C.

For ease of reference, in 3.2 there is a summary of all the recommendations contained in all the SCF guidance notes. These are then described in more detail in the subsequent clauses of the SCF.

3.2 Summary of recommendations

Smart city leaders should:

[A] Guiding principles

- a) Collaborate with city stakeholders to develop and agree a set of guiding principles for the smart city strategy that include, as a minimum, the need to:
 - 1) establish a clear, compelling and inclusive vision for the city;
 - 2) take a citizen-centric approach to all aspects of service design and delivery;
 - 3) enable a ubiquitous, integrative and inclusive digitization of city spaces and systems;
 - 4) embed openness and sharing in the way the city works.
- b) Use the SCF guiding principles given in Annex A as a key input and starting point for that process.

[B1] City vision

Create a vision of “what good looks like” for the city, today and in the future, that:

- a) is developed in an iterative and collaborative manner (that is, inclusive of all city stakeholder groups and informed by user research and engagement, with social media and other technologies used to enable public participation in the process);
- b) embraces the opportunities opened up by smart technologies, smart data and smart collaboration;
- c) does so in a way that integrates these with the core socio-economic, political and environmental vision and purpose for the city’s future, rather than seeing them as somehow separate from the city’s core strategic objectives;
- d) is measurable.

[B2] Transforming the city’s operating model

Ensure that their [B1] city vision includes the need to develop an integrated city operating model, which is focused around citizen and business needs, not just the city’s organizational structure.

[B3] Leadership and governance

Establish leadership and governance arrangements that ensure:

- a) a clear focus of accountability within the city authority;
- b) a broad-based leadership team across the city;
- c) city leaders are brought together on a cross-sectoral basis into effective governance arrangements, at both the strategic and delivery levels;
- d) deployment of formal programme management disciplines;

- e) the right skills mix in the leadership team;
- f) an ability to manage organizational evolution among city partner organizations;
- g) an open and transparent governance process, including through digitally-enabled models of public participation.

[B4] Stakeholder collaboration

Establish, and give high priority and adequate resources to, a formal managed stakeholder engagement programme. This should be led by a senior executive and integrated into the roles all those involved in delivering the smart city programme, and should cover:

- a) stakeholder participation;
- b) cross-sectoral partnership;
- c) engagement with other cities to learn lessons and exchange experience.

[B5] Procurement and supplier management

- a) Take an integrated view of the city's procurement requirements.
- b) Review procurement policies to ensure they align with smart city contracting principles (focus on outcomes, open data, incentives for innovation and collaboration, avoidance of lock-in).
- c) Work to nurture an innovation ecosystem across the city and its suppliers.

[B6] Mapping the city's interoperability needs

Use the smart city interoperability matrix as a tool to:

- a) help identify key barriers to interoperability in the city;
- b) establish policies and actions to address these, drawing on international, European and national standards where possible;
- c) promote commonality of approaches and easier linkages with other cities and other local and national authorities.

[B7] Common terminology and reference model

- a) Ensure that all stakeholders have a clear, consistent and common understanding of the key concepts involved in smart city development; how these concepts relate to each other; how they can be formally modelled; and how such models can be leveraged and integrated into new and existing information architectures.
- b) Seek agreement among stakeholders to establish and maintain an agreed and shared common terminology and reference model.

[B8] Smart city roadmap

- a) Establish a phased smart city roadmap.
- b) Work with stakeholders to identify a set of services and initial smart city deliverables that represent quick wins for the city.
- c) Give priority to changes that can be delivered quickly, at low cost and low risk.
- d) Establish systems to learn from early customer experience, to improve services in the light of this, and then to drive higher levels of take-up.
- e) Work with early adopters within the city authority and partner organizations in order to create exemplars and internal champions, and thus learn from experience and drive longer-term transformation.

[B9] Empowering stakeholder-led service transformation

Empower stakeholders to create new sorts of services and value, by opening up city data via open platforms, and by driving forward the internal culture changes and the external market enablers that are needed to create a flourishing city information marketplace.

[B10] Delivering city-led service transformation

- a) Provide citizens and businesses with public services that are accessible in one stop, over multiple channels, and built around user needs not the city's organizational structures.
- b) Establish an integrated business and information architecture to support this, enabling a whole-of-city view of specific customer groups for city services.
- c) Do so in a phased, low-cost and low-risk way, by rolling out a number of agile, cross-city, virtual franchise businesses that are based around specific customer segments and that sit within the existing delivery structures of the city.

[B11] Identity and privacy management

Embed an approach to identity and privacy management that is based on:

- a) an open and federated business model;
- b) a service-oriented IT architecture; and
- c) a citizen-centric trust model.

[B12] Digital inclusion and channel management

Establish a digital inclusion and channel management strategy, that includes:

- a) a clear audit of what existing channels are currently used to deliver city services, and the costs and service levels associated with these;
- b) the vision and roadmap for developing a new channel management approach, which:
 - 1) is centred on the needs and behaviour of citizens and businesses;
 - 2) identifies the opportunities for current services to be engineered out through the introduction of new smart connectivity directly between city assets and digital devices;
 - 3) encourages access and use of digital services by stakeholder groups currently excluded from these for whatever reason.

[B13] Resources mapping and management

Map out major information and ICT system resources across the city, prioritize those with the greatest potential for reuse, and establish governance processes and usage policies aimed at maximizing asset reuse by city partners.

[B14] Open, service-oriented, city-wide IT architecture

Work with stakeholders (including IT suppliers, SMEs and academic partners) to establish an open, service-oriented, city-wide IT architecture, and to develop a phased migration plan towards that architecture.

[C] Benefit realization

Establish a benefit realization strategy to ensure a clear line-of-sight between actions and vision, and that the intended benefits from the smart city programme are delivered in practice. The strategy should be built around the three pillars of:

- a) benefit mapping;
- b) benefit tracking; and
- c) benefit delivery.

[D] Critical success factors

Establish processes to ensure that critical success factors are identified, measured and managed.

4 Component A: Guiding principles

GUIDANCE NOTE [A]: GUIDING PRINCIPLES

Context

Development and delivery of a successful smart city strategy requires collaboration and change across a wide range of individuals, communities and organizations over a sustained period of time. An approach that is rooted in a set of clearly stated principles can help ensure that business decisions across those organizations align.

The need

Effective smart city strategies need to be principle-based.

Leaders of smart city programmes face significant challenges. These include:

- a) the scope of the programme, which touches on all aspects of city life;
- b) the scale of ambition for the programme (which typically will be aiming at achieving change that is transformational not incremental);
- c) the wide range of stakeholders and delivery partners involved in the programme;
- d) vulnerability to external change and uncertainties that can impact on programme delivery;
- e) managing the tension between the desire, on the one hand, to move faster by learning from successful approaches in other cities and, on the other hand, the need to develop bottom-up approaches that have strong local ownership and buy-in.

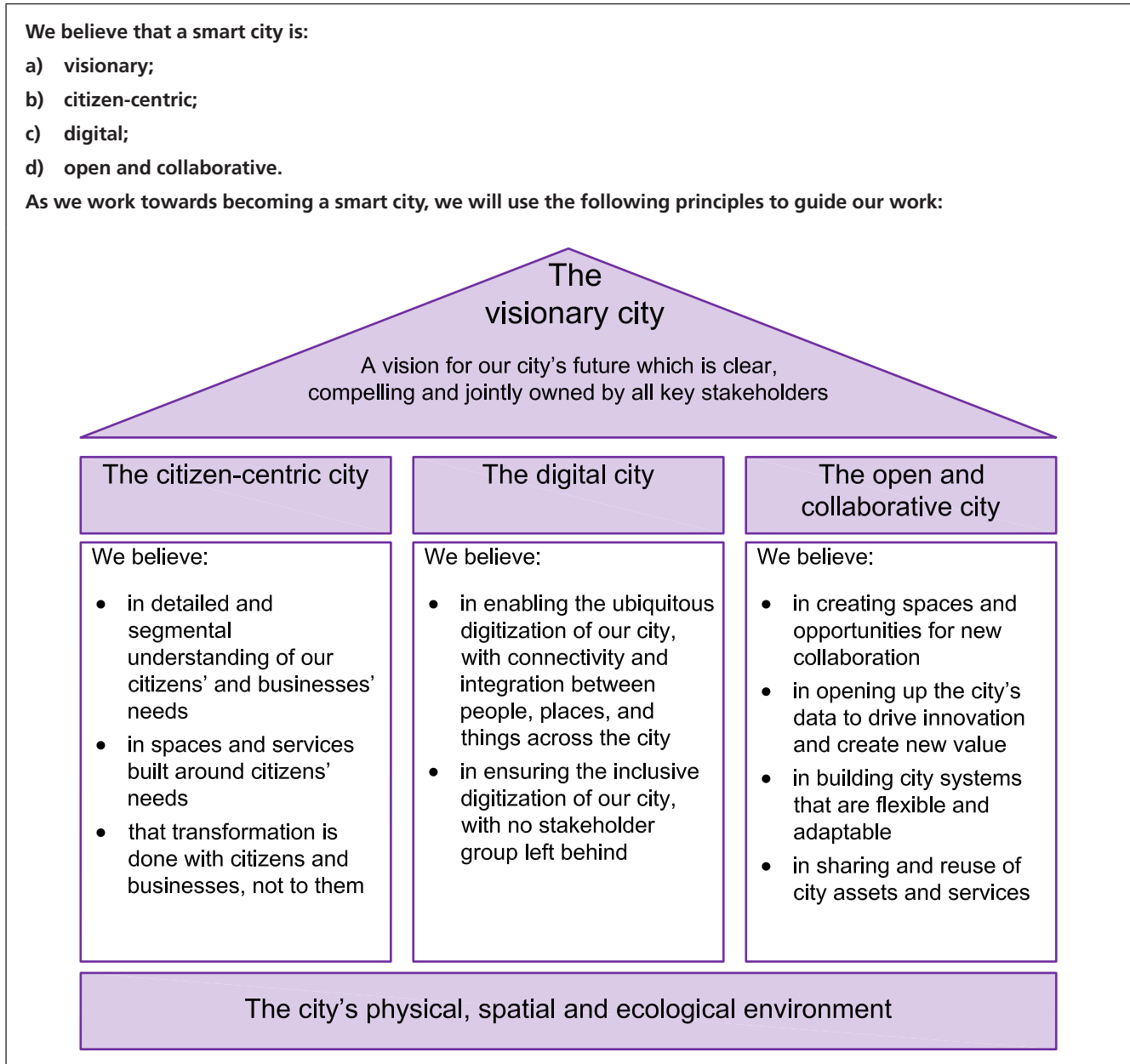
Taken together, these challenges mean that top-down change management approaches cannot work. Success cannot be delivered by planning in detail all elements of the change at the outset. Rather, it can be delivered by setting out a clear and agreed vision, and then underpinning this with a roadmap that does not over-plan but that provides a framework for an organic, inclusive process of change to deliver the vision over time for city stakeholders. Key elements of this are explored in other guidance notes within the SCF. But the starting point should be clarity about the guiding principles that city stakeholders will seek to work towards throughout this process.

The term “guiding principles” in the SCF means an agreed and enduring statement of values which can be used on a consistent basis to steer business decision-making by multiple stakeholders over the long term, and which are:

- used to inform and underpin the smart city strategy;
- understood, agreed and owned by stakeholders.

In developing such principles, each city does not need to start from scratch. A one-size-fits-all approach to city transformation and simplistic approaches to good practice transfer between one city and another are unlikely to work. That said, there is an increasingly rich body of knowledge about the underlying principles that inform successful smart city strategies. Figure 2 provides a summary of the SCF guiding principles, drawing on: i) a literature review of smart city publications by governments, industry, NGOs and academia; and ii) extensive peer review and consultation with UK smart city practitioners. These principles are set out in full in Annex A.

Figure 2 Summary of SCF guiding principles



Recommendations

Smart city leaders should:

- a) collaborate with city stakeholders to develop and agree a set of guiding principles for the smart city strategy that include, as a minimum, the need to:
 - 1) establish a clear, compelling and inclusive vision for the city;
 - 2) take a citizen-centric approach to all aspects of service design and delivery;
 - 3) enable a ubiquitous, integrated and inclusive digitization of city spaces and systems;
 - 4) embed openness and sharing in the way the city works;
- b) use the SCF guiding principles given in Annex A as a key input and starting point for that process.

Linkages

Developing, agreeing and acting as guardians of the guiding principles is a core task for people involved in smart city **[B3] leadership and governance**, and should be addressed at an early stage in development of the **[B1] city vision** and **[B8] smart city roadmap**.

5 Component B: Key city-wide governance and delivery processes

5.1 General

This clause brings together guidance on how to deliver the **[A] guiding principles** in practice. Its focus is on addressing city-wide challenges of joining-up across city silos, in three areas:

- business management, covered in guidance notes **[B1]** to **[B8]**;
- citizen-centric service management, covered in guidance notes **[B9]** to **[B12]**;
- technology and digital asset management, covered in guidance notes **[B13]** to **[B14]**.

5.2 Business management

This subclause of the SCF focuses on business management: that is, the key aspects of governance, planning and decision-making that need to be managed at a whole-of-city level. This does not mean a top-down, centrally planned and managed approach; it does mean taking a city-wide approach to:

- a) establishing an integrated vision, strategy and benefits realization plan;
- b) underpinning this with an operating model which balances the need for city-wide management on the one hand and local innovation on the other;
- c) taking a viral approach to implementation: establishing the business processes, capacity and structures that can drive transformation and create sustained improvements over time, even if all the steps of that transformational journey cannot be planned in detail at the outset.

The sub-components of the business management component of the SCF are:

- **[B1] city vision**;
- **[B2] transforming the city's operating model**;
- **[B3] leadership and governance**;

- [B4] stakeholder collaboration;
- [B5] procurement and supplier management;
- [B6] mapping the city’s interoperability needs;
- [B7] common terminology and reference model;
- [B8] smart city roadmap.

GUIDANCE NOTE [B1]: CITY VISION

Context

First among the SCF [A] **guiding principles** is the need for smart city leaders to develop a clear, compelling and shared vision for their city.

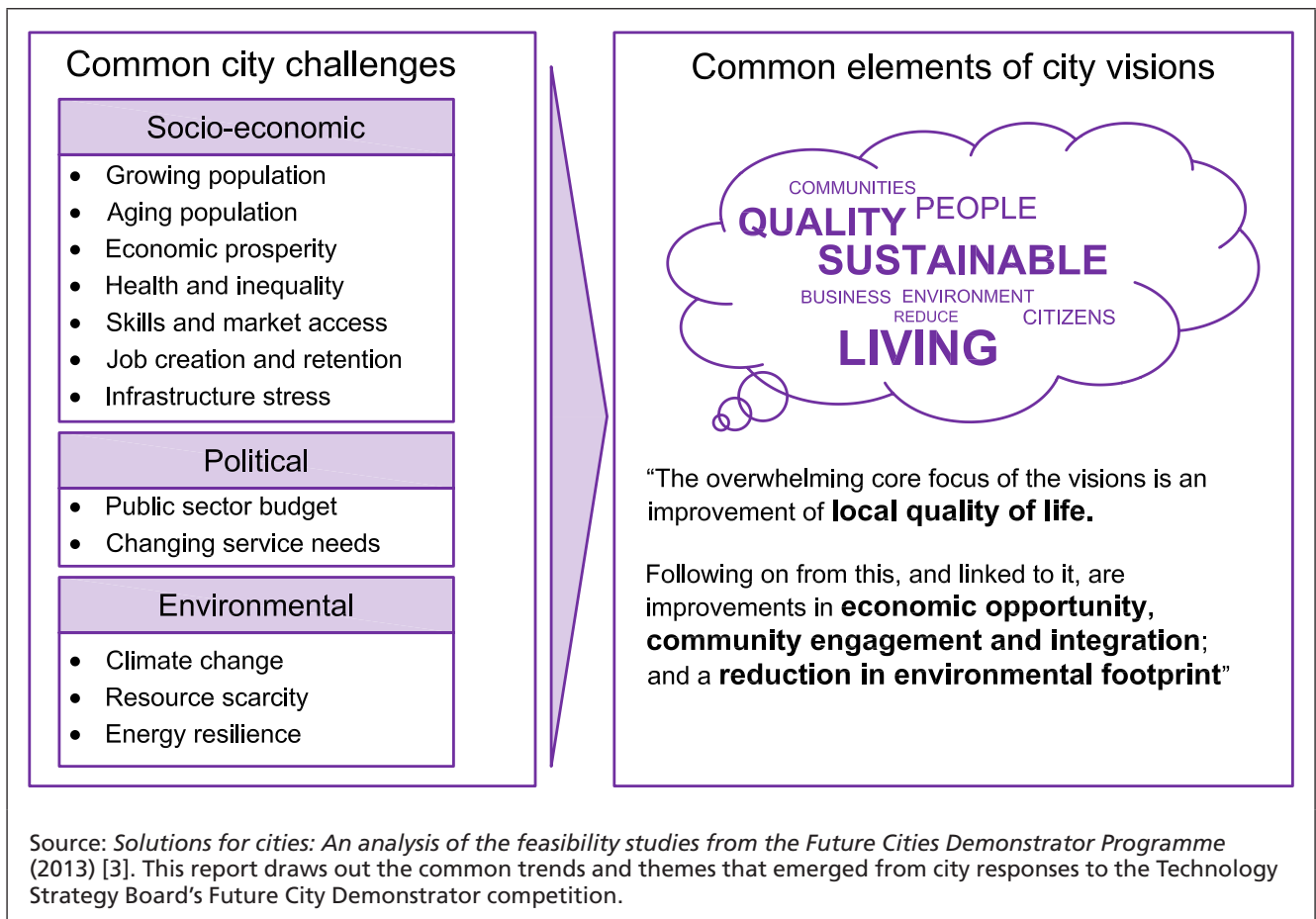
The need

An agreed vision of what a “smart future” looks and feels like for the city is essential for success.

As previously stated, this PAS does not seek to describe a one-size-fits-all vision for the future of UK cities. Cities are rooted in local place and local culture, and are developing different visions of how they wish to build on these for their futures.

That said, recent research into the future plans of 29 UK cities found a set of **common challenges** that cities are facing, and a set of **common themes in cities’ visions** for the future (as illustrated in Figure 3).

Figure 3 Common challenges and shared visions across 29 UK cities



Source: *Solutions for cities: An analysis of the feasibility studies from the Future Cities Demonstrator Programme* (2013) [3]. This report draws out the common trends and themes that emerged from city responses to the Technology Strategy Board’s Future City Demonstrator competition.

Increasingly, cities wishing to deliver their vision and strategic objectives in a smart way also seek to articulate within the vision how this will “feel” different from their city as it is now. Common characteristics of smart cities approach which cities articulate in their city visions are set out in Table 1.

Table 1 Characteristics of “smartness” highlighted in city visions^{A)}

• Connected – to opportunities, spaces, places, markets	• Transparent
• Open-minded, collaborative and experimental	• Academically rich
• Joined-up in our city thinking	• In harmony
• Easy, friendly and attractive place to come together	• Intelligent
• Better information, more choice, more convenience, less waste	• Liveable and sustainable
• Inclusive	• Interconnected
• Flourishing creativity	• Confident, cosmopolitan, creative
• Balanced demand/supply	• Outcome focused/evidence-based decision-making
• Agile and adaptive to changing needs	• Predictive of / resilient to future challenges

^{A)} Draws on the 29 feasibility studies from the Future City Demonstrator Programme submitted to the Technology Strategy Board in 2012 [3], and on BSI stakeholder consultation during 2013.

Recommendations

Smart city leaders should therefore create a vision of “what good looks like” for their city, now and in the future, that:

- a) is developed in an iterative and collaborative manner (that is, inclusive of all city stakeholder groups and informed by user research and engagement, with social media and other technologies used to enable public participation in the process);
- b) embraces the opportunities opened up by smart technologies, smart data and smart collaboration;
- c) does so in a way which integrates these with the core socio-economic, political and environmental vision and purpose for the city’s future, rather than seeing them as somehow separate from the city’s core strategic objectives;
- d) is measurable.

Linkages

The city vision should be informed by the city’s **[A] guiding principles**, and developed through intensive **[B4] stakeholder collaboration**. The vision should be expressed in terms of measurable outcomes and a clear line-of-sight established between all activities in the roadmap and delivery of these outcomes for the city vision. Guidance on how to do this effectively is set out at **[C] benefit realization**.

GUIDANCE NOTE [B2]: TRANSFORMING THE CITY’S OPERATING MODEL

Context

In developing the [B1] city vision, smart city leaders need to ensure that it is consistent with the [A] guiding principles that underpin the vision: citizen-centric, digital, open and collaborative. For most cities, these principles do not describe the business-as-usual state of the city. This means that, whatever the detail of the city vision and the strategic goals that city leaders aim to deliver, significant change is needed to the overall operating model within which city stakeholders work together.

The need

The traditional operating model for a city has been based around functionally-oriented service providers that operate as unconnected vertical silos, which are often not built around user needs. Smart cities need to develop new operating models that drive innovation and collaboration across these vertical silos.

Traditionally, budget-setting, accountability, decision-making and service delivery have been embedded within vertically-integrated delivery chains inside cities – delivery silos which are built around functions not user needs. As illustrated in Figure 4:

- the individual citizen or business has had to engage separately with each silo: making connections for themselves, rather than receiving seamless and connected service that meets their needs;
- data and information has typically been locked within these silos, limiting the potential for collaboration and innovation across the city, and limiting the potential to drive city-wide change at speed.

Figure 5 summarizes the change to this traditional way of operating, which smart cities are seeking to implement.

Figure 4 Traditional operating model: where cities have come from

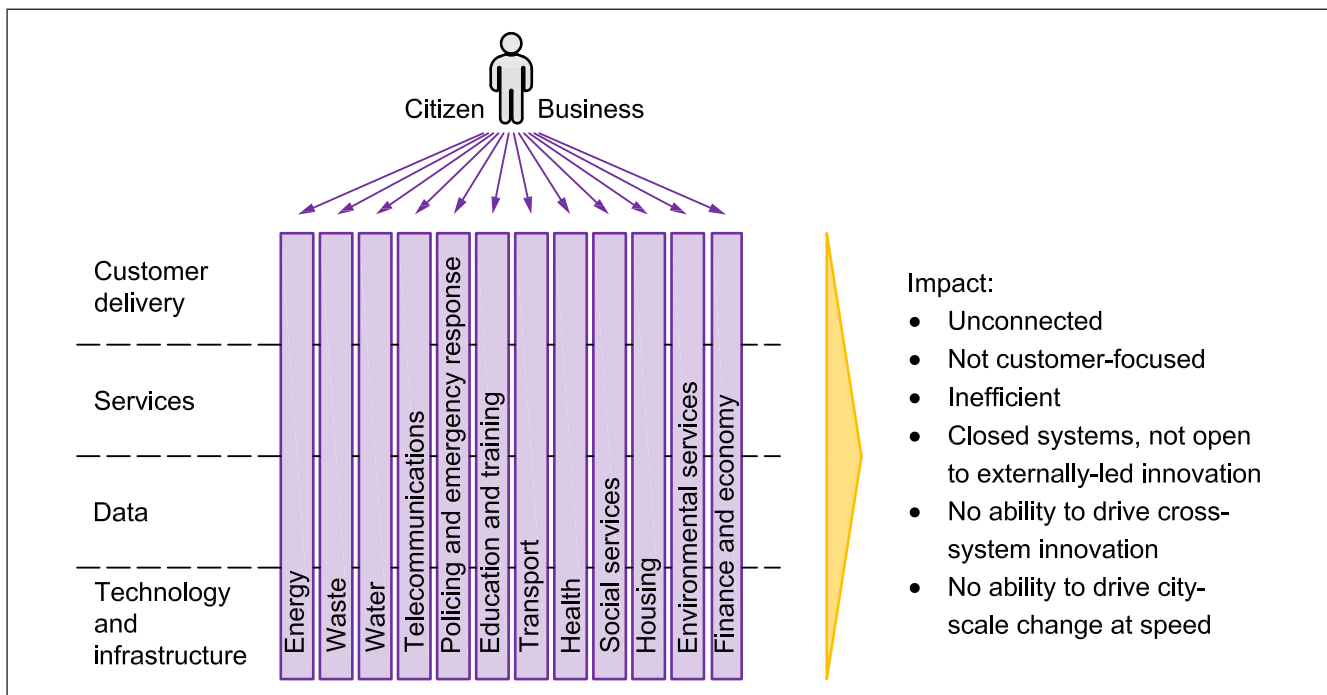
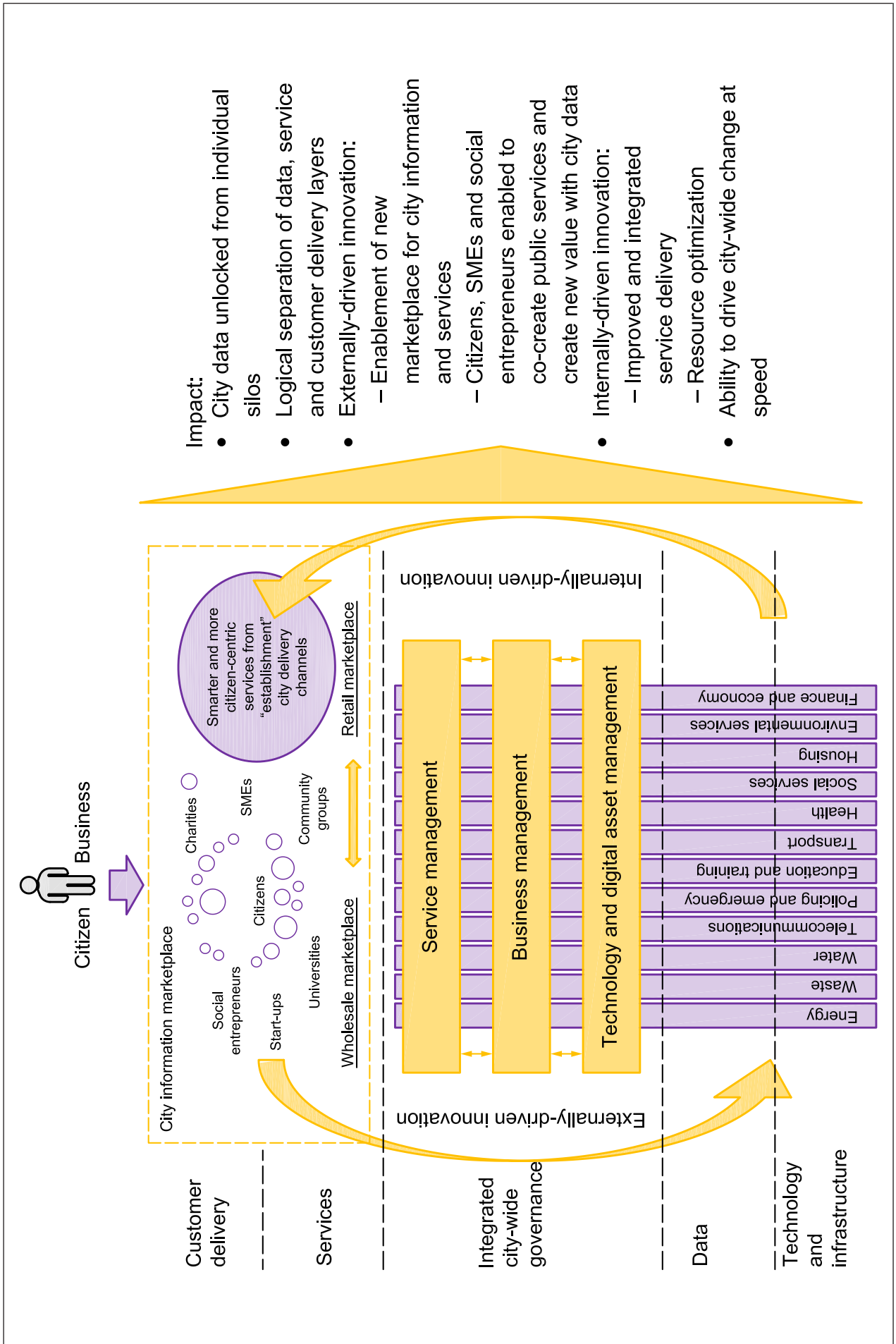


Figure 5 New integrated operating model: where smart cities are moving to



Key features of this shift to a smarter city operating model include:

- a) **investing in smart data**, i.e. ensuring that data on the performance and use of the city's physical, spatial and digital assets is available in real time and on an open and interoperable basis, in order to enable real-time integration and optimization of city resources;

NOTE For the purposes of this PAS, "digital assets" refers to digital data, applications and services.

- b) **managing city data as an asset in its own right**, both within the city authority and in collaboration with other significant data owners across the city;
- c) **enabling externally-driven, stakeholder-led innovation** by citizens, communities and the private and voluntary sectors, by opening up city data and services for the common good:
 - 1) both at a technical level, through development of open data platforms; and
 - 2) at a business level, through steps to enable a thriving market in reuse of public data together with release of data from commercial entities in a commercially appropriate way;
- d) **enabling internally-driven, city-led innovation** to deliver more sustainable and citizen-centric services, by:
 - 1) providing citizens and businesses with public services, which are accessible in one stop, over multiple channels, that engage citizens, businesses and communities directly in the creation of services, and that are built around user needs not the city's organizational structures;
 - 2) establishing an integrated business and information architecture which enables a whole-of-city view of specific customer groups for city services (e.g. commuters, elderly people, troubled families, disabled people);
- e) **setting holistic and flexible budgets**, with a focus on value for money beyond standard departmental boundaries;
- f) **establishing city-wide governance and stakeholder management processes** to support and evaluate these changes.

Recommendation

Smart city leaders should ensure that their **[B1] city vision** includes the need to develop an integrated city operating model, which is focused around citizen and business needs, not just the city's organizational structure.

Linkages

Different cities have approached this in different ways and this SCF brings together good practices on how to do so. Critical elements needed for an integrated city operating model are covered in **[B3] leadership and governance**, **[B9] empowering stakeholder-led service transformation**, **[B10] delivering city-led service transformation**, **[B13] resources mapping and management** and **[B14] open, service-oriented, city-wide IT architecture**. The transition to this new operating model has behavioural, skills and cultural implications, which need to be managed and therefore inevitably involves a degree of risk. Attention should be paid at all times to managing the **[D] critical success factors**.

GUIDANCE NOTE [B3]: LEADERSHIP AND GOVERNANCE

Context

Development of a shared and compelling [B1] city vision requires significant leadership; delivery of that vision then requires that leadership to be sustained over many years and embedded within effective governance processes.

The need

Smart city programmes cannot be delivered successfully through traditional top-down programme structures. Smart cities need to find effective ways to empower and enable leadership on a distributed, city-wide basis across all stakeholders.

There is no ideal leadership structure for a smart city programme: the optimal positioning of the leadership team will depend on the context of each city. However, global experience suggests the following factors are vital to address in whichever way is most appropriate for the specific city context.

- a) **A clear focus of accountability within the city authority.**
At both the political and administrative levels there should be an explicit functional responsibility for the smart city programme within the city authority. These functions should be occupied by individuals with sufficient authority to shape resource allocation and organizational priorities.
- b) **Building a broad-based leadership team across the city.**
It is not essential that all city stakeholders are committed to the smart city programme from the very outset. Indeed, a key requirement of building and managing a [B8] smart city roadmap is to work in ways that nurture and grow support for the strategy through the implementation process. However, it is important the smart city programme is not seen as a centralized or top-down initiative led solely by the city authority. Sharing leadership roles for the design and delivery of a programme with senior colleagues across the other sectors and organizations across the city is therefore important.
- c) **Bringing city leaders together in effective governance arrangements.**
City-wide, cross-sectoral governance systems need to be established at two levels:
 - 1) the strategic governance level, focused on defining required outcomes of the smart city programme and ensuring effective [C] benefit realization;
 - 2) the delivery governance level, focused on implementation of the [B8] smart city roadmap.
- d) **Deployment of formal programme management disciplines.**
To deliver effective city-wide transformation, it is vital to develop and manage a portfolio of programmes and projects that together are intended to deliver the smart city vision. While these can be managed by many different actors around the city, they should be brought together into an overall strategic programme of work with:
 - 1) an overall business case, supported by measurement of clear success indicators;
 - 2) prioritization of activities and programme changes, based on performance and feedback criteria linked to the city's [A] guiding principles;
 - 3) common frameworks for managing strategic risks, issues and constraints, bought into by all delivery partners.

- e) **Ensuring the right skills mix in the leadership team.**
Effective leadership of a smart city programme requires the senior accountable leaders to have access to a mix of key skills in the leadership team which they build around them, including: strategy development skills, stakeholder engagement skills, marketing skills, commercial skills and technology management skills. Deployment of a formal competency framework, such as Skills Framework for the Information Age (SFIA), can be helpful in identifying and building the right skill sets.
- f) **Allowing for organizations' evolution over time.**
Contributions by private and voluntary stakeholders are likely to be subject to engagement lifecycles. Organizations are created, evolve and eventually merge or decline. The continuity of smart city assets and services needs to be actively managed throughout this evolutionary process.
- g) **Ensuring an open and transparent governance process.**
Transparency is important in order to build trust, strengthen accountability for delivery of the smart city programme, and to facilitate openness and collaboration with all stakeholders. This means that the leadership of a smart city programme should aim to publish all key vision and strategy documents, make names and contact details of programme leaders publically available, and publish regular updates of performance and delivery against the **[B8] smart city roadmap**.

Increasingly, ICT-enabled tools are available to cities, particularly ones enhanced by visualization, that help support the delivery of all of the above factors.

Recommendations

Smart city leaders should establish leadership and governance arrangements that ensure:

- a) a clear focus of accountability within the city authority;
- b) a broad-based leadership team across the city;
- c) city leaders are brought together on a cross-sectoral basis into effective governance arrangements, at both the strategic and delivery levels;
- d) deployment of formal programme management disciplines and prioritization of activities and programme changes, based on performance and feedback criteria;
- e) the right skills mix in the leadership team;
- f) an ability to manage organizational evolution among city partner organizations;
- g) openness and transparency in the governance process, including through digitally-enabled models of public participation.

Linkages

Key tasks for the leadership of a smart city programme include:

- a) articulating and acting as guardians of the **[A] guiding principles** for the smart city programme;
- b) ensuring that the programme is aligned to deliver a clear, compelling and agreed **[B1] city vision**;
- c) acting as champions and ambassadors for the smart city approach as part of **[B4] stakeholder collaboration**;

- d) developing and overseeing a **[B8] smart city roadmap**; and
- e) ensuring line-of-sight from all investments and activities within that roadmap and the strategic outcomes being targeted by the programme through its smart city **[C] benefit realization framework**.

GUIDANCE NOTE [B4]: STAKEHOLDER COLLABORATION

Context

Effective stakeholder collaboration is critical. Establishing a process of sustainable change requires a critical mass of actors inside and outside of the city administration to be both engaged and supportive. Delivering a **[B1] city vision** cannot be done without meaningful stakeholder collaboration.

The need

Smart city programmes cannot be delivered successfully only by the city authority. The breadth of change and need for long-term commitment requires investment (in time, money and encouragement) from a critical mass of internal and external stakeholders.

Stakeholders are considered to be any individual or organization impacted by the programme.

The stakeholder mix involved in planning, delivering and sustaining a smart city programme is extensive and complex. There can be many different types of stakeholders with different objectives, requirements and levels of commitment. These can include:

- a) **Promoters**
Those with an interest in actively promoting the programme, including: local elected representatives; central government; consumer groups (including: business, suppliers to the programme and the media). This category will also cover any stakeholder with a negative agenda (negative promoters).
- b) **Investors**
Those investing resources into the programme, including: financial institutions; central government; businesses who stand to improve their return on investment through the programme's outcomes (including suppliers).
- c) **Deliverers**
Those involved in delivery of the programme, including: the city authority's internal business units; partners, including business, education and not-for-profit sectors; suppliers.
- d) **Consumers**
Those who will be affected by the programme, including: residents (individuals, communities and organizations); businesses; those who work and live in, as well as visit, the city.
- e) **External**
Those not directly involved in the programme but who will be affected by it directly or indirectly, including: central government; other local government and public sector organizations; businesses with an interest in the impact of the programme; the media.

This is not meant to be an exhaustive set of categories. It is provided to illustrate the diversity of stakeholders making up the city. Stakeholders fall into different groups with different needs, expectations and contributions to make, and moreover many stakeholders can be expected to fit into more than one category, with different needs at different times during the programme.

This complex and fluid landscape of stakeholders needs to be actively managed through the programme.

The stakeholder engagement workstream of the **[B8] smart city roadmap** is also the mechanism through which the needs and aspirations of stakeholders can be distilled and represented in the programme.

Recommendation

Smart city leaders should establish, and give high priority and adequate resources to, a **formal managed stakeholder engagement programme**. This should be led by a senior executive and integrated into the roles all those involved in delivering the smart city programme, and should cover:

- a) **stakeholder participation**: ensuring that all stakeholders (users, suppliers, delivery partners elsewhere in the public, private and voluntary sector, politicians, the media, etc.) have a clear understanding of the smart city programme and how they will benefit from it, and have effective and inclusive routes (including through use of digital media) to engage with and participate in the programme;
- b) **cross-sectoral partnership**: engaging effectively with stakeholders from the private, public and voluntary sectors to deliver the programme in a way that benefits all sectors;
- c) **engagement with other cities** to learn lessons and exchange experience.

Linkages

Stakeholder engagement should be established as a formal workstream within the **[B8] smart city roadmap**, with measurable performance metrics built into the **[C] benefit realization framework**. Stakeholder engagement underpins all other parts of the SCF, because anyone involved in the realization of the smart city vision (or receiving benefits as a result) is considered a stakeholder. However, intensive multi-stakeholder engagement is particularly important for **[B1] city vision**, **[B3] leadership and governance**, **[B5] procurement and supplier management**, **[B9] empowering stakeholder-led service transformation**, **[B10] delivering city-led service transformation** and **[B11] identity and privacy management**. Helpful and relevant guidance on stakeholder engagement is set out in BS 8900, *Guidance for managing sustainable development*.

GUIDANCE NOTE [B5]: PROCUREMENT AND SUPPLIER MANAGEMENT

Context

City authorities rely heavily on suppliers, a trend that is increasing as local authorities increasingly define themselves as commissioners not deliverers of services. However, legacy supplier relationships and procurement policies have often raised significant barriers to smart city developments.

The need

Cities need to develop procurement and supplier management strategies that act as enablers rather than blockers of their vision for more citizen-centric and integrated service delivery.

Public sector procurement practices can represent a significant obstacle to accelerating the growth of smart cities in the UK. From both the public and private sector sides of the market, there is strong evidence that traditional procurement of city services is stifling innovation and inhibiting the ability of cities and industry jointly to undertake real life R&D and to pool intellectual property for mutual benefit.

Equally, there is increasing consensus on new, smarter approaches to public procurement, which are already starting to develop and should be more widely adopted. Table 2 summarizes some of the key elements of this shift.

Table 2 Towards smarter city procurement

Traditional city procurement	Smart city procurement
Silo-based procurement, with requirements set by individual business units within the city ...	▶ An integrated strategic approach to the commissioning of services, across the city council and in partnership with other city service delivery organizations
... and with little ability to fund solutions that benefit multiple organizations	▶ Budget alignment mechanisms enable effective provision of common good platforms and services
The city defines the technology and other inputs it wants to buy, and the immediate outputs it wants these to deliver	▶ The city defines the outcomes and service levels it wants to achieve
Requirements are developed internally by the city	▶ Requirements are developed iteratively, in partnership between customer, commissioner and supplier
The city brings its requirements to the market in a piecemeal manner	▶ Published pipelines of future requirements help to stimulate the market and enable suppliers to propose new cross-cutting solutions to deliver multiple requirements (both within and across cities)
Cities define their requirements in isolation from each other	▶ Joint procurement initiatives, facilitated by shared pipelines, enable shared services across more than one city and also stimulate the market for standardized and replicable city solutions (including via G-Cloud in the UK)
Procurement and contracting is based around purchaser-provider, client-agent relationships	▶ A range of more innovative delivery models are deployed, including city companies, joint ventures, and partnerships between cities, industry and academia that promote collaborative solutions while safeguarding the intellectual property of each
Procurement decisions focus primarily on price	▶ Procurement decisions focus primarily on long-term value for money, including: <ul style="list-style-type: none"> • total cost of ownership (including costs of exit); • the suppliers' ability to innovate; • confidence in delivering the expected business benefits.
IT as a capital investment	▶ IT as a service
Long-term, inflexible contracts	▶ Short-term, on-demand purchasing
Bespoke, vertically-integrated solutions for each line of business	▶ Sharing and re-using standardized components, drawing on best-of-breed building blocks and commercial-off-the-shelf products
City systems are unable to interoperate, due to over-reliance on proprietary systems	▶ Interoperability based on open standards is designed into all procurements from the outset

Table 2 Towards smarter city procurement (*continued*)

Traditional city procurement	Smart city procurement
Important city data-sets cannot be opened up because they are owned by suppliers	▶ Standard contractual arrangements ensure that all city suppliers make city data available via open standards and either for free or, where appropriate, on fair, reasonable and non-discriminatory terms
No incentives on suppliers to share, collaborate and innovate with other city stakeholders	▶ Contractual arrangements encourage collaboration with others to create new value, and the sharing of common city assets, with benefits being shared between the city and its suppliers
The city buys from a limited pool of large suppliers	▶ The city buys from a large pool of small suppliers, plus strategic relations with one or a few platform suppliers who themselves integrate with many SMEs
City leaders focus on managing relationships with a few large vendors	▶ City leaders focus on nurturing and managing an innovation ecosystem

There is a perception that there are barriers rooted in the legislative framework for procurement. However, this is not primarily the case: smart, outcomes-based procurement is compatible with the fundamental premise of UK, EU and international law on public procurement, which states that authorities should specify outcomes not technological solutions in their procurement. The key barriers are rooted much more in procurement culture and practice, which can and should be tackled at city level.

Recommendations

Smart city leaders should therefore:

- a) **take an integrated view of the city's procurement requirements**, establishing governance arrangements that enable a city-wide overview of major procurements by the city council and other major public sector organizations operating in the city;
- b) **review procurement policies to ensure they align with smart city contracting principles**:
 - 1) **focus on procuring business outcomes**: specify what the supplier should achieve, not how it should achieve it (in general, this includes procuring services not assets);
 - 2) **build open data into all procurements**: be clear that all data is to be owned by the city not the supplier, or establish clear requirements for the supplier to make data available via open standards and fair, reasonable and non-discriminatory terms;
 - 3) **incentivize innovation and collaboration**: ensure that contractual arrangements encourage collaboration with others to create new value, and the sharing of common city assets;
 - 4) **avoid supplier lock-in**, by integrating interoperability requirements into all ICT procurement, using commercial off-the-shelf products and open standards wherever possible, and factoring in the costs of exit from the outset;

- c) **work to nurture an innovation ecosystem across the city and its suppliers**, including by:
- 1) **publishing the city's procurement policies**, ensuring that all changes following the review are widely known;
 - 2) **publishing and updating a pipeline** of major city procurement opportunities;
 - 3) **early and iterative engagement with potential suppliers**, including local and other SMEs, to benefit from innovation and stimulate the market;
 - 4) **stimulating SME-led innovation**, including through use of competitions and placing SME-engagement requirements on large suppliers;
 - 5) **driving forward the internal cultural and behavioural changes** entailed by the recommendations given in 1) to 4).

Linkages

The need to nurture an innovation ecosystem of city suppliers should be a major theme of **[B4] stakeholder collaboration**. In reviewing city procurement policies, city leaders should seek to align contracting principles with **[B14] open, service-oriented, city-wide IT architecture**.

GUIDANCE NOTE [B6]: MAPPING THE CITY'S INTEROPERABILITY NEEDS

Context

The SCF's **[A] guiding principles** (see Annex A) focus on the need to enable sharing and reuse of city assets and services, through interoperability enabled by open standards.

The need

Smart cities need to understand and map out barriers to interoperability. However, genuine interoperability between city systems needs change not just at the technical level. Cities need to take a holistic approach to interoperability.

Over recent years significant work has been done by public authorities and industry to help ensure interoperability between systems. In the UK, this is brought together in the *Open Standards Principles* [4] published by the Cabinet Office, and maintained on an ongoing basis via the Standards Hub [5]. This work focuses on standards and specifications aimed at ensuring technical interoperability and data (or semantic) interoperability.

However, genuine interoperability between city systems faces a wide range of non-technical barriers, which cities need to identify and address. The European Commission identifies five broad interoperability domains via the European Interoperability Framework (EIF): technical, semantic, organizational, legal, and policy interoperability. While this framework is conceptually complete, cities may find it helpful to map the five EIF dimensions against the three city-wide delivery and governance processes identified in this guide: business management, service management, and technology and data asset management.

The resulting matrix represents the landscape within which a city needs to map the barriers to interoperability which it faces, and relevant constraints placed by national or international policy commitments. In each cell of the matrix, some action is likely to be needed.

Figure 6 uses this matrix to set out, for illustrative purposes, some of the key policy products that cities might seek to use in tackling these barriers.

Each policy product is cross-referenced to the component of this SCF, which provides guidance on the activities needed to develop that policy product.

NOTE For the purposes of this PAS, "policy product" is defined as any written document used to shape, guide and deliver smart city activity. Examples include: written policies, standards, guidelines, and frameworks.

Recommendation

Smart city leaders should therefore use the **smart city interoperability matrix** as a tool to:

- a) help identify key barriers to interoperability in their city;
- b) establish policies and actions to address these, drawing on international, European and national standards where possible; and
- c) promote commonality of approaches and easier linkages with other cities, and other local and national authorities.

Linkages

Further detail on technical and semantic interoperability is addressed in **[B14] open, service-oriented, city-wide IT architecture**. Policies and actions to address barriers identified via this interoperability mapping should be addressed as part of the **[B8] smart city roadmap**.

Figure 6 Smart city interoperability matrix

SCF interoperability matrix	Political interoperability	Legal interoperability	Organizational interoperability	Semantic interoperability	Technical interoperability
Business management	Guiding principles [A] City vision [B1] Governance model [B3] Strategic business case for the overall programme [C] Risk management strategy [B8]	Legal vires for collaboration and data sharing between organizations [B6]	Operating model [B2] Smart city roadmap [B8] Stakeholder engagement plan [B4] KPI framework [C] Benefits realization plan [C] Skills framework [B3]	Open, service-oriented, city-wide IT architecture [B14] Common terminology and reference model [B7]	
Service management	Service transformation strategy [B9][B10] Identity and privacy management strategy [B11] Digital inclusion and channel management strategy [B11] City-wide procurement strategy [B5]	Privacy, data protection and data security legislation [B11] Smart contracting policy and principles [B5]	Customer segmentation framework [B10] Shared customer insight [B10] Key services portfolio [B10] Citizen-centric delivery model [B10] Marketing and communications plan [B4] Federated and citizen-centric trust model for identity management [B11] Supplier ecosystem management strategy [B5]	City services and channels map [B12] Publishing guidance and standards [B14]	Published APIs [B9] for city applications
Technology and data asset management	Shared vision and business case for open city data [B9]	Legal and policy framework for open city data [B9]	Documented suite of business models for supply and use of city data [B9] Technology and data roadmap [B14]	City data asset map [B13] Common data standards and taxonomies [B14]	City ICT asset map [B13] E-Government Interoperability Framework [B14]

GUIDANCE NOTE [B7]: COMMON TERMINOLOGY AND REFERENCE MODEL

Context

In any change programme of the breadth and complexity that the SCF supports, all stakeholders need to have a common understanding of the key concepts involved and how they interrelate, and have a common language to describe these in.

The need

Leadership and communication both break down when stakeholders understand and use terms and concepts in very different ways, leading to ambiguity, misunderstanding and, potentially, loss of stakeholder engagement.

Concepts do not exist in isolation. In addition to clear definitions and agreed terms, it is the broader understanding of the relationships between concepts that give them fuller meaning and allow us to model our world, our business activities, our stakeholders, etc. in a way that increases the chance that our digital systems are an accurate reflection of our work. Any partners involved in delivering a smart city programme should be able to use a common terminology without ambiguity and be sure that these terms are used consistently throughout all work.

Recommendations

Smart city leaders should:

- a) ensure that all stakeholders have a clear, consistent and common understanding of the key concepts involved in smart city development; how these concepts relate to each other; how they can be formally modelled; and how such models can be leveraged and integrated into new and existing information architectures;
- b) seek agreement among stakeholders to establish and maintain an agreed and shared common terminology and reference model.

Linkages

Detailed advice on smart city terminology and reference models is available in PAS 180, *Smart cities – Vocabulary*, and in PAS 182, *Smart city concept model – Guide to establishing a model for data interoperability*.

GUIDANCE NOTE [B8]: SMART CITY ROADMAP

Context

Work towards delivering the **[B1] city vision** and **[B2] transforming the city's operating model** needs to be underpinned by an effective roadmap.

The need

Cities need to develop a smart city roadmap that is practically deliverable: that is, not some all-encompassing master plan (which is likely to be brittle and prone to failure) but a pragmatic framework for delivering clearly identifiable results in achievable stages.

Different cities are at different stages of maturity in their evolution towards the sort of transformed operating model described in the guidance above at **[B2] Transforming the city's operating model**, and may have very different outcomes that they seek to achieve as part of their **[B1] city vision**. So there can be no one-size-fits-all roadmap.

That said, an effective smart city roadmap for any city is likely to take a phased and incremental approach, which does not over-plan at the outset but provides a

framework for an organic, market-based process of change to deliver the vision over time. A typical smart city roadmap might therefore cover five main phases, as illustrated in Figure 7.

Figure 7 Phases of a smart city roadmap

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 actions 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 actions 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.

Recommendations

Smart city leaders should:

- a) establish a phased smart city roadmap;
- b) work with stakeholders to identify a set of services and initial smart city deliverables that represent quick wins for the city;
- c) give priority to changes that can be delivered quickly, at low cost and low risk;
- d) establish systems to learn from early customer experience, to improve services in the light of this, and then to drive higher levels of take-up;
- e) work with early adopters within the city authority and partner organizations in order to create exemplars and internal champions and thus learn from experience and drive longer-term transformation.

Linkages

Implementation of the smart city roadmap should be pursued with due attention to risk management, and should therefore include checkpoints at key stages to allow regular, independent review of performance against the **[D] critical success factors**.

5.3 Citizen-centric service management

This subclause of the SCF addresses the way in which city services for citizens and businesses are planned and delivered. The focus is on the changes that are needed in cities to align service delivery more closely with the **[A] guiding principles**, and with the vision described in 5.2 for **[B2] transforming the city's operating model**.

At the heart of the SCF approach to service management is a belief that a twin-track approach needs to be taken to the smart transformation of city services:

- a) First, the increasing digitization of city services and of city assets presents a huge opportunity to make the city more open to externally-driven innovation. So smart city programmes should seek to accelerate this, by facilitating and incentivizing the development of a new "information marketplace" for the city, within which city systems are opened up to SMEs, social entrepreneurs and individual citizens to design and deliver city services themselves, mash up city data with other data, and create new sorts of public value. This is addressed below in the guidance note **[B9] empowering stakeholder-led service transformation**.
- b) Second, the city authority itself (together with other major service deliverers in the city) has a responsibility to drive improvements to its own services through the application of smart data and more citizen-centric ways of working. This is addressed below in the guidance note **[B10] delivering city-led service transformation**.

The other two sub-components of the service management component of the SCF are aimed at supporting both parts of this twin-track approach, and are:

- **[B11] identity and privacy management;**
 - **[B12] digital inclusion and channel management.**
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GUIDANCE NOTE [B9]: EMPOWERING STAKEHOLDER-LED SERVICE TRANSFORMATION

Context

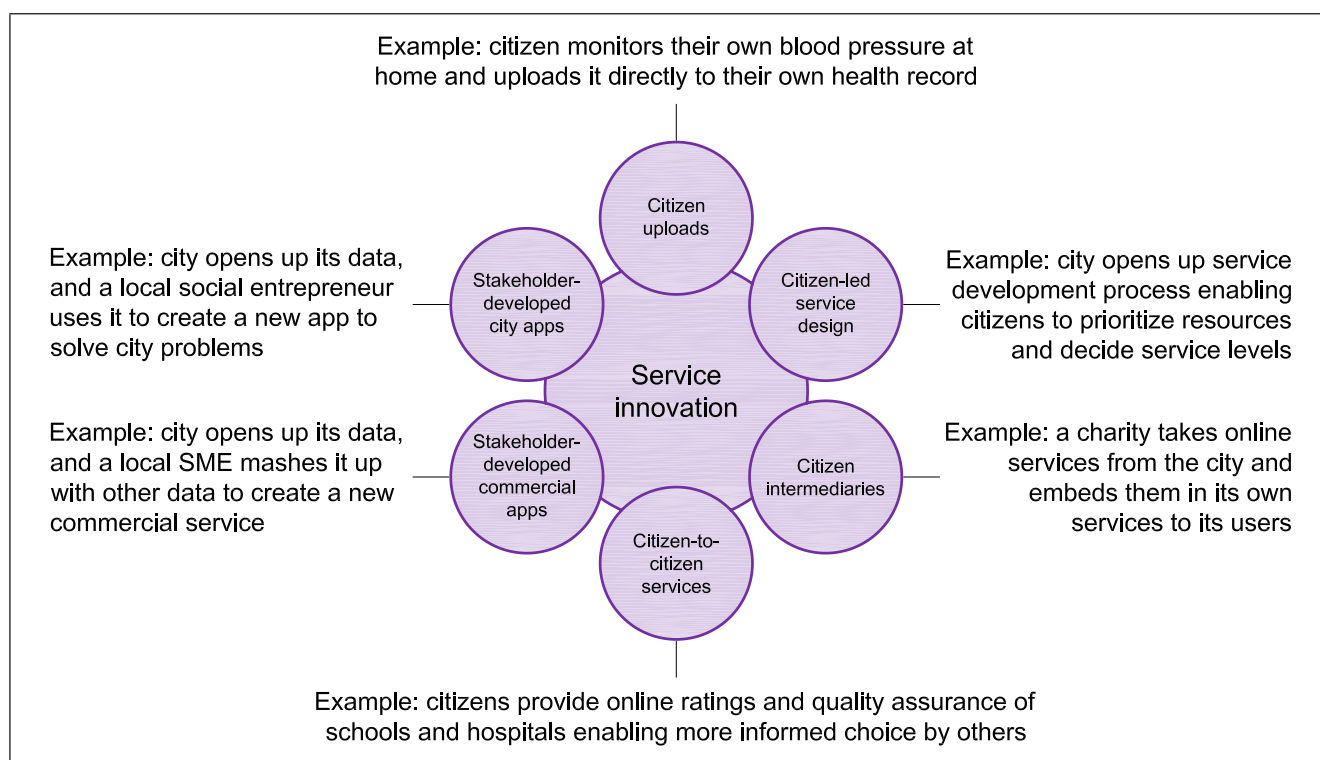
The SCF [A] **guiding principles** highlight the importance of opening up the city's data to drive innovation and create new value, and empowering citizens and businesses within the city to create public value themselves through city data.

The need

Smart cities seek to engage with citizens and businesses as owners of and participants in the creation and delivery of city services, not as passive recipients of services. Getting this right can be a powerful driver of service transformation, but significant barriers need to be tackled.

Service delivery in a smart city is not something that is done by the city authority to citizens but is something in which they are active co-creators of services (or even where public services are delivered directly citizen-to-citizen with no or minimal city involvement). Innovators in cities who are making this shift are starting to develop a wide range of new ways to create public value and enhance services, as illustrated in Figure 8.

Figure 8 Service innovation through stakeholder empowerment



Such changes are beginning to happen whether cities plan for them or not, driven by the increasing adoption of social media and by rising expectations from citizens on the degree of interactivity they want from services (expectations that are constantly being raised by the best digital offerings from the private sector globally).

A lot of smart city projects will be carried out by individuals, communities and businesses using technology available to them on the open market; but there is a lot that city leaders and institutions can do to help stakeholders better access that market. For example, knowledge of how social media and smartphones can be powerful enablers to community activities and business is still very poorly

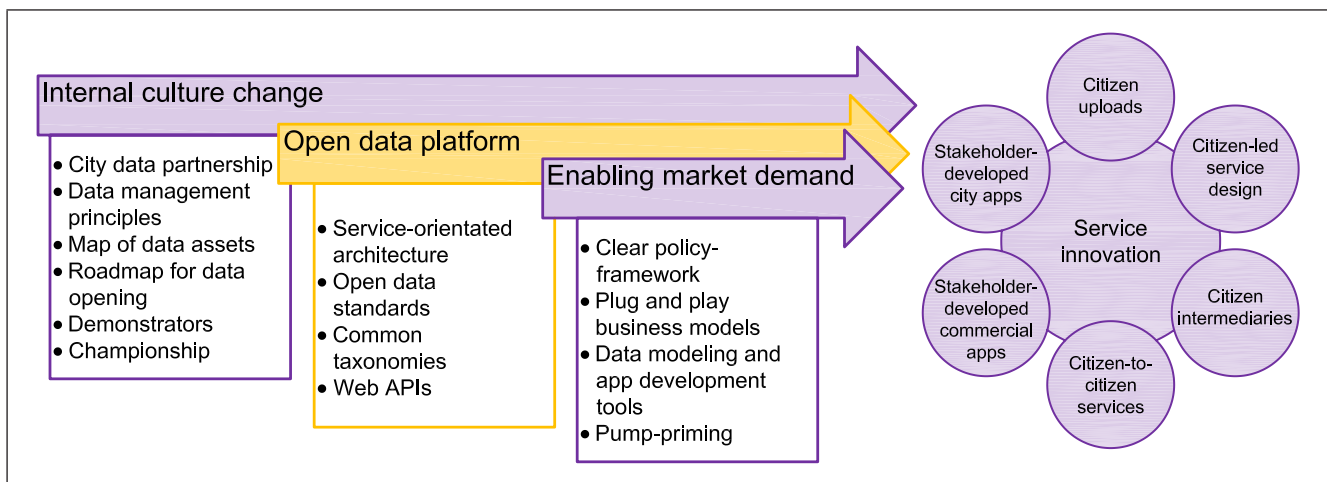
disseminated throughout our population. Many of the most effective programmes for spreading awareness are volunteer- or community-led activities.

Smart city programmes can seek to embrace and accelerate those changes through measures such as those illustrated in Figure 9.

A key enabler is the establishment of an open data platform for the city: aimed at putting the city’s data in the hands of the city’s citizens, entrepreneurs, social enterprises, public service providers, and businesses. (A total of 23 out of the 30 UK cities participating in the Technology Strategy Board’s “Future City Demonstrator” programme during 2012 proposed such a platform [3].)

However, while open data platforms have the potential to unleash significant amounts of innovation, experience from cities around the world is that the technology alone will not do so. Business change is critical, and this needs to be addressed at two levels, as illustrated in Figure 9.

Figure 9 Delivering stakeholder empowerment



First, cities need to drive change upstream of the data platform: that is, work on *internal culture change* with data owners across the city (from the public, private and voluntary sectors) to ensure a willingness and capability to provide data into the platform, and to tackle barriers to opening up data. These barriers are as much cultural ones as they are technical ones (given the strong tradition of internal silo-based control of city data) and require sustained leadership over several years. Illustrative actions, which may be built into a **[B8] smart city roadmap**, include:

- a) establishing a coalition of the willing between the city authority and other major data owners in the city, committed to increasing the number of data sets provided and used on the platform;
- b) building a shared vision and business case for the value that smarter, more open and more interoperable data can create in the city;
- c) agreeing a set of principles for the future management of data that data owners commit to working towards, including use of open data standards and the Five Star Rating for Open Data [6];
- d) developing a prioritized map of key data assets across the city, and a roadmap for converging these with the agreed principles and standards;
- e) promoting demonstrator projects and championing the benefits being achieved by early adopters.

Second, cities need to drive change downstream of the data platform: that is, *enabling market demand* by citizens, businesses and other stakeholders.

Illustrative actions which might be built into a **[B8] smart city roadmap** include:

- f) establishing a clear and easily understandable policy framework of rights and responsibilities around open city data, which:
 - 1) puts protection of personal privacy at its heart;
 - 2) creates a level-playing field between public, private and voluntary sector organizations that develop services based on city data;
 - 3) ensures compliance with relevant regulation and with government open data policy;
- g) developing and documenting a suite of sustainable business models for supply and use of data via the platform (including publication of free public data, publication of public data with additional charges to cover the cost of value-add services, and publication of data on a commercial subscription basis);
- h) enhancing the city open data platform so it provides tools to facilitate exploration and experimentation with city data by application developers;
- i) pump-priming the market with seed-corn funding and/or incubation facilities to stimulate innovative, service-related application development aimed at solving city challenges;
- j) supporting stakeholder and community-led collaborations and programmes to enable individuals, communities and businesses to learn about, use and benefit from digital technologies.

Developing a sustainable business model and funding approach for the establishment, maintenance and development of such an open data platform is vital. There are a range of options, such as pooling resources from public sector bodies as a cost-effective, shared service route to complying with their open data obligations, generating revenue from the platform itself through subscription and value-add services, and leveraging investment on the basis of future efficiency savings in city authorities and economic growth in the city generated by the platform.

Recommendation

Smart city leaders should empower city stakeholders to create new sorts of services and value by opening up city data via open platforms, and by driving forward the internal culture changes and the external market enablers which are needed to create a flourishing city information marketplace.

Linkages

The approach to stakeholder empowerment described above is a key element of the broader shift towards **[B2] transforming the city's operating model**. To succeed, the approach should be closely linked with work on **[B11] identity and privacy management**, and the more integrated approach to specifying and purchasing city-wide services as set out in **[B5] procurement and supplier management**. Further details on the technology and data asset management processes needed to support the approach are set out at **[B13] resources mapping and management** and **[B14] open, service-oriented, city-wide IT architecture**.

GUIDANCE NOTE [B10]: DELIVERING CITY-LED SERVICE TRANSFORMATION

Context

The SCF [A] **guiding principles** highlight the importance of building services around customer needs, not organizational structure.

The need

Smart cities need to develop new ways of working across vertical silos to deliver more citizen-centric services.

The guidance note on [B2] **transforming the city's operating model** noted that service delivery in cities has traditionally been based around vertically-integrated delivery silos that are built around specific functions not user needs. And it recommended the development of new operating models to drive innovation and collaboration across these vertical silos.

[B9] **Empowering stakeholder-led service transformation** is one vital element of this. Additionally, and as illustrated in Figure 5, the city authority and other major service delivery organizations in the city also have a responsibility to use joined-up city data to improve services directly themselves (to act as best practice retailers of data-rich, citizen-centric services, not just as wholesalers facilitating innovation by others).

A smart city programme should therefore also involve a shift away from silo-based delivery of service towards an integrated, multi-channel, service delivery approach: an approach that enables a whole-of-city view of the customer and an ability to deliver services to citizens and businesses where and when they need it most, including through one-stop services and through private and voluntary sector intermediaries.

While many UK cities have made progress in this direction at least in terms of physically bringing together service delivery channels (via one-stop web services, or single phone number initiatives), this is often not a fully citizen-centric approach. Many city departments and agencies have overlapping but partial information about their citizen and business customers, but for the most part nobody takes a lead responsibility for owning and managing that information across the city, let alone using it to design better services.

The SCF recommends an approach which permits the joining-up of services from all parts of the city authority and other public service providers in a way that makes sense to citizens and businesses (yet without enforcing a restructure of the participating organizations). Conceptually, this leads to a model where the existing service delivery organizations within the city continue to act as the supplier of services, but intermediated by a virtual business infrastructure based around customer needs. Successfully implemented at city, state and national level in several countries around the world, this is a low-risk, low-cost, high-impact approach, which involves:

- a) establishing new customer franchise teams, focused on specific customer groups within the city (such as for example, parents, commuters, disabled people, troubled families);
- b) resourcing these within the existing delivery functions of the city without creating additional costs;
- c) empowering these teams, within a defined and quality-assured operating model to:
 - 1) use customer insight research and city-wide data to understand the needs of their customer groups;

- 2) deliver customer-centric, trusted and interoperable content and transactions to their citizens and business customers;
- 3) act as champions of, and drivers for, a brand-led and customer-centric approach to the development and delivery of public services across the city;
- d) providing a safe and quality-assured means of allowing new business models and new types of public private partnership to flourish;
- e) establishing a clear framework of performance and impact measurement, to ensure that service leaders are monitored and challenged to achieve smarter and more user-centric ways of working.

NOTE Attention is drawn to the OASIS TGF [1], which provides further details and global case studies.

Recommendation

Smart city leaders should:

- a) provide citizens and businesses with public services which are accessible in one stop, over multiple channels, and built around user needs not the city's organizational structures;
- b) establish an integrated business and information architecture to support this, enabling a whole-of-city view of specific customer groups for city services;
- c) do so in a phased, low-cost and low-risk way, by rolling out a number of agile, cross-city, virtual franchise businesses that are based around specific customer segments and that sit within the existing delivery structures of the city.

Linkages

The approach to delivering city-led service transformation described above is a key element of the broader shift towards **[B2] transforming the city's operating model**. To succeed, the approach needs to be closely linked with work on **[B4] stakeholder collaboration**, **[B11] identity and privacy management** and **[B12] digital inclusion and channel management**. Further details on the technology and data asset management processes needed to support the approach are set out at **[B13] resource mapping and management** and **[B14] open, service-oriented, city-wide IT architecture**. Further guidance and global good practices on the customer franchise model and on brand-led service delivery are set out in the TGF [1].

GUIDANCE NOTE [B11]: IDENTITY AND PRIVACY MANAGEMENT

Context

The SCF **[A] guiding principles** highlight the importance of ensuring that all personal data is held securely, and under the ownership and control of the individual citizen.

The need

A smart city requires trust. Significant benefits can be achieved by making data more open, more interconnected and available in real-time. But it is essential that any moves in this direction retain the trust of citizens, by placing the security and privacy of their personal data at the heart of the city's approach to service management.

Identity is a complex, and by definition deeply personal, concept. An individual can have multiple, overlapping and partial identities, each of which is associated with different rights and permissions, even different addresses. These identities often overlap, but in some cases the individual could want to keep them separate in order to protect privacy. At other times, the individual could want them to be

joined-up, and be frustrated at constantly having to furnish city authorities with the same information over and over again.

Cities have often struggled to manage this complexity. Often, identity is defined and managed separately in relation to different city services. Many of the tools that city authorities have put in place to guarantee secure access to public services in the digital world (passwords, PINs, digital signatures, etc.), have in practice acted as barriers to take-up of digital services. And attempts to join up databases to enable city-wide efficiencies and service improvements can often be met with mistrust and suspicion by users.

The SCF recommends an approach to identity and privacy management based around three pillars:

- a) **Open business architecture**
Firstly, a business architecture for identity management that is based on federation between a wide range of trusted organizations (the city authority, government departments, banks, employers etc.), and a clear model for cross-trust between these organizations.
- b) **Open technical architecture**
Secondly, a technology architecture to support this, which does not rely on monolithic and potentially vulnerable large databases, but which, in line with the service-oriented architecture (SOA) paradigm, uses internet-based gateway services to act as a broker between the different databases and IT systems of participants in the federated trust model.
- c) **Citizen-centric trust model**
Thirdly, and perhaps most importantly, a customer service model for identity management that places individuals themselves directly in control of their own data, able to manage their own data relationship with the city (and with clearly visible controls to reassure them that this is the case). In practice, this means adherence to the identity and privacy principles published by the Government Digital Service in March 2012 [7], and summarized in Table 3.

Table 3 GDS identity and privacy principles

Principle	User benefit
User control	<i>Identity assurance activities can only take place if I consent or approve them.</i>
Transparency	<i>Identity assurance can only take place in ways I understand and when I am fully informed.</i>
Multiplicity	<i>I can use and choose as many different identifiers or identity providers as I want to.</i>
Data minimization	<i>My request or transaction only uses the minimum data that is necessary to meet my needs.</i>
Data quality	<i>I choose when to update my records, at a time of my choosing, free of charge, and in a simple and easy manner.</i>
Service user access and portability	<i>I have to be provided with copies of all of my data on request; I can move/remove my data whenever I want.</i>
Governance/certification	<i>I can trust the scheme because all the participants have to be accredited.</i>
Problem resolution	<i>If there is a problem I know there is an independent arbiter who can find a solution.</i>
Exceptional circumstances	<i>Any exception has to be approved by parliament and is subject to independent scrutiny.</i>

Recommendation

Smart city leaders should embed an approach to identity and privacy management that is based on:

- a) an **open and federated business model**;
- b) a **service-oriented IT architecture**; and
- c) a **citizen-centric trust model**.

NOTE For example, the identity and privacy principles recommended by the Government Digital Service [7] can form the basis of a citizen-centric trust model.

Linkages

This guidance helps deliver integrated, customer-centric services as part of **[B10] delivering city-led service transformation**, as well as to enable **[B9] empowering stakeholder-led service transformation**. Further detail on the service-oriented IT architectures needed to support this recommended approach to identity and privacy management is given at **[B14] open, service-oriented, city-wide IT architecture**. Key actions to be taken to deliver the identity and privacy management strategy should be built into the **[B8] smart city roadmap**.

GUIDANCE NOTE [B12]: DIGITAL INCLUSION AND CHANNEL MANAGEMENT

Context

The benefits that a city will derive from **[B9] empowering stakeholder-led service transformation** and **[B10] delivering city-led service transformation** are magnified the more that citizens and businesses engage with city services through digital channels.

The need

Channel management is often a weak spot in city service delivery, with widespread duplication, inefficiency and lack of user focus.

Experience has shown that common pitfalls in channel management for public services in cities include:

- a) lack of understanding of the barriers to take-up of digital services;
- b) managing new, digital channels as bolt-ons, with business and technical architectures which are separate from traditional face-to-face or paper-based channels;
- c) no common view of customer service across multiple channels;
- d) operational practices, unit costs and service standards for many channels which fall well below standards set for those channels in the private sector;
- e) a reliance on government-owned channels, with insufficient understanding of how to partner with private and voluntary sector organizations who have existing trusted channels to government customers;
- f) costly duplication of IT and data assets across channels;
- g) unproductive and costly competition among service delivery channels;
- h) an approach that is incremental not transformational.

Smart city programmes seek to avoid these pitfalls by building a channel management approach centred on the needs and behaviour of citizens and businesses within the city. This means that delivery of services needs to be customer-centric, with services accessible where and when citizens and businesses

want to use them, including through both one-stop services and a wide range of private and voluntary sector intermediaries. Services should be offered over multiple channels, but with clear strategies to shift service users into lower-cost digital channels (including a digital inclusion strategy to enable take-up of digital services by those segments of the customer population currently unable or unwilling to use them).

Recommendation

Smart city leaders should therefore establish a digital inclusion and channel management strategy, which includes:

- a) **a clear audit** of what existing channels are currently used to deliver city services, and the costs and service levels associated with these;
- b) **the vision and roadmap** for developing a new channel management approach which:
 - 1) is centred on the needs and behaviour of citizens and businesses;
 - 2) identifies the opportunities for current services to be engineered out through the introduction of new smart connectivity directly between city assets and digital devices;
 - 3) encourages access and use of digital services by stakeholder groups currently excluded from these for whatever reasons, by:
 - i) using the benefits from future universality to fund the costs of ensuring digital inclusion now;
 - ii) ensuring adequate assisted digital provision for the digitally excluded;
 - iii) taking a proactive approach to the digitally excluded in terms of training, access and education, and the identification of channels to allow their views and voices to be heard and incorporated into decision-making.

Linkages

This guidance helps deliver integrated, customer-centric services as part of **[B10] delivering city-led service transformation**, as well as to enable **[B9] empowering stakeholder-led service transformation**. Further detail on the technical and semantic interoperability issues which need to be managed in supporting channel integration are given at **[B6] mapping the city's interoperability needs** and **[B14] open, service-oriented, city-wide IT architecture**. Key actions to be taken as part of the digital inclusion and channel management strategy should be built into the **[B8] smart city roadmap**.

5.4 Technology and digital asset management

This subclause of the SCF addresses how changes to the way in which technology and digital assets are managed in a city can help to accelerate, de-risk and lower the cost of smart city programmes (and in particular to align service delivery more closely with the **[A] guiding principles**, and with the vision described in 5.2 for **[B2] transforming the city's operating model**).

There are two main elements:

- **[B13] resources mapping and management;**
- **[B14] open, service-oriented, city-wide IT architecture.**

GUIDANCE NOTE [B13]: RESOURCES MAPPING AND MANAGEMENT

Context

Technology resources, and the digital data they incorporate, are often seen simply as a means to a specific end; and so are procured and managed by a single organization for a single purpose. **[B2] transforming the city's operating model** involves a set of significant changes to this silo-based approach to managing technology and digital resources.

The need

Cities need to establish governance process which enable technology and digital assets to be managed as city-wide resources.

Major private sector organizations are moving towards a model of company-wide, service-oriented architecture, where common building blocks using open standards can be reused to enable flexible, adaptive and scalable use of technology to react quickly to changing customer needs and demands. Increasingly, companies are gaining even greater efficiency benefits by managing these building blocks as a service, provided not only from within their own ICT architecture but also from within the cloud (the dynamically-scalable set of private and public computing resources now being offered as a service over the internet).

Cities are increasingly taking this building block approach to technology deployment, both across the different departments of the city authority and in collaboration with other major service delivery organizations in the city.

A key starting point is to map out key assets and establish governance processes that enable them to be managed as an asset separately from their original intended use. In order to be reused effectively, resources need to be:

- a) identified and managed as distinct, valued assets by explicitly designated owners;
- b) identifiable across ownership domains;
- c) associated with clear policies and processes for reuse, particularly across ownership domains.

This need for cities to get a grip on the effective management of their digital assets is being increased dramatically by the growth of the "Internet of Things". Buildings, roads, places and a huge range of things and devices are becoming smart and internet-connected, multiplying hugely the potential sources of city data (but also the potential for inefficiency, duplication and lack of citizen-centricity if that data is not effectively managed).

Recommendation

Smart city leaders should map out major information and ICT system resources across the city, prioritize those with the greatest potential for reuse, and establish governance processes and usage policies aimed at maximizing asset reuse by city partners.

Linkages

Moving towards effective city-wide management of technology and digital assets will be an incremental process over time, not a one-off change. This process should be built in as a core element of the **[B8] smart city roadmap**. Priority in that process should be given to assets that stakeholders identify as critical for:

- a) opening up high-priority city data assets to wider use as part of **[B9] empowering stakeholder-led service transformation**;
- b) providing a city-wide view of the customer as part of the multi-channel, service delivery approach required by **[B10] delivering city-led service transformation** and subject to the citizen-centric trust model within **[B11] identity and privacy management**;
- c) **[B14] open, service-oriented, city-wide IT architecture**.

Further detail on the long-term architectural vision that this resource management process should aim to move the city towards is described in **[B14] open, service-oriented, city-wide IT architecture**.

GUIDANCE NOTE [B14]: OPEN, SERVICE-ORIENTED, CITY-WIDE IT ARCHITECTURE

Context

In order for **[B13] resources mapping and management** to be effective in aligning city technology and digital assets with the integrated, non-silo based approach set out in **[B2] transforming the city's operating model**, it is essential to have a top-level vision and architecture for future technology use across the city.

The need

Technological change is much more rapid than organizational change, and yet cities often find themselves locked-in to particular technology solutions. Smart cities need to protect themselves against the downside of rapid technology evolution, by developing a strategic IT platform that guarantees future agility as markets develop and city priorities change.

Such a platform cannot afford to be locked-in to specific technologies or solutions that prevent or limit such agility. This means that a city should establish a blueprint for an open, city-wide, service-oriented, interoperable IT platform. Such a blueprint is not something that would typically be implemented in a big bang or by a single IT supplier, but would:

- provide an agreed architecture on which city partners and suppliers can converge over time;
- establish a multi-level competitive landscape at the platform, services and application layers.

As set out in Annex A on smart city guiding principles (see **A.5.2** and **A.5.4**), key principles underpinning such a platform should include:

- a) **opening up the city's data to drive innovation and create new value:**
 - 1) all personal data held securely, and under the ownership and control of the individual citizen;
 - 2) all non-personally identifiable public data open for reuse and innovation by third parties;
 - 3) open data designed in to all city procurements;

- 4) commitment by private and voluntary sector partners to open up data where not commercially or personally sensitive;
 - 5) standards, metadata, tools, incentives and business models to facilitate a thriving market in the use of city data by all stakeholders;
- b) **sharing and reuse of city assets and services:**
- 1) city-wide sharing of common citizen and business data-sets, common applications and application interfaces, common delivery processes, and core ICT infrastructure;
 - 2) use of SOA principles to join up technology and services and reduce infrastructure duplication;
 - 3) interoperability enabled by open standards.

Key features of such a platform can include:

- a) **modular design**, including the realization of discrete services that can perform work on behalf of other parties, underpinned by clear service descriptions and contracts for any capability that is offered for reuse by another party;
- b) **clear ownership and governance** for all blueprint elements;
- c) **published standards** to enable safe exchange of information between modules (all open, exportable, and based wherever possible on international standards) and which cover:
 - 1) services;
 - 2) data outcomes;
 - 3) rules;
 - 4) KPIs;
 - 5) interoperability.

Recommendation

Smart city leaders should work with stakeholders (including IT suppliers, SMEs and academic partners) to establish and maintain an open, service-oriented, city-wide IT architecture, and to develop a phased migration plan towards that architecture.

Linkages

Shifting from the current set of legacy IT systems and contractual arrangements to a more integrated, SOA-based platform for the city will be a multi-year process of change. That process should be built in as a core element of the **[B8] smart city roadmap** and, in particular, to work on **[B5] procurement and supplier management** (which is essential in order to ensure that new procurements establish requirements and supplier relationships that help build towards the platform blueprint). City services and data managed across the platform (and the standards that support them) should be made publically available to city stakeholders for reuse on the basis described in **[B9] empowering stakeholder-led service transformation**. And the process will need proactive governance, as described in **[B13] resources mapping and management**.

NOTE Further guidance on service-oriented architecture is given in the Reference Model for Service Oriented Architecture [8].

6 Component C: Benefit realization strategy

GUIDANCE NOTE [C]: BENEFIT REALIZATION

Context

No programme has any value if it does not or cannot deliver what has been promised. Benefits realization is therefore a core responsibility for the [B3] leadership and governance of a smart city programme.

The need

All intended benefits need to be delivered in practice, and this will not happen without proactive benefits management.

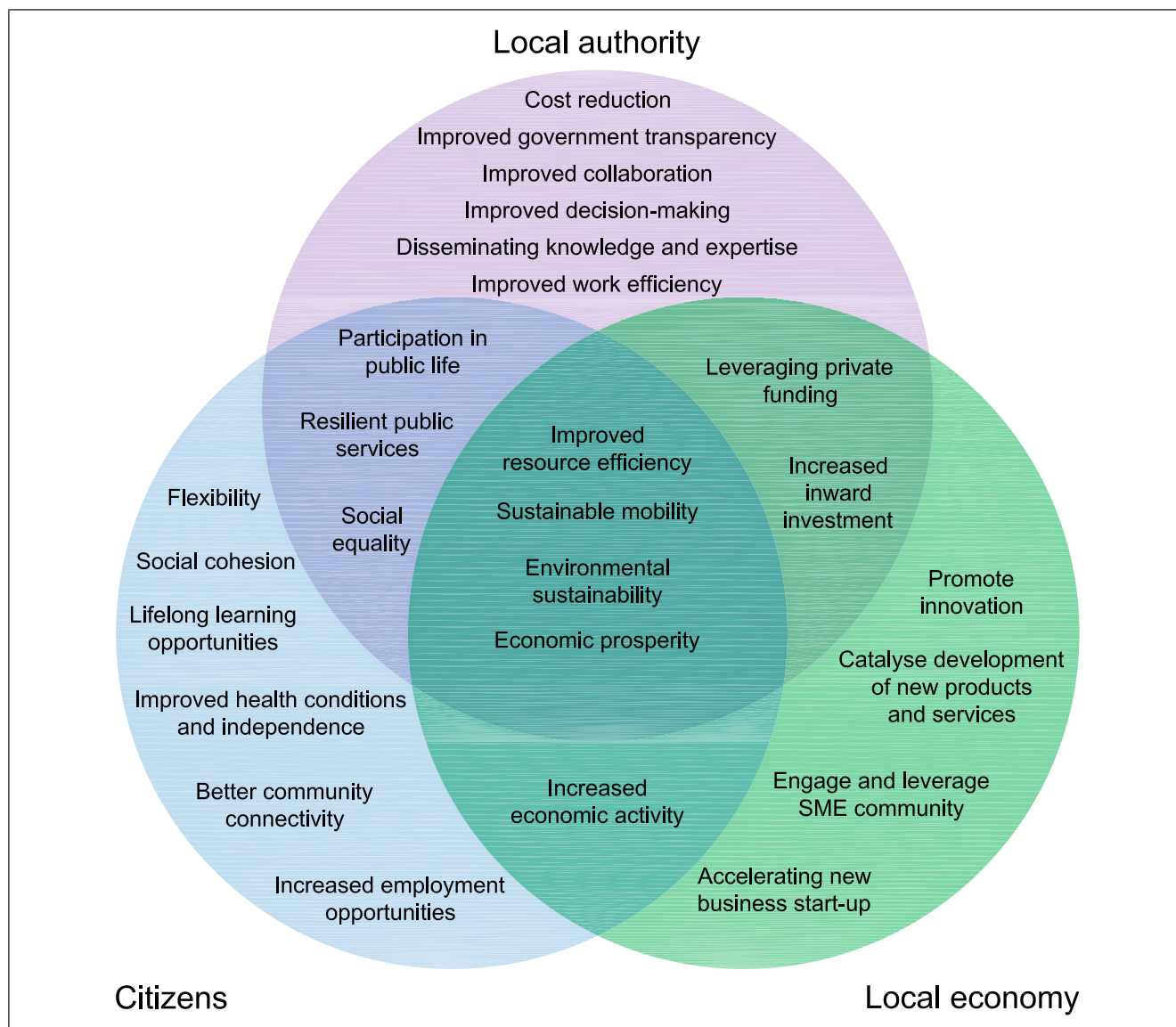
In the past, many cities have often failed to manage the downstream benefits proactively after an individual project or programme has been completed, particularly where it touches on multiple stakeholders. ICT programmes in particular are often seen as completed once the technical implementation is initially operational. Yet in order to reap the full projected benefits (efficiency savings, customer service improvements, etc.), ongoing management is essential, often involving significant organizational and cultural changes.

Smart city programmes face this challenge on a large scale, so throughout the lifecycle of the programme it is essential to:

- ensure clear line-of-sight between every investment and activity in the programme, the immediate outputs these produce, and the final targeted outcomes;
- establish clear governance and accountability arrangements for ensuring the successful delivery of outcomes, not just outputs from the smart city programme.

The SCF does not seek to specify in detail what benefits and impacts a smart city programme should seek to focus on (that is a matter for each individual city). By way of illustration, Figure 10 summarizes the key benefits that the 29 UK cities submitting feasibility studies for the Future City Demonstrator competition [3] were targeting, which focused on:

- benefits for citizens, in terms of improved quality of life;
- benefits to the local economy;
- benefits to the city authority itself in terms of improved transparency and decision-making, and more efficient service delivery;
- improvements in environmental sustainability.

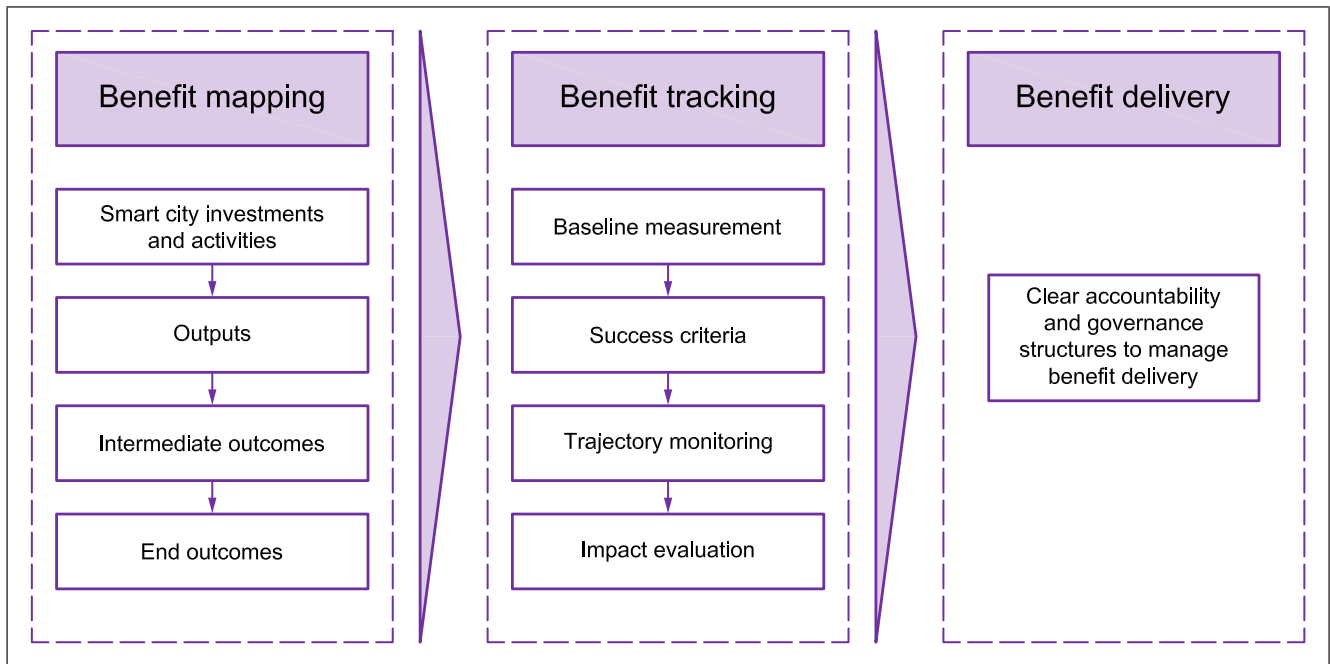
Figure 10 Benefits being targeted in 29 UK smart city initiatives^{A)}

^{A)} Source: Solutions for cities: An analysis of the feasibility studies from the Future Cities Demonstrator Programme (2013) [3].

Whatever the selection of targeted benefits and impacts (which will be integrally linked to the specific **[B1] city vision** for any city), the SCF does recommend that cities should adopt a good practice, outcomes-based approach to benefits realization, covering the elements illustrated in Figure 11:

- a) **Benefit mapping**
Setting out all the intended outcomes from the smart city programme, with clear line-of-sight showing how the immediate outputs from specific activities and investments in the programme flow through to deliver those outcomes.
- b) **Benefit tracking**
Establishing a baseline of current performance by the city against the target output and outcomes, defining smart success criteria for future performance, and tracking progress against planned delivery trajectories aimed at achieving these success criteria.
- c) **Benefit delivery**
Ensuring that governance arrangements are in place to ensure clear accountabilities for the delivery and ongoing monitoring of every intended outcome.

Figure 11 SCF benefit realization framework



Recommendation

Smart city leaders should establish a **benefits realization strategy** to ensure a clear line-of-sight between actions and vision, and that the intended benefits from the smart city programme are delivered in practice. The strategy should be built around the three pillars of:

- a) benefit mapping;
- b) benefit tracking; and
- c) benefit delivery.

Linkages

Work to develop the benefit realization framework should form an integral part of the initial planning phase of the **[B8] smart city roadmap**. During the implementation phases of the roadmap, cities should ensure that they remain on track to deliver their planned benefits through regular healthchecks of their programme against the **[D] critical success factors**.

7 Component D: Critical success factors

GUIDANCE NOTE [D]: CRITICAL SUCCESS FACTORS

Context

Smart city programmes face significant risks to successful delivery.

The need

Cities need to identify critical success factors for their smart city programme and track progress against them.

In delivering a **[B8] smart city roadmap**, cities should ensure that they are managing the major strategic risks effectively. Typically, these risks are not related to smart technologies (which are increasingly mature and proven) but rather to business and

cultural changes. Such changes are integral to the city-wide approaches to business management, service management and technology management described in Component B (Clause 5) of the SCF.

However, there is now an increasing body of research that seeks to understand why some ICT-enabled transformation programmes succeed and why others fail. The SCF therefore includes nine critical success factors that reflect and respond to the findings of such research, validated through consultation with stakeholders in the UK smart city market and internationally. The nine critical success factors are summarized in Figure 12 below, and described in more detail in the checklist in Annex B.

Figure 12 SCF critical success factors

Strategic clarity <ul style="list-style-type: none"> • Clear vision • Strong business case • Focus on results 	Leadership <ul style="list-style-type: none"> • Sustained support • Leadership skills • Collaborative governance 	User focus <ul style="list-style-type: none"> • A holistic view of the city's citizen and business customers • Citizen-centric delivery • Stakeholder empowerment
Stakeholder engagement <ul style="list-style-type: none"> • Stakeholder communication • Cross-sectoral partnership • Engagement with other cities 	Skills <ul style="list-style-type: none"> • Skills mapping • Skills integration 	Supplier partnership <ul style="list-style-type: none"> • Smart supplier selection • Supplier integration
Achievable delivery <ul style="list-style-type: none"> • Phased delivery • Continuous improvement • Risk management 	Future-proofing <ul style="list-style-type: none"> • Interoperability • Web-centric delivery • Agility • Shared services • Support and maintenance 	Benefit realization <ul style="list-style-type: none"> • Benefit mapping • Benefit tracking • Benefit delivery

Recommendation

Therefore, smart city leaders should establish processes to ensure that critical success factors are identified, measured and managed.

Linkages

Monitoring of progress against the critical success factors is a core task for smart city **[B3] leadership and governance**. Regular external healthchecks of the programme against the critical success factors should be built in to the **[B8] smart city roadmap**. Further detail on the critical success factors is set out in the checklist in Annex B.

Annex A
(informative)

SCF guiding principles

A.1 General

We believe that a smart city is:

- a) *visionary;*
- b) *citizen-centric;*
- c) *digital;*
- d) *open and collaborative.*

As we work towards becoming a smart city, we should use the following principles to guide our work.

A.2 The visionary city

A.2.1 We believe our city needs a vision for its future which is clear, compelling and jointly owned by all key stakeholders:

- a) clarity about the social, economic and environmental outcomes we want to achieve for the city, and the challenges involved in doing so;
- b) a shared vision of how we will invest in and transform our physical, spatial, digital and human assets to deliver those outcomes, and what doing so will look and feel like;
- c) all stakeholders involved in developing and delivering the vision;
- d) a proactive approach to the digitally excluded, in terms of training, access and education, and the identification of channels to allow their views and voices to be heard and incorporated into decision-making.

A.2.2 We believe leadership in delivering the vision is needed at all levels:

- a) strong leadership and commitment from the city authority;
- b) a broad-based leadership team, drawing on the strengths of all city partners and communities.

A.3 The citizen-centric city

A.3.1 We believe in detailed and segmented understanding of our citizens' and businesses' needs:

- a) a shared city-wide understanding of key customer segments, based on evidence not assumptions;
- b) real-time, event-level understanding of citizen and business interactions with city systems.

A.3.2 We believe in spaces and services built around citizen needs:

- a) citizens' needs, and the cultural and organizational business changes needed to deliver them, understood before the city spends money on technology or infrastructure;
- b) a one-stop service for citizen and business interactions with public services in the city, which is available anytime, anywhere, any channel, any device and is built around user needs not the organizational structures of the city;
- c) championing each customer segment at the city-wide level with customer franchises (small customer-focused teams that sit within the existing organizational structures of the city and act as change agents for their customer segments).

A.3.3 We believe that transformation is done with and by our citizens and businesses, not to them:

- a) all stakeholders engaged directly in design and delivery of city services;
- b) citizens and businesses empowered to create public value themselves;
- c) the adoption of a common co-design/co-production ethos across services.

A.4 The digital city

A.4.1 We believe in enabling the ubiquitous and integrated digitization of our city:

- a) digital connectivity and integration between people, places and things across the city;
- b) digital by default for all city services;
- c) analysis of the city's digital data to match supply with demand better, improve services and sustainability, and to better predict and prevent future problems.

A.4.2 We believe in ensuring the inclusive digitization of our city:

- a) no stakeholder group left behind;
- b) using the benefits from future universality to fund the costs of ensuring adequate assisted digital provision to our citizens now and of investing to deepen digital inclusion now.

A.5 The open and collaborative city

A.5.1 We believe in creating spaces and opportunities for new collaborations:

- a) physical and digital spaces where city innovators can come together across sectoral and organizational boundaries;
- b) building in opportunities for people to connect, interact and transact, both by design and by serendipity;
- c) new forms of collaboration, new networks, new business models;
- d) open access for citizens and community groups to exploit publicly funded digital intellectual property rights (IPR) for the wider common good.

A.5.2 We believe in opening up the city's data to drive innovation and create new value:

- a) all personal data held securely, and under the ownership and control of the individual citizen;
- b) all non-personally identifiable public data open for reuse and innovation by third parties;
- c) open data designed in to all city procurements;
- d) commitment by private and voluntary sector partners to open up data where not commercially or personally sensitive;
- e) standards, metadata, tools, incentives and business models to facilitate a thriving market in the use of city data by all stakeholders.

A.5.3 We believe in building city systems that are flexible, resilient and adaptable:

- a) agility and continuous improvement, not get it right first time;
- b) resilient against accidental and deliberate faults;
- c) phased change, not big bang.

A.5.4 We believe in sharing and reuse of city assets and services:

- a) city-wide sharing of common citizen and business data-sets, common applications and application interfaces, common delivery processes, and core ICT infrastructure;
- b) use of SOA principles to join up technology and services and reduce infrastructure duplication;
- c) interoperability enabled by open standards.

Annex B
(informative)

Checklist of critical success factors

This annex provides a checklist giving more detail on the nine critical success factors referred to in guidance note [D].

1) Strategic clarity	
a) Clear vision	
• Our vision has been developed collaboratively.	✓
• All stakeholders have a clear and common understanding of what our smart city programme is seeking to achieve.	✓
• This vision is underpinned by guiding principles on how we work together to deliver the vision in practice.	✓
b) Strong business case	
• We know what outcomes we want to achieve, and have established clear, evidence-based measures of success.	✓
• There is a clear and quantified baseline of the costs and performance of current service delivery systems across the city, against which we can compare the impact of the smart city programme.	✓
c) Focus on results	
• We focus on taking concrete, practical steps in the short to medium term.	✓
• The programme is delivering significant benefits to stakeholders (including citizens and businesses) now.	✓
• We are not spending money on technology before having identified the key organizational and business changes needed for it to help deliver our vision.	✓
2) Leadership	
a) Sustained support	
• Political leaders and senior management from all city stakeholders are committed to the smart city programme for the long term.	✓
b) Leadership skills	
• Our leadership team has the skills needed to drive ICT-enabled business transformation at a city-wide level.	✓
• Our leadership team has access to external support, including engagement with leaders of smart city initiatives elsewhere in the UK and internationally.	✓
c) Collaborative governance	
• Leaders from the city authority and all major city partners are motivated for the smart city programme to succeed, and are engaged in clear and collaborative governance mechanisms to manage key risks and issues.	✓
• There is unambiguous accountability as to which partner has the lead role on each aspect of roadmap delivery.	✓

3) User focus	
a) A holistic view of the city's citizen and business customers	
<ul style="list-style-type: none"> We have a whole-of-city view of the customers for city services, and understand their needs on a segmented basis. Customer insight is informed by both on research and analysis of city data. Customer insight is pooled at a city-wide level, not managed within individual city silos. 	<ul style="list-style-type: none"> ✓ ✓ ✓
b) Customer-centric delivery	
<ul style="list-style-type: none"> Citizens and businesses can access all city public services through a one-stop service. This is available over multiple channels, but we use common web-based services to join it all up, provide a single view of the customer and reduce infrastructure duplication. We are proactively working to encourage take-up of services through digital channels, and to help those who are currently digitally excluded to benefit from these services. 	<ul style="list-style-type: none"> ✓ ✓ ✓
c) Stakeholder empowerment	
<ul style="list-style-type: none"> We engage customers directly in service design and delivery. We provide all stakeholders with access to city data and support to use it to create new commercial and public value. 	<ul style="list-style-type: none"> ✓ ✓
4) Stakeholder engagement	
a) Stakeholder communication	
<ul style="list-style-type: none"> All our stakeholders (users, suppliers, delivery partners elsewhere in the public, private and voluntary sector, politicians, the media, etc.) have a clear understanding of our smart city programme, how they can engage with it and how they will benefit from it. 	<ul style="list-style-type: none"> ✓
b) Cross-sectoral partnership	
<ul style="list-style-type: none"> The smart city programme is engaging effectively with stakeholders in the public, private and voluntary sectors. The smart city programme is delivering clear benefits for all stakeholder groups. 	<ul style="list-style-type: none"> ✓ ✓
c) Engagement with other cities	
<ul style="list-style-type: none"> Our smart city programme is engaging systematically with other cities to learn lessons and exchange experience. 	<ul style="list-style-type: none"> ✓
5) Skills	
a) Skills mapping	
<ul style="list-style-type: none"> We have mapped out the skills we need to deliver the smart city programme, and have established clear plans for acquiring and maintaining them. 	<ul style="list-style-type: none"> ✓
b) Skills integration	
<ul style="list-style-type: none"> We have effective mechanisms in place to maximize value from all the skills available across the partners involved in delivery of the smart city roadmap. 	<ul style="list-style-type: none"> ✓
6) Supplier partnership	
a) Smart supplier selection	
<ul style="list-style-type: none"> The city's procurement and contracting policies are aligned with smart city procurement principles (focus on outcomes, open data, incentives for innovation and collaboration, avoidance of lock-in). The city selects suppliers based on long-term value for money rather than price, and in particular based on our degree of confidence that the chosen suppliers will secure delivery of the expected business benefits. 	<ul style="list-style-type: none"> ✓ ✓

<p>b) Supplier integration</p> <ul style="list-style-type: none"> We manage the relationship with strategic suppliers at the level of top management on both sides of the partnership, aiming to develop win-win alignment behind our city vision. 	<p>✓</p>
<p>7) Future-proofing</p>	
<p>a) Interoperability</p> <ul style="list-style-type: none"> Wherever possible we use interoperable, open standards that are well supported in the market place. 	<p>✓</p>
<p>b) Web-centric delivery</p> <ul style="list-style-type: none"> We use SOA principles in order to support all of our customer interactions, from face-to-face interactions by frontline staff to online self-service interactions. 	<p>✓</p>
<p>c) Agility and resilience</p> <ul style="list-style-type: none"> We deploy technology using common building blocks that can be reused to enable flexibility, resilience and adaptiveness. 	<p>✓</p>
<p>d) Shared services</p> <ul style="list-style-type: none"> We manage key building blocks as city-wide resources (in particular common customer data sets; common applications and application interfaces; and core ICT infrastructure). 	<p>✓</p>
<p>e) Support and maintenance</p> <ul style="list-style-type: none"> We have support and maintenance arrangements in place that can take over responsibility for assets developed and/or managed by stakeholders who leave the smart city's ecosystem for whatever reason. We have a process in place that can engage with replacement stakeholders when existing stakeholders deemed to provide value leave the smart city's ecosystem or become disengaged. 	<p>✓ ✓</p>
<p>8) Achievable delivery</p>	
<p>a) Phased implementation</p> <ul style="list-style-type: none"> We avoid a big bang approach to implementation, reliant on significant levels of simultaneous technological and organizational change. 	<p>✓</p>
<p>b) Continuous improvement</p> <ul style="list-style-type: none"> We expect not to get everything right first time, but have systems that enable us to understand the current position, plan, move quickly and learn from experience. 	<p>✓</p>
<p>c) Risk management</p> <ul style="list-style-type: none"> We have clarity and insight into the consequences of transformation and mechanisms to assess risk and handle monitoring, recovery and roll-back. Our smart city programme benefits from regular external healthchecks. 	<p>✓ ✓</p>
<p>9) Benefits realization</p>	
<p>a) Benefit mapping</p> <ul style="list-style-type: none"> Every aspect of our work and investment has clear line-of-sight through to the strategic outcomes being targeted by the city. Every major delivery partner involved in the smart city programme has a clear and quantified view of the benefits that the smart city programme will deliver specifically for that partner. The benefits that the smart city programme is seeking to achieve are documented in a strategic business case that has been agreed with city partners. 	<p>✓ ✓ ✓</p>

<p>b) Benefit tracking</p> <ul style="list-style-type: none"> • Clear baselines for all benefits have been established (that is, we know where we are starting from). • Measurable success criteria have been agreed for each benefit in the business case (that is, we know where we want to get to). • An effective measurement framework of key performance indicators is in place to track progress in delivering each benefit (that is, we know how well we are doing). 	<p>✓</p> <p>✓</p> <p>✓</p>
<p>c) Benefit delivery</p> <ul style="list-style-type: none"> • Governance arrangements are in place to ensure clear accountabilities for the delivery of every intended outcome. 	<p>✓</p>

Annex C
(informative)

The SCF “pattern language” approach

As discussed briefly in Clause 3 of the SCF, all of the core components of the SCF have been structured using a common “pattern language”. The idea of pattern languages, as a process for analysing recurrent problems and a mechanism for capturing those problems and archetypal solutions, was first outlined by architect Christopher Alexander [9, 10]. Each pattern in a pattern language is expressed essentially as a three-part rule:

- 1) the **context** in which a particular problem arises (the ex-ante condition) and in which the pattern is intended to be used;
- 2) the “system of forces” or **problem to be solved**, including the drivers, constraints and concerns that the pattern is intended to address;
- 3) the “configuration” or **solution**.

The exact configuration varies from one pattern language to another, and the pattern adopted in the SCF is structured as follows:

- the **name** of the pattern and a **reference number**;
- an introduction that sets the **context** and, optionally, indicates how the pattern contributes to a larger pattern;
- a **headline** statement that captures the essence of the **need** being addressed;
- the **body** of the problem being addressed;
- the **recommended solution** – what should be done;
- some **completion notes** that link the pattern to related and more detailed patterns that further implement or extend the current pattern. In some cases this also includes references to external resources that are not part of the SCF.

Four key benefits of this approach which have led to it being adopted for the SCF are:

- **brings the rigour needed for a standard**: that is, it brings a common repeatable structure, and allows clear cross-referencing and a basic hierarchy of SCF components;
- **human-readable but machine-tractable**: that is, use of this approach means that the SCF is readable end-to-end as an easy-to-grasp piece of prose, but is also structured in a way that lends itself to being encapsulated in future in more formal, tractable, and machine-processable forms including concept maps, Topic Maps, RDF or OWL;

- **a modular and extensible approach:** the initial set of “SCF Core Patterns” described in Clause 4 may be quoted and used pattern by pattern to fit the different needs of different cities, and also provides a scalable basis for adding further or more detailed sub-patterns in future to reflect emerging stakeholder needs;
- **a proven approach:** the pattern language idea has already been transposed in IT-related areas (organizational patterns, design patterns, requirements patterns), and forms the basis of a major global open standard for ICT-enabled service transformation, the TGF [1].

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