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Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities

Villes et communautés territoriales durables — Lignes directrices pour l'établissement de stratégies pour les villes intelligentes et les collectivités

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*.

In the development of this document, ISO Guide 82 has been taken into account in addressing sustainability issues.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document helps cities deliver their vision for a sustainable future, by providing a toolkit of "smart practices" for managing governance, services, data and systems across the city in an open, collaborative, citizen-centric and digitally-enabled way. It defines a "smart operating model" for cities, which enables them to operationalize their vision, strategy and policies at a faster pace, with greater agility and with lower delivery risk.

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

a) make current and future citizen needs the driving force behind investment decision-making, planning and delivery of 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 this document are relevant within specific vertical sectors of cities (e.g. water, waste, energy, urban agriculture, transport, IT), the focus is very much on the issues and challenges involved in joining all of these up into a whole-city strategic approach to the use of smart data, smart ways of working and smart technologies. Central to this document is therefore a strong emphasis on leadership and governance, culture, business model innovation, and the active role played by citizens, businesses and civil society in the creation, delivery and use of city spaces and services.

This document is aimed at city leaders. Much in the guidance can also be helpful to leaders of communities other than at city-scale, including both smaller urban areas and larger, regional-scale initiatives. But the prime intended audience, with whom the guidance has been developed and validated, is 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 interested parties interested in leading and shaping the city environment, including:
  — senior executives in the private sector who wish to partner with and assist cities in the transformation of city systems to create shared value;
  — leaders from voluntary sector organizations active within the city;
  — leaders in the higher and further educations sectors;
  — community innovators and representatives.

In addition to this leadership audience, the document will be of interest to all parties engaged in smart cities, including individual citizens.

The working definition of a smart city used for the purposes of this document is that approved by ISO TMB:

A smart city should be described as one that 'dramatically increases the pace at which it improves its sustainability and resilience… by fundamentally improving how it engages society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data and integrated technologies… in order to transform services and quality of life to those in and involved with the city (residents, businesses, visitors).'

NOTE This 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 world, there is also significant diversity. All cities embarking on the 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 interested parties to define what, for them, is meant by "Smart Paris", "Smart Tokyo" or "Smart Toronto" is an important one.

Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities

1 Scope

This document gives guidance for leaders in smart cities and communities (from the public, private and voluntary sectors) on how to develop an open, collaborative, citizen-centric and digitally-enabled operating model for their city that puts its vision for a sustainable future into operation.

This document does not describe a one-size-fits-all model for the future of cities. Rather, the focus is on the enabling processes by which innovative use of technology and data, coupled with organizational change, can help each city deliver its own specific vision for a sustainable future in more efficient, effective and agile ways.

This document provides proven tools that cities can deploy when operationalizing the vision, strategy and policy agenda they have developed following the adoption of ISO 37101, the management system for sustainable development of communities. It can also be used, either in whole or in part, by cities that have not committed to deployment of the ISO 37101 management system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 37100, *Sustainable cities and communities — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 37100 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

NOTE 1 The term “smartness”, defined in ISO 37101 as a “quality of contributing to sustainable development and resilience, through soundly based decision making and the adoption of a long- and short-term perspective”, is particularly relevant to this document. Smartness is embedded in the process of sustainable development, i.e. sustainable development is the overarching process, while smartness is a characteristic. It implies a holistic approach, including good governance and adequate organization, processes and behaviours, and appropriate innovative use of techniques, technologies and natural resources.

NOTE 2 The term “smart community infrastructure”, defined in ISO/TS 37151 as “community infrastructure with enhanced technological performance that is designed, operated, and maintained to contribute to sustainable development and resilience of the community”, is also relevant when referring specifically to infrastructure.

3.1
innovation ecosystem
complex system of interdependent components from the public and private sectors that work together to enable innovation within a city or community

3.2
silo
group of individuals/teams/organizations that collaborate to deliver a specific function within a city

EXAMPLE Education, energy, transport.

3.3
citizen-centric
<design and delivery of city services> driven by the needs of citizens rather than the functional structures of a city's silos

Note 1 to entry: The term citizen in this context includes residents, visitors and businesses within the city.

4 Overview of this document

4.1 Transforming the traditional operating model for cities

The traditional operating model for a city is based around functionally-oriented service providers that operate as unconnected vertical silos, which are often not built around user needs. This document defines best practices in moving to a "smart city operating model" – one which enables cities to drive innovation and collaboration across these vertical silos and hence operationalize their vision, strategy and policies at a faster pace, with greater agility and with lower delivery risk.

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. This is illustrated in Figure 1:

— 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.

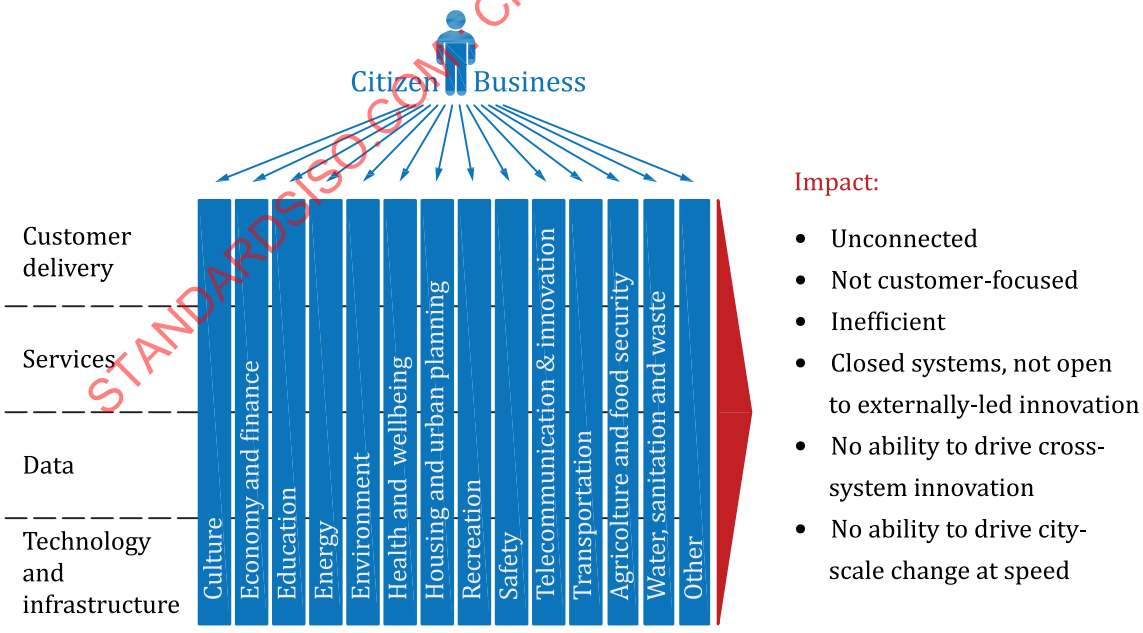


Figure 1 — Traditional operating model: where cities have come from

Figure 2 summarizes the change to this traditional way of operating, which smart cities are seeking to implement.

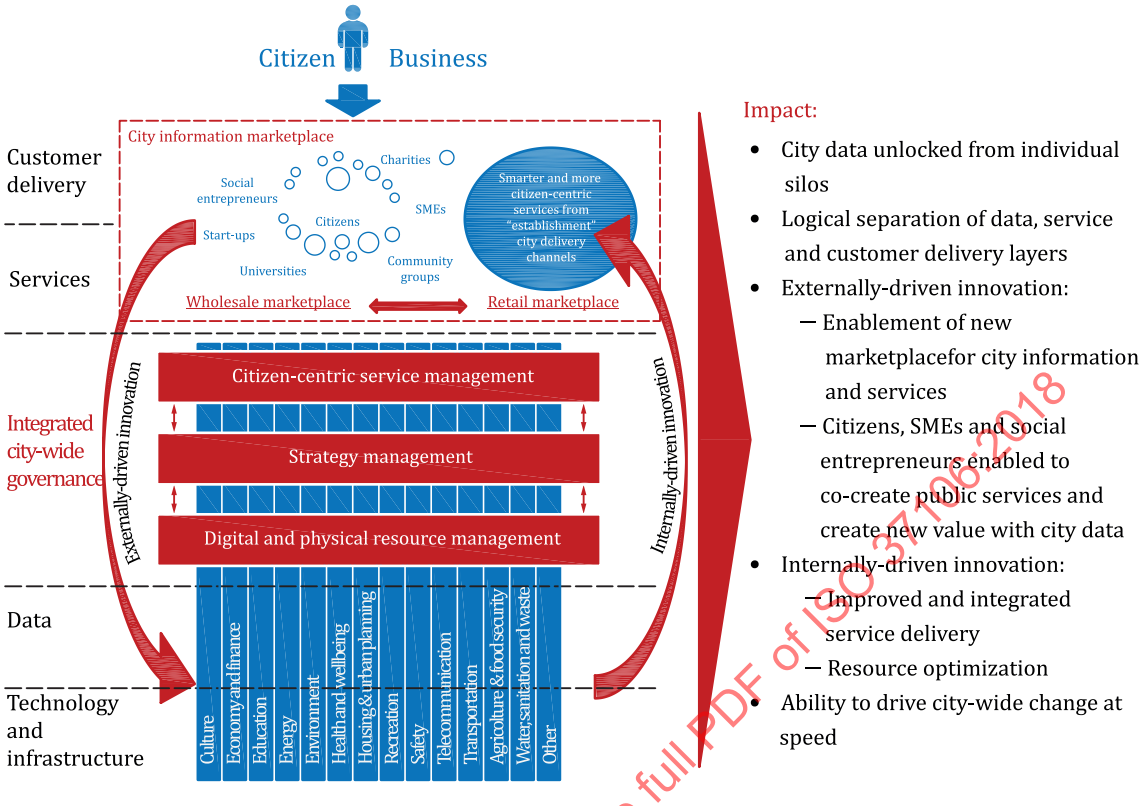


Figure 2 — A smart city operating model: where cities are moving to

Key features of this shift to a smart 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;

b) managing city data as an asset in its own right, both within the local authority and in collaboration with other significant data owners across the city;

c) enabling externally-driven, community-led innovation by citizens, businesses and civil society, 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.

4.2 Structure of this document

The content of this document can be seen schematically in Figure 3. At the top-level, it is made up of four components needed to support this shift to a smart city operating model:

[A] **Delivery principles**: a statement of values which city leaders can use to steer decision-making as they seek to operationalize their vision and strategy for the city;

[B] **Key cross-city 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 clean line of sight between smart city investments and the social, economic and environmental outcomes the city aims to achieve, and that the intended benefits are clearly articulated, measured, managed, delivered and evaluated in practice;

[D] **Risk management**: a checklist of issues which a city should regularly monitor to ensure that it is effectively managing the major risks to delivering its vision and strategy.

These components are described in more detail in Clauses 5 to 8. Detailed guidance notes are given on each of the subcomponents illustrated in Figure 3, with each guidance note structured using a common pattern language.

For ease of reference, in 4.3 there is a summary of all the recommendations contained in this document. These are then described in more detail in the subsequent clauses of this document.

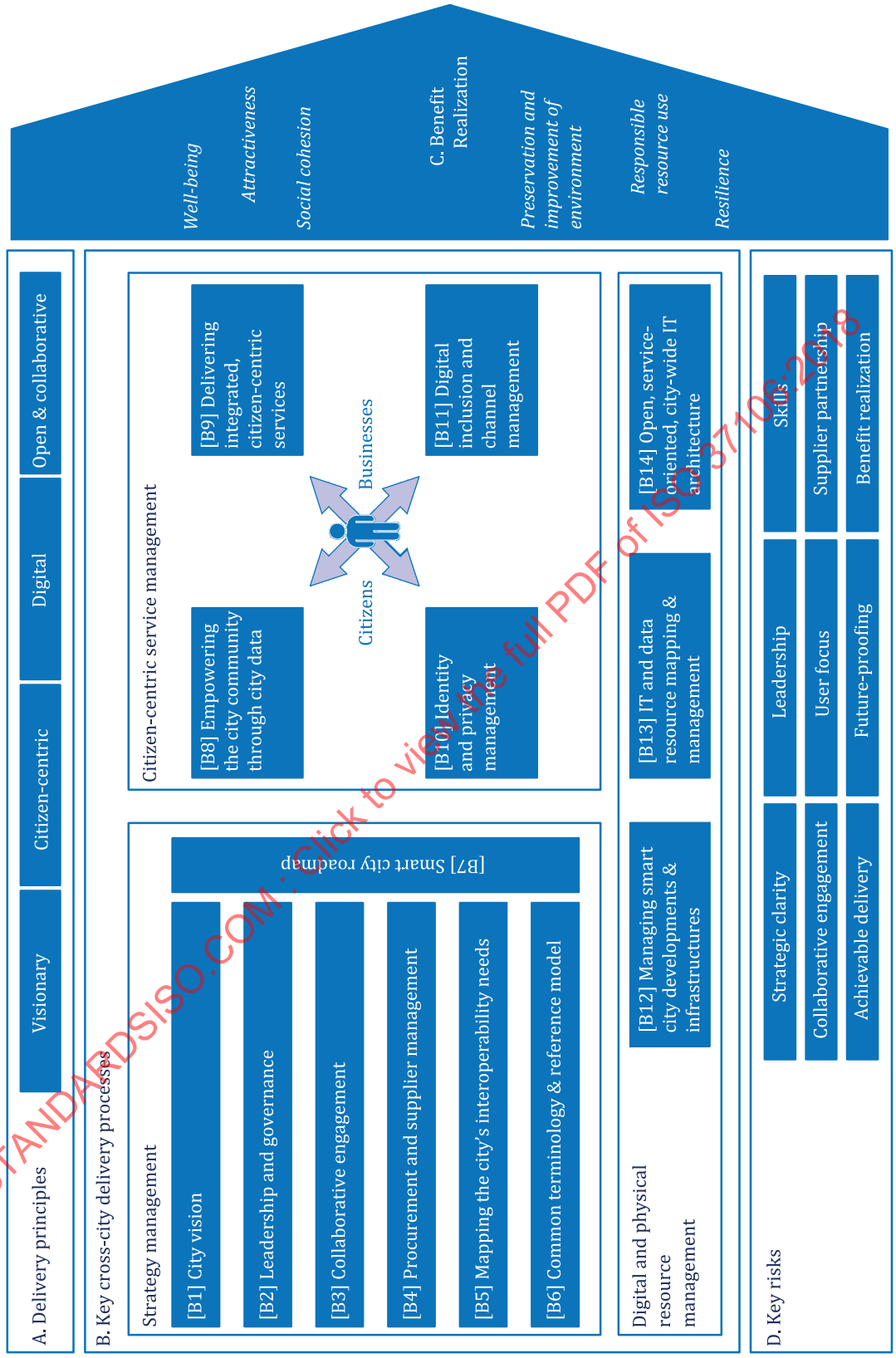


Figure 3 — High-level structure of this document

4.3 Summary of recommendations

Smart city leaders should do the following:

[A] Delivery principles

a) Collaborate with interested parties to develop and agree a set of delivery principles that include, as a minimum, the need to:

   1) establish a clear, compelling and inclusive vision for the sustainable future of 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 delivery principles given in Annex A as a key input and starting point for that process.

[B] Key cross-city delivery processes

[B1] City vision

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

a) is aligned with the purposes for sustainable communities set out in ISO 37101, reflecting local priorities;

b) is developed in an iterative and collaborative manner (that is, inclusive of all interested parties and informed by user research and engagement, with social media and other technologies used to enable public participation in the process);

c) embraces the opportunities opened up by smart technologies, smart data and smart collaboration;

d) 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;

e) uses digital modelling, data visualization and/or other technologies to "bring to life" what it will be like to live and work in the city's vision for the future;

f) is measurable.

[B2] Leadership and governance

Establish leadership and governance arrangements that ensure:

a) a clear focus of accountability within the local 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) the possibility of evolution over time among stakeholder organizations;

g) an open and transparent governance process, including through digitally-enabled public participation.

[B3] Collaborative engagement

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

a) awareness and participation of interested parties;

b) cross-sectoral partnership;

c) engagement with other cities to learn lessons and exchange experience.

[B4] 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 (i.e. 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.

[B5] 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.

[B6] Establishing a common terminology and reference model

a) Ensure that all interested parties 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 interested parties to establish and maintain an agreed and shared common terminology and reference model.

[B7] Smart city roadmap

a) Establish a phased smart city roadmap.

b) Work with interested parties 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 local authority and partner organizations in order to create exemplars and internal champions, and thus learn from experience and drive longer-term transformation.

[B8] Empowering the city community through city data

Empower interested parties of all sorts across the city 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.

[B9] Delivering integrated citizen-centric services

a) Provide citizens and businesses with public services that are accessible in one stop, over multiple channels, and built around user needs rather than 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.

[B10] 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.

[B11] Digital inclusion and channel management

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 citizen and business groups currently excluded from these for whatever reason.

[B12] Managing smart city developments and infrastructures

Work collaboratively with all relevant interested parties to ensure that all development and infrastructure projects across the city:

a) build smart delivery principles into project planning from the outset;

b) take a holistic approach across all types of city infrastructure;

c) build partnerships and new business models.

[B13] IT and data resources mapping and management

Map out major information and IT 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 interested parties (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] Risk management

Establish processes to ensure that the key risks to successful implementation of the city's strategy are identified, measured and managed.

5 Component A — Delivery principles

5.1 Context

Managing the shift to a smart city operating model 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.

5.2 The need

Putting a strategy for city-wide change into practice requires a principle-based approach to implementation.

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 interested parties 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 overplan but that provides a framework for an organic, inclusive process of change to deliver the vision over time. Key elements of this are explored in other guidance notes within this document. But the starting point should be clarity about the delivery principles that key actors in the city will seek to work towards throughout this process.

The term "delivery principles" in this document means an agreed and enduring statement of values which can be used on a consistent basis to steer business decision-making by multiple city organizations over the long term, and which are:

— used to inform and underpin the smart city strategy;

— understood, agreed and owned by all key organisations across the city with a stake in delivering the strategy.

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 4 provides a summary of the delivery principles recommended in this document, drawing on: i) a literature review of smart city publications by governments, industry, NGOs and academia; and ii) extensive peer review and consultation with smart city practitioners. These principles are set out in full in Annex A.

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 will use the following principles to guide our work:

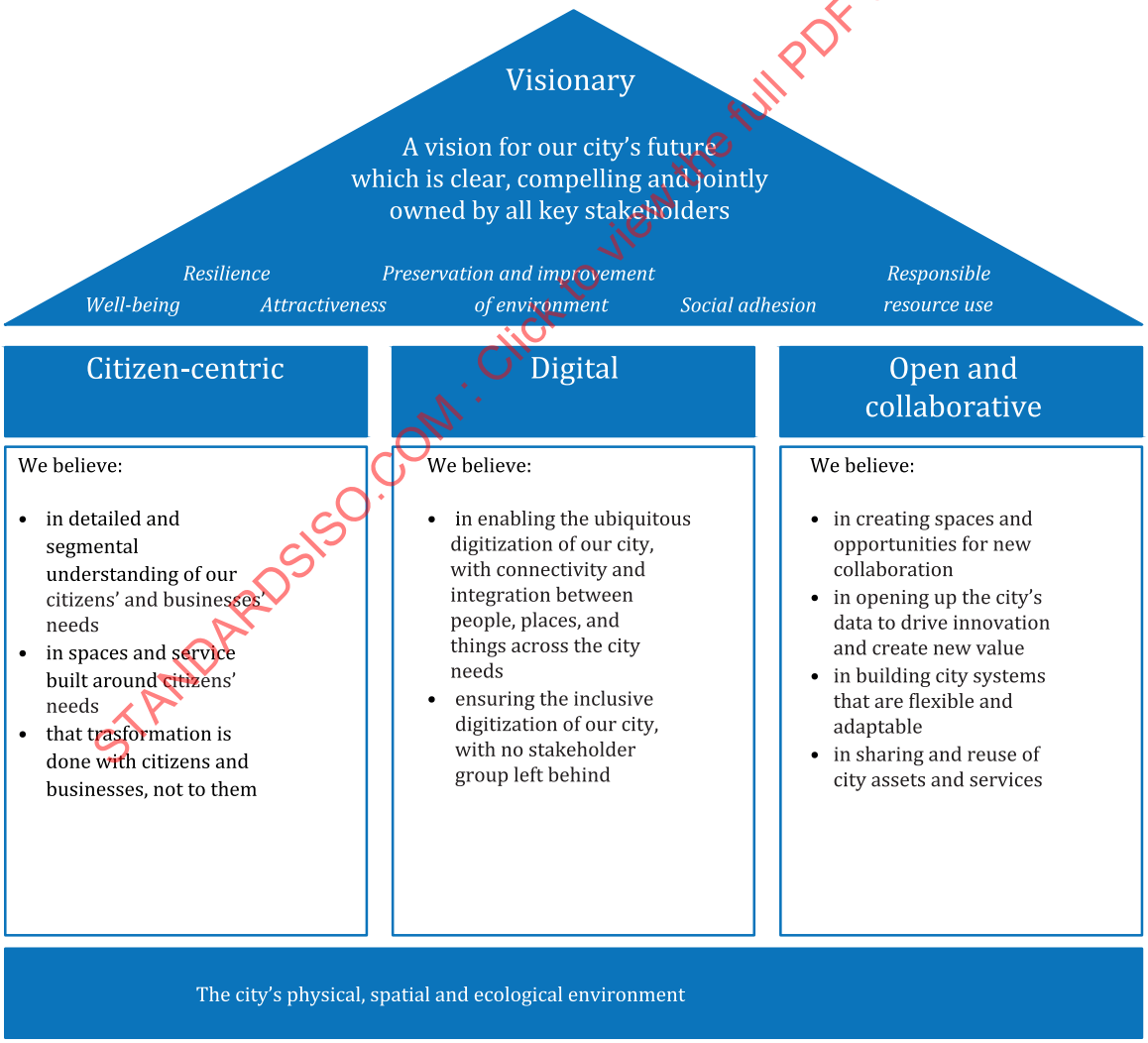


Figure 4 — Summary of smart city delivery principles

5.3 Recommendations

The following are recommended.

a) Smart city leaders should collaborate with interested parties to develop and agree a set of delivery principles that include, as a minimum, the need to:

   1) establish a clear, compelling and inclusive **[B1] city vision**;

   2) take a citizen-centric approach (in which the needs of citizens, rather than the structures of the city's organisations, drive 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) Smart city leaders should use the delivery principles given in Annex A as a key input and starting point for that process.

5.4 Linkages

Developing, agreeing and acting as guardians of the delivery principles is a core task for people involved in smart city **[B2] leadership and governance**, and should be addressed at an early stage in development of the **[B1] city vision** and **[B7] smart city roadmap**.

6 Component B — Key cross-city delivery processes

6.1 General

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

— strategy management, covered in guidance notes **[B1]** to **[B7]**;

— citizen-centric service management, covered in guidance notes **[B8]** to **[B11]**;

— digital and physical resource management, covered in guidance notes **[B12]** to **[B14]**.

6.2 Strategy management

This subclause focuses on strategy management, i.e. 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 an organic approach to implementation: establishing the business processes, capacity and structures that can drive transformation and create and grow sustained improvements over time, even if all the steps of that transformational journey cannot be planned in detail at the outset.

The subcomponents of the strategy management component of this document are:

— **[B1] City vision**;

— **[B2] Leadership and governance**;

— **[B3] Collaborative engagement**;

— **[B4] Procurement and supplier management**;

— **[B5] Mapping the city's interoperability needs**;

— **[B6] Establishing a common terminology and reference model**;

— **[B7] Smart city roadmap**.

6.3 Subcomponent [B1] — City vision

6.3.1 Context

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

6.3.2 The need

An agreed vision of what a "sustainable future" looks and feels like for the city is essential for success.

As previously stated, this document does not seek to describe a one-size-fits-all vision for the future of 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, there is increasing consensus on the **purposes** that cities and communities should focus on in order to ensure sustainable development. ISO 37101 describes six purposes for communities to consider when developing their vision and strategy for the future, as illustrated in Table 1. The associated implementation guidance for ISO 37101 sets out a four-stage process for cities to use in developing a strategy to deliver these sustainability purposes: 1) baseline review; 2) strategy definition; 3) establishing and implementing the action plan; and 4) performance evaluation and continuous improvement.

Table 1 — Community purposes

Purpose	Including
Attractiveness	Appeal to citizens and other interested parties, e.g. investors; belonging; culture; place; sense of identity
Preservation and improvement of environment	Improved environmental performance, including reducing greenhouse gas emission; protection, restoration and enhancement of biological diversity and ecosystem services, including protection of ecosystems, plant and animal diversity and migration as well as genetic diversity; reduced health hazard
Resilience	Anticipation; climate change mitigation and/or adaptation; economic shocks and stresses preparedness, social evolution
Responsible resource use	Consumption; distribution; improved land management; reducing, reusing and recycling of materials; respect for scarcity of all types of resources (natural, human, financial); sustainable production, storage and transport
Social cohesion	Accessibility; culture; dialogue with external parties not limited by boundaries, diversity; equity; heritage; inclusiveness; inequalities reduction; rootedness; sense of belonging and social mobility
Well-being	Access to opportunities; creativity, education; happiness; healthy environment; human capital improvement; liveable city; prosperity; quality of life; security; self-confidence; welfare
Source: ISO 37101:2016	

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, and to bring this to life through use of digital modelling, data visualization, social media and/or other technologies. Common characteristics of the smart cities approach which cities articulate in their city visions are set out in Table 2.

Table 2 — 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 UK Technology Strategy Board in 2012[2], and on BSI stakeholder consultation during 2013.

6.3.3 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 aligned with the purposes for sustainable communities set out in ISO 37101, reflecting local priorities;

b) 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);

c) embraces the opportunities opened up by smart technologies, smart data and smart collaboration;

d) 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;

e) uses digital modelling, data visualization and/or other technologies to present what it will be like to live and work in the city's vision for the future;

f) is measurable.

6.3.4 Linkages

The city vision should be informed by the city's **[A] delivery principles**, and developed through **[B3] collaborative engagement** with all interested parties. 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 in **[C] benefit realization**.

6.4 Subcomponent [B2] — Leadership and governance

6.4.1 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.

6.4.2 The need

Smart cities need to find effective ways to empower and enable leadership on a distributed, city-wide basis across all interested parties.

Smart city programmes cannot be delivered successfully through traditional top-down programme structures.

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 local authority*. At both the political and administrative levels there should be an explicit functional responsibility for the smart city programme within the local 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 interested parties are committed to the smart city programme from the very outset. Indeed, a key requirement of building and managing a **[B7] 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 local 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 **[B7] 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] delivery 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 organizations 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 facilitate openness and collaboration with all interested parties. 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 **[B7] smart city roadmap**. This should explicitly include progress reporting against commitments in the road map on **[B3] collaborative engagement** and **[B11] digital inclusion and channel management**.

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

6.4.3 Recommendations

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

a) a clear focus of accountability within the local 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.

6.4.4 Linkages

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

a) articulating and acting as guardians of the **[A] delivery 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 **[B3] collaborative engagement,** and embracing citizen-centric and digitally-enabled policies for **[B11] digital inclusion and channel management**;

d) developing and overseeing a **[B7] smart city roadmap**; and

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

6.5 Subcomponent [B3] — Collaborative engagement

6.5.1 Context

Effective collaboration across a wide range of interested parties 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 collaboration.

6.5.2 The need

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

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

The mix of interested parties who need to be involved in planning, delivering and sustaining a smart city programme is extensive and complex. There can be many different types of interested parties 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 (such as 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 (such as suppliers).

c) *Beneficiaries*. Those involved in delivery of the programme, including: the local authority's internal business units; partners, such as 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 interested parties in the city. Interested parties fall into different groups with different needs, expectations and contributions to make, and moreover many interested parties 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 interested parties needs to be actively managed through the programme.

The collaborative engagement workstream of the **[B7] smart city roadmap** is also the mechanism through which the needs and aspirations of interested parties can be distilled and represented in the programme.

6.5.3 Recommendation

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

a) *Awareness and participation of interested parties*: ensuring that all interested parties (e.g. users, suppliers, delivery partners elsewhere in the public, private and voluntary sector, politicians, the media) 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 interested parties 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.

6.5.4 Linkages

Collaborative engagement should be established as a formal workstream within the **[B7] smart city roadmap**, with measurable performance metrics built into the **[C] benefit realization framework**. Collaborative engagement with interested parties underpins all other parts of this document, because anyone involved in the realization of the smart city vision (or receiving benefits as a result) is considered

an interested party. However, collaborative engagement is particularly important for **[B1] city vision**, **[B2] leadership and governance**, **[B4] procurement and supplier management**, **[B8] empowering the city community through city data**, **[B9] delivering integrated citizen-centric services** and **[B10] identity and privacy management**.

6.6 Subcomponent [B4] — Procurement and supplier management

6.6.1 Context

City authorities rely heavily on suppliers, a trend that is increasing as local authorities increasingly define themselves as commissioners rather than deliverers of services. However, legacy supplier relationships and procurement policies have often raised significant barriers to smart city developments.

6.6.2 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. 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 research and development 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.

NOTE Table 3 summarizes some of the key elements of this shift.

Table 3 — 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
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.

Table 3 *(continued)*

Traditional city procurement	Smart city procurement
Procurement decisions focus primarily on price	Procurement decisions focus primarily on long-term value for money, including: — 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 reusing standardized components, drawing on best-of-breed building blocks and commercial-off-the-shelf products
City systems are unable to interoperate, due to overreliance on proprietary systems	Interoperability based on open standards is designed into all procurements from the outset
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 interested parties	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 can be compatible with the fundamental premise of 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.

6.6.3 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 are 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 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).

6.6.4 Linkages

The need to nurture an innovation ecosystem of city suppliers should be a major theme of **[B3] collaborative engagement**. In reviewing city procurement policies, city leaders should seek to align contracting principles with **[B14] open, service-oriented, city-wide IT architecture**.

6.7 Subcomponent [B5] — Mapping the city's interoperability needs

6.7.1 Context

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

6.7.2 The need

Smart cities need to understand and map out barriers to interoperability.

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. 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 (such as organizational barriers and legal barriers), which cities also need to identify and address.

This document recommends that cities use the matrix in Figure 5 to map out the full landscape of barriers to interoperability which they face. This takes the three city-wide implementation processes identified in this document (strategy management, service management, and technology and data asset management), and maps them against the five commonly accepted dimensions of interoperability: technical, semantic, organizational, legal and policy interoperability.

Interoperability barriers will vary from city to city, but some action is likely to be needed in each cell of the matrix. Figure 5 sets 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 document which provides guidance on the activities needed to develop that policy product.

NOTE For the purposes of this document, "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.

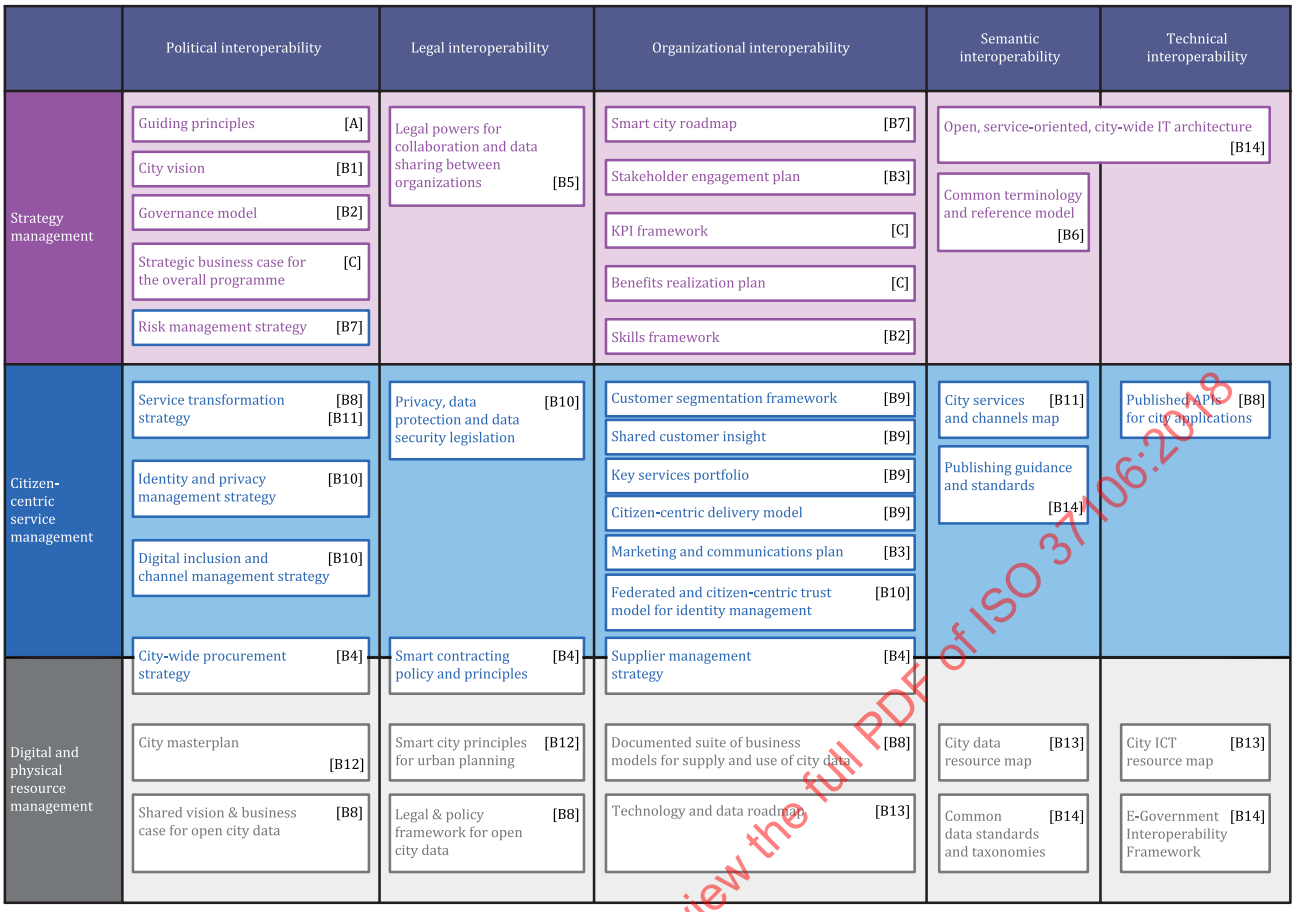


Figure 5 — Smart city interoperability matrix

6.7.3 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 or national standards where possible; and

c) promote commonality of approaches and easier linkages with other cities, and other local and national authorities.

6.7.4 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 **[B7] smart city roadmap**.

6.8 Subcomponent [B6] — Establishing a common terminology and reference model

6.8.1 Context

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

6.8.2 The need

Leadership and communication both break down when interested parties understand and use terms and concepts in very different ways, leading to ambiguity, misunderstanding and, potentially, loss of organisational commitment.

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 gives them fuller meaning and allows us to model, for example, our world, our business activities and our interested parties in a way that increases the chance of our digital systems being 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.

6.8.3 Recommendations

Smart city leaders should:

a) ensure that all interested parties 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 interested parties to establish and maintain an agreed and shared common terminology and reference model.

6.8.4 Linkages

Detailed advice on smart city terminology and reference models is available in ISO/IEC 30182 and ISO 37100.

6.9 Subcomponent [B7] – Smart city roadmap

6.9.1 Context

Work towards delivering the **[B1] city vision** in a smart way needs to be underpinned by an effective roadmap.

6.9.2 The need

Cities need to develop a smart city roadmap that is practically deliverable, i.e. 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 in this document, 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 overplan 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 Table 4.

Table 4 — 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 interested parties are on board. Key outputs from this phase should include: **[A] delivery principles:** the agreed set of principles that interested parties 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: — a 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. **[B7] smart city roadmap**: a multi-year transformation plan, covering, among other things: — embedding the **[B2] leadership and governance** processes; — a **[B3] collaborative engagement** workstream; — development and delivery of a smart **[B4] procurement and supplier management** strategy; — integration of physical and digital planning for the city, as recommended in **[B12] managing smart city developments and infrastructures**; — plans for mapping IT and digital assets, and moving towards the **[B14] open, service-oriented, city-wide IT architecture** needed to support transformation of the city's operating model; — any additional priority actions identified as a result of **[B5] mapping the city's interoperability needs**; — a risk-management strategy, to ensure that the delivery process effectively addresses the smart city **[D] key risks**.
Initiate In this first phase of delivery, the focus is on building the maximum momentum behind the roadmap for the minimum 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 interested parties; 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.

6.9.3 Recommendations

Smart city leaders should:

a) establish a phased smart city roadmap;

b) work with interested parties 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 local authority and partner organizations in order to create exemplars and internal champions and thus learn from experience and drive longer-term transformation.

6.9.4 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] key risks**.

6.10 Citizen-centric service management

This subclause 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] delivery principles**.

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

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 **[B8] empowering the city community through city data**.

b) Second, the local 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 **[B9] delivering integrated citizen-centric services**.

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

— **[B10] identity and privacy management**; and

— **[B11] digital inclusion and channel management.**

6.11 Subcomponent [B8] — Empowering the city community through city data

6.11.1 Context

The **[A] delivery 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.

6.11.2 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 local 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 6.

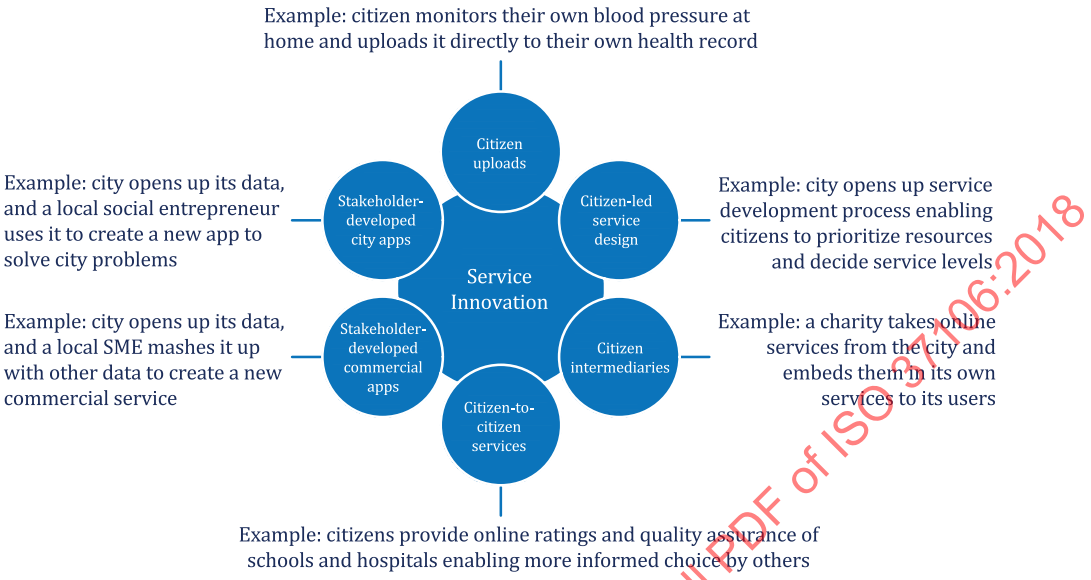


Figure 6 — Service innovation through stakeholder empowerment

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 interested parties 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 the 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 7.

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. 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 7.

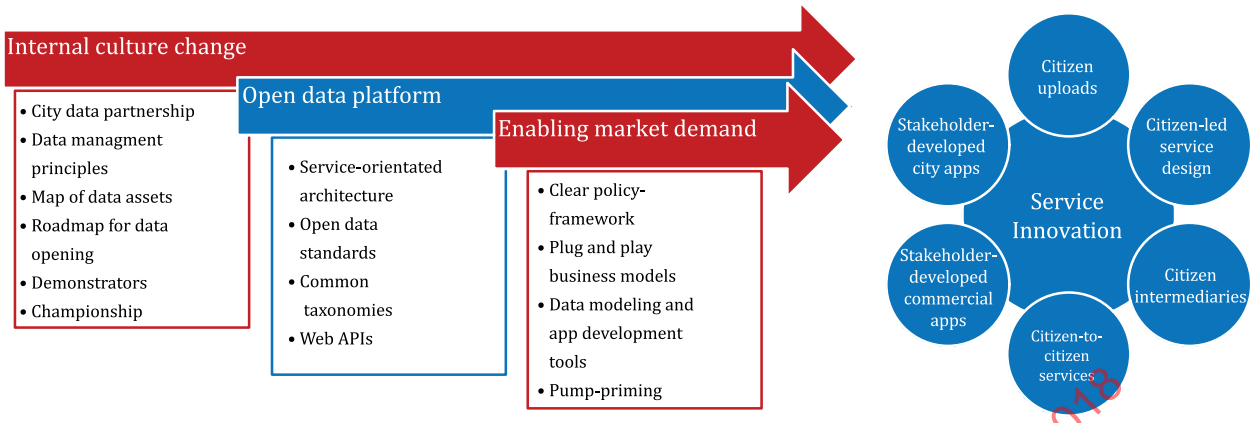


Figure 7 — Delivering stakeholder empowerment

First, cities need to drive change upstream of the data platform, i.e. 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 as they are technical (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 **[B7] smart city roadmap**, include:

a) establishing a coalition of the willing between the local 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[2];

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, i.e. enabling market demand from citizens, businesses and other interested parties. Illustrative actions which might be built into **a [B7] smart city roadmap** include:

1) establishing a clear and easily understandable policy framework of rights and responsibilities around open city data, which:

   i) puts protection of personal privacy at its heart;

   ii) creates a level playing field between public, private- and voluntary-sector organizations that develop services based on city data;

   iii) provides citizens with assurance that their data is managed in compliance with all relevant regulation;

2) 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-added services, and publication of data on a commercial subscription basis);

3) enhancing the city open data platform so it provides tools to facilitate exploration and experimentation with city data by application developers;

4) pump-priming the market with seed-corn funding and/or incubation facilities to stimulate innovative, service-related application development aimed at solving city challenges;

5) 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-added services, and leveraging investment on the basis of future efficiency savings in city authorities and economic growth in the city generated by the platform.

6.11.3 Recommendation

Smart city leaders should empower interested parties across the city 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.

6.11.4 Linkages

The approach to community empowerment described above is a key element of the broader shift towards the smart city operating model described in this document. To succeed, the approach should be closely linked with work on **[B10] identity and privacy management**, and the more integrated approach to specifying and purchasing city-wide services as set out in **[B4] procurement and supplier management**. Further details on the technology and data asset management processes needed to support the approach are set out in **[B13] IT and data resource mapping and management** and **[B14] open, service-oriented, city-wide IT architecture**.

6.12 Subcomponent [B9] — Delivering integrated citizen-centric services

6.12.1 Context

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

6.12.2 The need

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

Service delivery in cities has traditionally been based around vertically-integrated delivery silos that are built around specific functions, not user needs (see 4.1). This document supports the development of new operating models to drive innovation and collaboration across these vertical silos.

[B8] empowering the city community through city data is one vital element of this. Additionally, and as illustrated in Figure 5, the local authority and other major service delivery organizations in the city 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 – one 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 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.

This document recommends an approach which permits the joining-up of services from all parts of the local 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 suppliers 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 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 Standard 'Transformational Government Framework[1], which provides further details and global case studies.

6.12.3 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; and

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.

6.12.4 Linkages

The approach to delivering integrated citizen-centric services described in this subclause is a key element of the broader shift towards a smart city operating model. To succeed, the approach needs to be closely linked with work on **[B3] collaborative engagement**, **[B10] identity and privacy management** and **[B11] digital inclusion and channel management**. Further details on the technology and data asset management processes needed to support the approach are set out in **[B13] IT and data 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].

6.13 Subcomponent [B10] — Identity and privacy management

6.13.1 Context

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

6.13.2 The need

A smart city requires trust.

Significant benefits can be achieved by ensuring the city shares data for the delivery of city services. But it is essential that a move to shared data retains 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 may want to keep them separate in order to protect privacy. At other times, the individual may want them to be joined-up, and be frustrated at constantly having to furnish city authorities with the same information over and over again.

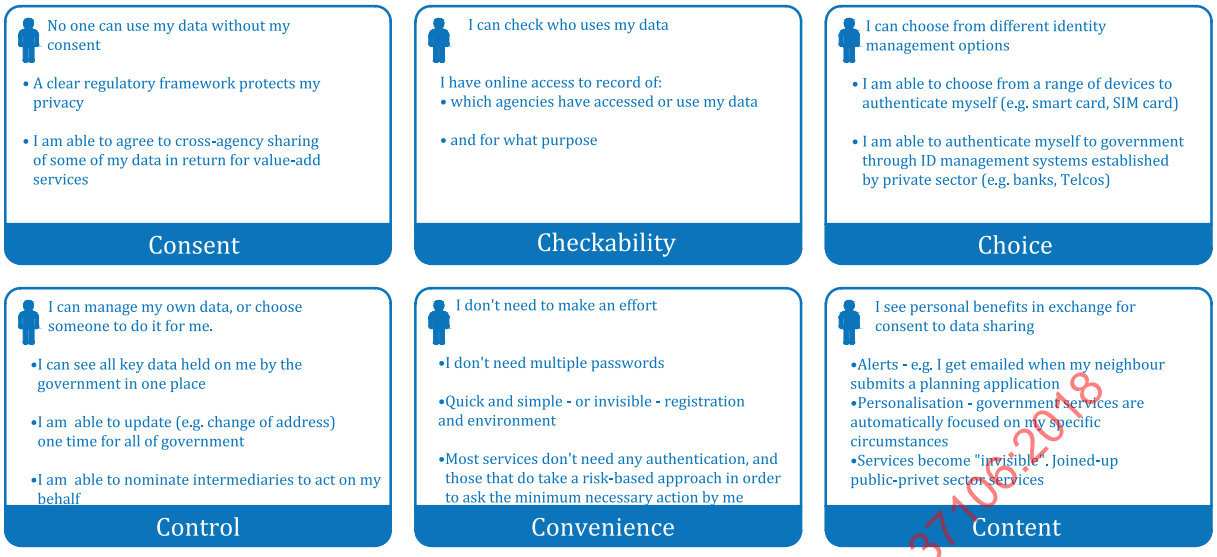
Cities have often struggled to manage this complexity. Often, identity is defined and managed separately in relation to different city services. Many of the tools that city authorities have put in place to guarantee secure access to public services in the digital world, such as passwords, PINs and digital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

This document recommends an approach to identity and privacy management based around three pillars:

a) *Federated business architecture*. First, a business architecture for identity management that is based on federation between a wide range of trusted organizations (e.g. the local authority, government departments, banks, employers) and a clear model for establishing trust between these organizations.

b) *Interoperable technical architecture*. Second, a technology architecture to support the interoperability of data and IT services, which does not rely on legacy siloed technical implementation, but which, in line with the service-oriented architecture (SOA) paradigm, uses internet-based gateway services to act as a broker between the different data and IT services of the participants in the federated trust model.

c) *Citizen-centric trust model*. Third, 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). This citizen-centric approach to identity management is illustrated in Figure 8.



Source OASIS TGF[1], used with permission.

Figure 8 — Citizen-centric identity model

6.13.3 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.

6.13.4 Linkages

This guidance helps deliver integrated, customer-centric services as part of **[B9] delivering integrated citizen-centric services**, as well as to enable **[B8] empowering the city community through city data**. 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 **[B7] smart city roadmap**.

6.14 Subcomponent [B11] — Digital inclusion and channel management

6.14.1 Context

The benefits that a city will derive from **[B8] empowering the city community through city data** and **[B9] delivering integrated citizen-centric services** are magnified the more that citizens and businesses engage with city services through digital channels.

6.14.2 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 citizen-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).

6.14.3 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.

6.14.4 Linkages

This guidance helps with **[B9] delivering integrated citizen-centric services**, and enables **[B8] empowering the city community through city data**. Further details on the technical and semantic interoperability issues which need to be managed in supporting channel integration are given in **[B5] 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 **[B7] smart city roadmap.**

6.15 Digital and physical resource management

This subcomponent shows how changes to the way in which physical, technological and information resources 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] delivery principles**.

There are three main elements:

— **[B12] Managing smart city developments and infrastructures**;

— **[B13] IT and data resource mapping and management**;

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

6.16 Subcomponent [B12] — Managing smart city developments and infrastructures

6.16.1 Context

Component A of this document recommends that all aspects of smart city implementation should be guided by four **[A] delivery principles**: visionary, citizen-centric, digital, open and collaborative. This sub-component of the document focuses on the importance of ensuring that these principles are integrated into the planning, construction and management of the city's built environment and physical infrastructures.

6.16.2 The need

City development and infrastructure projects need to integrate smart principles from the earliest stages of planning, and be managed in a way that recognizes their synergy and interdependence on each other.

Smart city approaches build on and transform a key element of modern urban planning and design – the concept of place-making.

It has long been recognized that urban planning and design cannot simply focus on the hard infrastructures of buildings, roads and so on, but needs to give just as much attention to the social systems that enable society to function. Buildings and infrastructures on their own, no matter how well designed, cannot make an area attractive, vibrant and sustainable; the activities of service providers, businesses and community organizations are just as important. Place-making recognizes that the physical design of a neighbourhood needs to facilitate positive interaction between people and make it easy for them to use.

Place-making for smart cities needs to be:

— **Visionary**: Clearly rooted in an overall **[B1] city vision** that is clear, compelling and jointly owned by all interested parties.

— **Citizen-centric**: Designed in partnership with citizens, businesses, service providers and community organisations so that it works well for the people who live in it and use it.

— **Digital**: Embracing the opportunities that are now opened up by digital technologies to create visionary and citizen-centric places in innovative ways, including:

  — using digital modelling of the city to test and compare different options, evaluating their likely impact on the city;

  — using digital visualizations to engage interested parties in more meaningful consultation and co-creation of city spaces;

- enabling much greater amounts of data, including real-time data, to be collected, integrated and used to improve neighbourhood management and service delivery;
- embracing digital communications and social media to make the community safer and more cohesive, and to facilitate behaviour changes that make the community more sustainable.

— **Open and collaborative**: Developing new types of business models and public–private partnerships that enable the sharing and joint development of assets across organizational and sectoral boundaries.

Putting this approach into practice requires smart city leaders to establish systems to ensure that all development and infrastructure projects in the city address the following three issues:

a) **Build smart delivery principles into project planning from the outset**

It is easier and cheaper to put in place the foundations for a smart city within a development or infrastructure project at the initial planning and implementation stages than to seek to retro-fit them later. For example:

- digging and retro-fitting communications networks can represent anything up to 80 % of the cost of installation, so it is likely to be cost-effective to ensure that adequate provision is built into new developments at the construction stage;
- sensor networks can be installed much more cheaply when the development or infrastructure is being built;
- establishing common protocols for data sharing and interoperability between development partners and service deliverers is much easier to manage and gives greater benefits if done early.

b) **Take a holistic approach across all types of city infrastructure**

There is a great deal of synergy between the city infrastructures that enable the delivery of energy, water, waste, telecoms and transportation services. All of these infrastructures need to link up every single part of the city and so they tend to run in close proximity with each other. There are also many similarities between the ways they are planned, funded, developed, operated and maintained. Because of the similarities of these different infrastructures, there are many benefits in managing them in a collaborative and synergistic way. It is true that in many cases some or all of these infrastructures are outside the direct control and management of the city administration. A key role for **[B2] leadership and governance** is therefore to build links with the owners and managers of all of these infrastructures and engage them in collaboratively developing a consistent and holistic approach. For example, good practice documents being developed on this subject by ISO include:

- the agreement of a common assessment methodology, taking into account the impact of the infrastructures and the services they support on all of the different stakeholders as well as on the environment;
- the development of common data-sharing protocols to enable the easy and secure sharing of data of common interest, in order to provide better overall management;
- the review of opportunities for synergies between the different infrastructures, such as:
  - the development of collaborative installation and maintenance protocols;
  - the use of joint sensor networks to monitor the integrity and performance of the different infrastructures;
- the review of opportunities for collaborative overall management. For example:
  - how the growth in the use of electric vehicles can be managed in a way that takes account of the capacity of the electricity supply as well as of the potential of the vehicle batteries

to be used to store some of the excess energy that might be supplied by renewable energy sources;

— how the use of waste incinerators to generate energy can be managed in a way that not only takes account of the waste that needs to be disposed of, but also of the requirements of the energy suppliers to meet the requirements of their users;

— the development of joint risk mitigation strategies to deal with the increasing interdependence of the city infrastructures on each other.

c) **Build partnerships and new business models**

New development and infrastructure projects often provide cost-effective opportunities to test and trial smart city products and services, and the business models required to fund and operate them, before rolling them out citywide.

However, existing procurement processes used by city administrations can often be too rigid to enable smart city solutions. When the city administration is procuring infrastructure, such as improvements to the public realm, street lighting and major refurbishment programmes, the procurement processes are usually managed by one part only of the city administration, with a brief to achieve specific objectives at the least possible cost. This misses the opportunity to provide wider smart city benefits at little or no extra cost. It is therefore essential to ensure that all procurement for developments and infrastructure follows the smart procurement practices described in **[B4] procurement and supplier management**.

6.16.3 Recommendation

Smart city leaders should work collaboratively with all relevant interested parties to ensure that all development and infrastructure projects across the city.

a) Build smart delivery principles into project planning from the outset.

b) Take a holistic approach across all types of city infrastructure.

c) Build partnerships and new business models.

6.16.4 Linkages

Effective delivery of these recommendations requires strong and inclusive **[B2] leadership and governance**, and intensive **[B3] stakeholder collaboration**. All procurements activity undertaken in delivering smart city developments and infrastructure should comply with the best practices recommended in **[B4] stakeholder collaboration**. Open, interoperable and discoverable data across smart city developments and infrastructure can be facilitated by following the best practices recommended in **[B13] IT and data resource mapping and management**.

An individual smart city development or infrastructure project is likely to be a complex change programme in its own right. As such, project leaders should

— develop a project-level roadmap that applies the best practices recommended within the overall **[B7] smart city roadmap**;

— apply the risk management practices recommended in **[D] key risks**.

Relevant detailed guidance includes ISO/TS 37151 and ISO/TR 37152. Work has also begun on guidelines on data exchange between smart community infrastructures.

6.17 Subcomponent [B13] — IT and data resource mapping and management

6.17.1 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. A smart city operating model involves a set of significant changes to this silo-based approach to managing technology and digital resources.

6.17.2 The need

Cities need to establish a governance process which enables 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 local 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 assets separately from their original intended use. In order to be reused effectively, resources need to be:

— identified and managed as distinct, valued assets by explicitly designated owners;

— identifiable across ownership domains;

— 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 these data are not effectively managed).

6.17.3 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.

6.17.4 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 **[B7] smart city roadmap**. Priority in that process should be given to assets that interested parties identify as critical for:

a) opening up high-priority city data assets to wider use as part of **[B8] empowering the city community through city data**;

b) providing a city-wide view of the customer as part of the multi-channel, service delivery approach required by **[B9] delivering integrated citizen-centric services** and subject to the citizen-centric trust model within **[B10] 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**.

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

6.18.1 Context

In order for **[B13] IT and data resource mapping and management** to be effective in aligning city technology and digital assets with the integrated, non-silo-based approach demanded by a smart city operating model, it is essential to have a top-level vision and architecture for future technology use across the city.

6.18.2 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, citizen needs change and city priorities evolve.

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 delivery principles (see A.6), 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 interested parties.

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:

c) **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;

d) **clear ownership and governance** for all blueprint elements;

e) **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.

6.18.3 Recommendation

Smart city leaders should work with interested parties (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.

6.18.4 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 **[B7] smart city roadmap** and, in particular, to work on **[B4] 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 interested parties for reuse on the basis described in **[B8] empowering the city community through city data**. The process will also need proactive governance, as described in **[B13] IT and data resource mapping and management**.

NOTE Further guidance on service-oriented architecture is given in ISO/IEC 18384-2.

7 Component C – Benefit realization framework

7.1 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 **[B2] leadership and governance** of a smart city programme.

7.2 The need

All intended benefits need to be delivered in practice, and this will not happen without proactive benefit 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 interested parties. 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 (e.g. efficiency

