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Information technology — Smart City ICT reference framework —

Part 1: Smart city business process framework

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Foreword

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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 document 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 or www.iec.ch/members_experts/refdocs).

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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. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

A list of all parts in the ISO/IEC 30145 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

Introduction

0.1 General

The purpose of the ISO/IEC 30145 series is to assist city chief information officers (CIO) and other stakeholders in planning and implementing a smart city. It comprises the following three parts:

— Part 1: Smart city business process framework (this document)

— Part 2: Smart city knowledge management framework

— Part 3: Smart city engineering framework

Each of the three parts are aimed at a different role or viewpoint within the city and thus separate focus needs to be maintained. The "separation of concerns" is a principle for the development of a city as it uses ICT to deliver the vision and objectives for the city. The value of using the separation of concerns is to simplify development and maintenance of the architecture as the city both develops and delivers improved outcomes for the city stakeholders.

Figure 1 shows the components of the smart city ICT reference framework, which consist of 5 components: stakeholders, vision and outcomes, the business process framework, the knowledge management framework, and the engineering framework. This document describes stakeholders, vision and outcomes, and the business process framework. The knowledge management framework and engineering framework are described in ISO/IEC 30145-2 and ISO/IEC 30145-3 respectively.

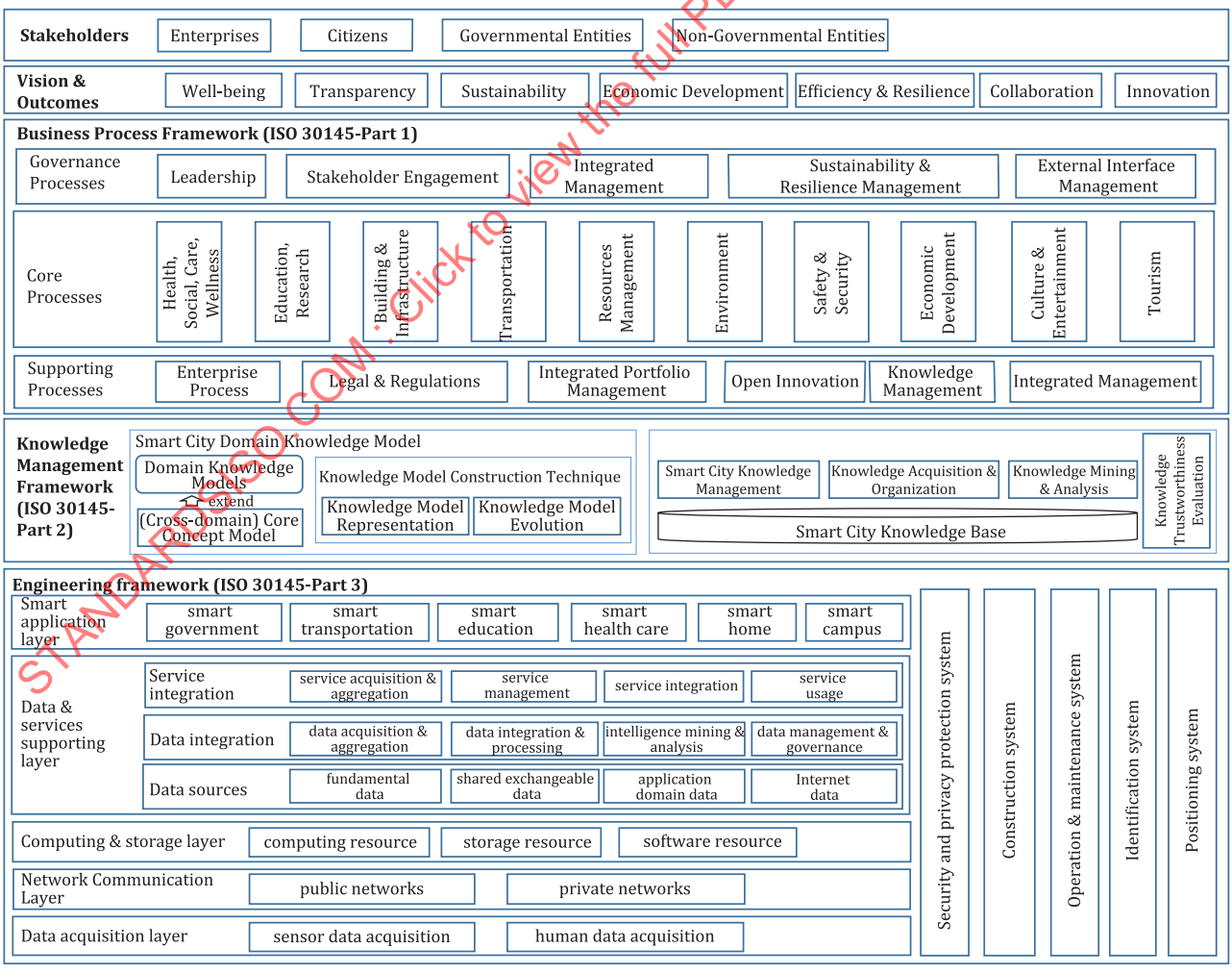

Figure 1 — Smart city ICT reference framework

0.2 Stakeholders

The stakeholders served by the smart city ICT reference framework are enterprises, citizens, government entities and non-government entities. This stakeholder list is not exhaustive but defines the key stakeholders in a smart city and the user for the smart city ICT reference framework.

0.3 Vision and outcomes

The motivation for making a city smart is a result of a shared vision and a set of agreed outcomes from all the city stakeholders. The vision and outcomes of the smart city ICT reference framework are well-being, transparency, sustainability, economic development, efficiency and resilience, collaboration and innovation. This vision and outcomes list is not exhaustive, but defines the key vision and outcomes of a smart city. The smart city ICT reference framework articulates a vision that the Smart City will be transparent in the delivery of city services that meet city sustainability ambitions. This vision uses collaboration and innovation approaches to deliver desired city outcomes. City outcomes are expected to improve the efficiency and resilience of city services and promote economic development activities that enhance the well-being of citizens.

Information technology — Smart City ICT reference framework —

Part 1:
Smart city business process framework

1 Scope

This document specifies a generic business process framework for a smart city focusing solely on smart city-specific processes. Generic business processes common between smart cities and commercial organizations are be identified but not detailed.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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/

4 Smart city business process overview

The objectives of a business process framework (adapted from the TM Forum 2015[8]) are to:

— create a common language for use across departments, systems, external partners and suppliers, reducing cost and risk of system implementation, integration and procurement; and

— adopt a standard structure, terminology and classification scheme for business processes to simplify internal operations and maximize opportunities to partner within and across industries.

The aim of the smart city business process framework is to identify and describe the key business processes required in a smart city and to provide a framework for individual cities to describe how those processes are being carried out within their city.

This will:

— allow cities to review how well their existing processes are designed to deliver the smart city outcomes for which they are aiming;

— allow business processes in different cities to be compared to enable the determination of best practices; and

— provide a foundation to enable more detailed work to be undertaken on these business processes in the future.

The business processes in this document are only a fraction of all the business processes found in a smart city. Only the most significant processes that make a city ‘smart’ have been included.

Given the complexity and considerable number of smart city business processes, this framework:

— Focuses on what makes a city 'smart'.

— Uses a simple single layer architecture.

— Uses an outcome-based approach to characterize business processes.

An attempt has been made to use terminology that is standard in the Enterprise Architecture, Business Process analysis and Systems Engineering domains.

A smart city is an IT-intensive System of Systems (SoS). At a very high level, it can be viewed as a set of business processes that are integrated through the judicious use of sophisticated IT capabilities to realize outcomes.

This document describes 21 smart city business processes, divided into three types, as illustrated in Figure 2.

Governance processes: This document describes five "horizontal" business processes that are the driving force that govern and manage the capabilities of a smart city to produce the desired outcomes.

Core processes: This document describes ten business processes used to manage the city systems in an integrated way to deliver a smart city.

Supporting processes: This document describes six business processes required to enable the city systems to be properly integrated. One of these, the knowledge management process, describes the business processes required to deliver the knowledge management framework detailed in ISO/IEC 30145-2. Another, the integrated engineering process, describes the business processes required to deliver the engineering framework detailed in ISO/IEC 30145-3. The business processes mapping onto ISO 37106 is described in Annex A.

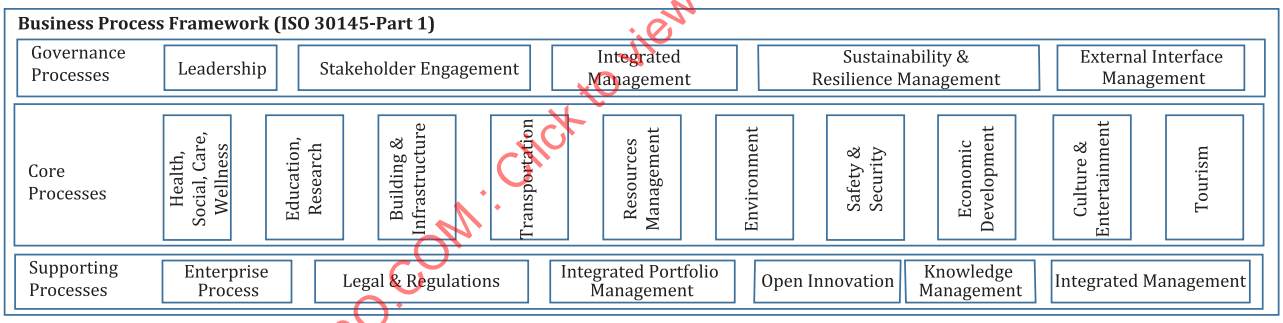

Figure 2 — Smart city business process framework

5 Smart city governance processes

5.1 General

As mentioned in Clause 4, there are five processes under this category:

G1. Leadership

G2. Stakeholder Engagement and Citizen Focus

G3. Integrated Management

G4. Sustainability and Resilience Management

G5. External Interface Management

5.2 Leadership

Process ID	G1
Process name	Leadership
Brief description	The Smart City Leadership process provides a high-level overall view of a city. Taking advantage of the ability to collect and analyse big data, it provides the city leaders with a clearer overall, longer-term view of the city, which they can use to provide better management and governance of the city as a whole.
Extended description	This enables the smart city leadership to bring together the work of different government departments by using ICT technologies such as system engineering, big data analysis, IOT technologies and systems, etc. By doing so, the smart city leadership will be able to achieve the following: — Effective strategic planning for the city as a whole. — Cooperation and collaboration across government departments. — Improved and more efficient business processes.
Process purpose	The purpose of the Leadership process is to provide strategic direction and vision to the city, ensure the buy in by all stakeholders, allocate resources, monitor the implementation of the vision, set policies and manage risks.
Process outcomes	As a result of successful implementation of this process: 1) The city has a clear smart city vision. 2) This vision has been communicated to all city stakeholders. 3) Implementation of the vision is tracked and regularly assessed. 4) ICT related risks are assessed and managed. 5) Policies pertinent to ICT, including IoT and ICT-enabled services, are elaborated and deployed. 6) Improvement programmes are endorsed and funded.
Base practices	There is an overall appointed transformation leader, working with a broad-based team representing all stakeholders, driving the implementation of the smart city vision. The city has set up a cross-silo funding and budget process to address collaborative initiatives.
Relationship notes	G2. Stakeholder Engagement and Citizen Focus G3. Integrated Management G4. Sustainability and Resilience Management G5. External Interface Management

Selected work products	
Inputs	**Outputs**
Requirements analysis SWOT analysis Technology trends analysis	Smart city strategic plan Smart city implementation project portfolio
Assessment of technology requirements	Smart city technology architecture guidelines
Budget allocation	Funding requirements secured

5.3 Stakeholder Engagement and Citizen Focus

Process ID	G2
Process name	Stakeholder Engagement and Citizen Focus
Brief description	The Stakeholder Engagement and Citizen Focus process provides a platform for the exchange of ideas and for the sharing of information to make sure that the demands and ideas of citizens and other stakeholders are fully socialized, considered and discussed.
Extended description	The Stakeholder Engagement and Citizen Focus process enables the management and future plans for city development to be focused around the citizen, taking into account their requirements for city design, city functions, city services, etc., to make sure smart city projects fulfil the demands of citizens. By using system engineering and system thinking, this process ensures smart city stakeholders are fully involved to minimize conflicts and unfulfilled requirements. Enabling platforms such as electronic bulletin boards, e-voting systems, or feedback/monitoring systems using social media are used to enhance the stakeholder and citizen engagement.
Process purpose	The purpose of the Stakeholder Engagement and Citizen Focus process is to engage the citizens, community organizations and businesses in the process of making the city smarter and in fulfilling its vision.
Process Outcomes	As a result of successful implementation of this process: — Citizens and stakeholders are easily able to find out about city plans and provide their input and see evidence that their input affects the way the plans are carried out. — Additional Funding for smart city project is available from partners. — Smart city projects are properly prioritized from the citizen perspective. — Smart city projects are implemented with the right functionality to meet the needs of citizens. — Service processes are successfully re-engineered to ensure citizen-centric outcomes.
Base practices	1) Stakeholders such as citizens, enterprises and non-governmental entities, are consulted and involved in the development of the city strategy. 2) There are effective mechanisms in place to capture citizen and customer input and to provide feedback as to the actions taken in response. 3) Smart city services are designed around the identified needs of citizens and how they wish to interact with the city. 4) The city has collaboration and formalized partnerships with third parties, such as universities, businesses and community organizations, to tackle city problems.
Relationship notes	G1. Leadership G3. Integrated Management G4. Sustainability and Resilience Management G5. External Interface Management

Selected work products	
Inputs	**Outputs**
Online consultation systems and voting systems Online discussion lists Citizen satisfaction surveys	City services feedback acted upon Citizen satisfaction feedback acted upon

5.4 Integrated Management

Process ID	G3
Process name	Integrated Management
Brief description	By applying technologies such as big data analysis and data mining, etc. this process provides a smart city with harmonious and holistic city management, which improves efficiency and provides significant added value.
Extended description	By analysing a city's existing management processes, and by taking advantage of system engineering, the city management functions and processes can be analysed and optimized to improve city functions or services. This will break the silos and provide added value through the analysis of big data, data mining and other ICT technologies.
Process purpose	The purpose of the Integrated Management process is to create value by enabling cross-functional activities and promoting a holistic approach to city management.
Process outcomes	As a result of successful implementation of this process: — The City managers and employees have access, in real time, to the data required for their activities. — Value is created by implementing ICT enabled applications that use data from multiple domains. — Cross-functional services are deployed. — There is no 'silo' culture in the city.
Base practices	1. Sharing of data across functional boundaries and domains. 2. Democratization of data access within the city management and administration. 3. Deployment of big data city analytics solutions.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G4. Sustainability and Resilience Management G5. External Interface Management

Selected work products	
Inputs	**Outputs**
Data sharing policies	Re-engineered and integrated business process

5.5 Sustainability and Resilience Management

Process ID	G4
Process name	Sustainability and Resilience Management
Brief description	Introducing and implementing effective plans to ensure the sustainability and resilience of the city.
Extended description	This ensures that the city's carbon footprint and vulnerabilities to major disasters are thoroughly audited and that comprehensive, multi-stakeholder plans are put in place to address these. This will include the identification and constant monitoring of KPIs related to sustainability and resilience and the review of all plans in the light of the results. New technologies and big data analysis are used to better assess and predict risk and to suggest effective ways of responding and recovering when disaster occurs.
Process purpose	To ensure that the city plays its role in preserving a planet that provides for the needs of future generations and that safeguards the city in the event of disaster.
Process outcomes	— Rapid progress towards the city becoming carbon neutral. — Clear behaviour changes by citizens and businesses to make their city more sustainable. — Rapid and effective response to emergencies by all agencies and residents. — Availability targets are defined for all critical and non-critical services of the city and these services are engineered accordingly. — The city has an ICT enabled disaster recovery plan that is regularly tested.
Base practices	1) The identification and monitoring of relevant KPIs. 2) Regular, cross agency reviews of progress with full citizen participation. 3) Inclusion of key sustainability and resilience goals within all city plans.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G3. Integrated Management G5. External Interface Management

Principal work products	
Inputs	**Outputs**
Sustainability and city carbon footprint audit	City sustainability strategy
Sustainability and city carbon footprint targets set	City resilience strategy
Resilience audit	Planning guidelines for sustainability and resilience
Resilience targets set	Implementation of a system of relevant KPI measurement and evaluation
	Emergency response plan
	Emergency response system implemented

5.6 External Interface Management

Process ID	G5
Process name	External Interface Management
Brief description	This process enables the city to interact with the wider city region and other cities, and to better manage the flow of people, goods and supplies coming in and out of the city.
Extended description	The city should be able to share data with agencies in the wider region to enable better management of people and goods in and out of the city. Arrangements should be in place to ensure that the city needs for energy, food, clean water, etc. can be met from the wider region. The city plans for transport and infrastructures are made in conjunction with plans for the wider regions.
Process purpose	This process aims to ensure that the city can be managed within the context of the wider region, so that the city can be supplied externally with all its requirements, so that flows in and out of the city can be properly managed and so the city can play a positive role in the wider region.
Process Outcomes	As a result of successful implementation of this process: — The city has secure supplies of food and other requirements. — The transport and other needs of people coming into the city for employment, shopping and leisure can be properly met. — City plans are more effective as they take into account the influence and impact of the surrounding region.
Base practices	1) Information is effectively shared between internal and external suppliers and distributers of energy, water, telecoms, food and other key supplies. 2) City planning is undertaken in partnership with regional authorities.
Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively.

Principal Work Products	
Inputs	**Outputs**
City data and regional data Partnership agreements with all relevant external agencies	Regional plans incorporating the requirements of the city in the larger context Effective supply chain management

6 Smart city core processes

6.1 General

As mentioned in Clause 4, there are 10 processes in this category:

C1. Health, Social, Care and Wellness

C2. Education and Research

C3. Smart Infrastructure and Building

C4. Integrated Transportation

C5. Resources Management

C6. Environment Management

C7. Safety and Security

C8. Economic Development

C9. Culture and Entertainment

C10. Tourism

Many of these are processes that are normally considered as part of e-government. The difference here is that in a smart city these processes need to be fully integrated across all key service providers.

6.2 Health, Social, Care and Wellness

Process ID	C1
Process name	Health, Social, Care and Wellness
Brief description	This process integrates the processes that underpin all city issues that impact citizens' health, social, care and wellness factors. This enables them to be managed holistically so that the city can offer the best possible environment for its citizens' health and wellbeing.
Extended description	This integrating process enables all relevant agencies in the city to: — Gather and analyse the data they need to understand the health and wellbeing requirements of their citizens. — Gather and analyse the data they need to understand the most appropriate ways to meet those requirements, then — act in a coordinated way to deliver them; and — evaluate how well their strategies are working. This also enables the citizens and businesses to: — Know what research is being conducted into city related issues in order to support collaboration. — Have better information on the services available. In general, this process will enable greater efficiency in service provision.
Process purpose	The purpose of the health, social, care and wellness process is to: — Enable the city to be managed in the best possible way to support the health, social, care and wellness factors of its citizens. — Enable patients, caregivers and healthcare professionals to access data and information more easily and improve the quality and outcomes of both health and social care. — Improve citizen wellbeing by providing efficient and cost-effective services and by making the city environment and working and living conditions more conducive to a healthy lifestyle.

Process outcomes	As a result of successful implementation of this process: — Citizens' access to health and social services is enhanced. — Health and social services are optimized. — Personalized care is delivered to citizens. — Emergency services are more efficient. — The city environment and living conditions are healthier and more conducive to citizen wellbeing. — The city is more attractive to external investors and highly qualified professionals.
Base practices	1) Data regarding the overall health and wellbeing of the citizens as a whole, including by key demographics, are regularly collected and reviewed by cross-sector strategic groups, and policies and practices are adapted as required to optimize outcomes. 2) Implementation of an easily accessible and regularly updated city-wide healthcare directory. 3) Integration of the directory within geolocalization-enabled applications. 4) Implementation of a centralized citizen health and social registry.
Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively. Specifically, this is intended to have a positive impact on the city economy and on education outcomes.

Selected work products	
Inputs	**Outputs**
Research into the overall health and wellness needs of the city Identification of all the key issues in the city that impact people's health, social, care and wellness factors The setting up of a strategic, cross organisation health and wellness management structure	Development and implementation of a citywide health and wellness strategy
Identification of the data required to enable effective decision-making regarding health and wellness	Development and implementation of a strategic plan to gather and analyse the required data.

6.3 Education and Research

Process ID	C2
Process name	Education and Research
Brief description	These are the processes that enable the city to provide the education and training that the citizens need to play an active and effective role in the economic and social life of the city and that provide local business and industry with the skills they need to flourish. This also includes the processes needed to ensure that all research into the needs and opportunities facing the city is effectively coordinated.

Extended Description	This enables all relevant agencies in the city to: — Gather the data they need to understand the education requirements of the citizens and of local businesses and enterprises. — Gather and analyse the data they need to understand the most appropriate ways to meet those requirements, then — act in a coordinated way to deliver them; and — evaluate how well their strategies are working. This also enables citizens and businesses to: — Have better information on the educational services available. — Gain the support and advice they need to access the educational services of most benefit to them or their staff. In general, this enables greater efficiency in service provision.
Process purpose	The purpose of the Education and Research process is to ensure that the city has an adequate infrastructure of lower and higher education institutions that are aligned to both present and future needs of the city stakeholders, including enterprises and citizens, and to work in partnership with them.
Process outcomes	As a result of successful implementation of this process: — All citizens are able to access the education and training that will enable them to achieve their potential. — The city has an adequate supply of Human Resources (HR) across all the required spectrum (trades, technical, STEM, etc.) to ensure its wellbeing and economic development. — The city has the necessary infrastructure to keep its HR capital up-to-date or provide retraining as required. — Cooperative research and development projects are undertaken by higher education institutions that routinely partner with industry. — Pre-competitive cooperative research and development projects are performed in university-industry consortia. — Higher education entities participate in open innovation initiatives.
Base practices	1) Educational entities, especially higher and professional education, work cooperatively with city stakeholders to adjust their service offerings. 2) Higher education entities offer professionals and academics continuing education programmes in line with the city stakeholders' needs. 3) Educational entities offer industrial internship programmes in cooperation with industry. 4) The higher education instructions routinely partner with industry on R&D projects and participate in open innovation initiatives. 5) Educational entities use innovative teaching and delivery approaches, including online courses and training.

Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively. Specifically, this has a positive impact on the city economy.

Selected work products	
Inputs	**Outputs**
Research into the overall educational needs of the city The setting up of a strategic, cross organization educational management structure	Development and implementation of a citywide education and research strategy
Identification of the data required to enable effective decision making regarding educational provision	Development and implementation of a strategic plan to gather and analyse the required data.

6.4 Smart Infrastructure and Building

Process ID	C3
Process name	Smart Infrastructure and Building
Brief description	This process ensures the use of appropriate new technologies throughout the procedure of planning, constructing, and operating of building and city infrastructures and requires that all data generated be available for ongoing management purposes.
Extended description	This process enables all relevant interested parties to collaborate to ensure that all development and infrastructure projects across the city: — Build smart delivery principles into project planning from the outset. — Take a holistic approach across all types of city infrastructure. — Build partnerships and new business models. — Ensure that the built environment is designed around the requirements of the citizen. — Ensure that all useful data generated in the planning and management of the infrastructure and building is available at a fair cost for any appropriate use.
Process purpose	The purpose of the Smart Infrastructure and Building process is to improve the management of the City infrastructure, provide new value-added services using this infrastructure and introduce more sophisticated functions using autonomous technologies.
Process outcomes	As a result of successful implementation of this process: — Management and ongoing maintenance are supported by access and use of relevant data. — Smart services and functions, such as integrated transportation, are enabled. — Infrastructure resiliency is improved. — The city sustainability is improved. — Preventive maintenance of the infrastructure is enhanced.

Base practices	1) The city infrastructure is instrumented with sensors and actuators. 2) The city infrastructure integrates smart devices. 3) The city collects and analyses the data required to manage the infrastructure. 4) Data analysis is used to continuously improve services provided over the infrastructure. 5) Autonomous systems using this data and other pertinent data from other city domains, as well as data external to the city, are systematically introduced to improve response times and deploy more sophisticated processes.
Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively.

Principal Work Products	
Inputs	**Outputs**
City data	Smart infrastructure services
Building data	Building control and monitoring services

6.5 Integrated Transportation

Process ID	C4
Process name	Integrated Transportation
Brief description	This process links together the various transport services in the city to enable citizens to plan and make seamless journeys using the most appropriate mix of types of transport. It also uses data to enable the mix of transport provision to be managed and planned in the most appropriate way.
Extended description	Integrated transportation involves the management of the transport infrastructure such as roads, cycle paths and rail lines, as well as the vehicles and people that use them, including buses, commuter trains, subways, etc. This process enables all relevant interested parties to collaborate to ensure that all development and infrastructure projects across the city: — Build smart delivery principles into project planning from the outset. — Take a holistic approach across all types of city infrastructure. — Build partnerships and new business models. — Offer citizens the information that will support multimodal journeys.
Process purpose	The purpose of the Integrated Transportation process is to provide the city stakeholders with efficient and sustainable multimodal transport services.
Process outcomes	As a result of successful implementation of this process: — Transport infrastructure resiliency will be improved. — Transport infrastructure capacity will be improved. — Transport infrastructure will be designed and managed more closely around the requirements of the citizen.

Base practices	1) City transportation is managed and engineered holistically. 2) Transportation assets (roads, cycling paths, buses, rail, subway, etc.) are planned and managed in an integrated fashion. 3) Data analysis, using transportation data as well as other data such as weather, is used to continuously improve services. 4) Autonomous systems using this data and other pertinent data from other city domains, as well as data external to the city, are systematically introduced to improve response time and deploy more sophisticated processes.
Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively.

Principal work products	
Inputs	**Outputs**
City transport strategic plan Public transport information	Journey planning service New types of transportation services such as bicycle and scooter sharing

6.6 Resources Management

Process ID	C5
Process name	Resources Management
Brief description	This process enables different stakeholders to collaborate to ensure the city projects can be optimized to save on resources.
Extended description	This process enables all interested parties to collaborate in order to ensure that all services and infrastructure projects across the city: — Build smart delivery principles into project planning from the outset. — Take a holistic approach across all types of city service and infrastructure. — Build partnerships and new business models.
Process purpose	The purpose of the Resources Management process is to optimize the city resource management, thus improving services and the city sustainability.
Process outcomes	As a result of successful implementation of this process: — The overall city strategic plan is reviewed from the resource saving perspective. — City projects are reviewed to save on resources.
Base practices	1) City projects are modified through multi-objective optimization analysis. 2) City project funding is reviewed and rescheduled to save on resources.
Relationship notes	This process requires all the governance, core and supporting processes to be in place and working effectively.

Principal work products	
Inputs	**Outputs**
City strategic plan City projects	Reviews of city projects with implementation of key recommendations Optimized city project timelines

6.7 Environment Management

This includes air quality, carbon footprint, city aesthetics and attractiveness, open spaces and wildlife, etc.

Process ID	C6
Process name	Environment Management
Brief description	This process ensures that the ongoing improvement of the urban environment is a central part of all city developments and that the city is managed in in a way that minimizes negative impact on the environment, including air quality, water quality, species diversity, etc.
Extended description	Long-term city development vision is realized through data sharing and data mining across different sectors to take into consideration issues of improving the wider environment: — City projects are reviewed and analysed to fulfil environmental protection purposes using big data analysis and Artificial Intelligence. — Timelines and implementation plans of city projects are reviewed and modified to reduce negative impacts on the environment. — The city is managed in such a way as to minimize negative impacts on the environment and to provide a pleasant setting for the citizens to live their lives.
Process purpose	The purpose of the Environment Management process is to improve the quality of the city environment, and thus citizens' wellbeing.
Process outcomes	As a result of successful implementation of this process: — The city is a more attractive and pleasant place in which to live. — Citizen wellbeing is improved. — The city finds it easier to attract high quality companies and investment.
Base practices	1) The city collects and analyses the data required to plan the urban environment. 2) Data analysis, using environmental data as well as other data such as weather predictions or road congestion, is used for decision making in city management.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G3. Integrated Management G4. Sustainability and Resilience Management C1. Health, Social, Care and Wellness C4. Integrated Transportation S5. Knowledge Management

Principal work products	
Inputs	**Outputs**
City environment audit Development of a strategic plan for the urban environment Agreement on key environmental KPIs including air quality, green space, etc.	Modified city projects Modified city project timelines

6.8 Safety and Security

Process ID	C7
Process name	Safety and Security
Brief description	This process aims to use ICT and data to make the city safer and more secure.
Extended description	This process reviews how better design of public space and new solutions (such as the use of smart technology on lampposts to ensure that pathways are always well lit when needed and interactive sensors that can alert the police when crimes are about to be committed) can be used to provide a safer environment in the city, while maintaining privacy. New technologies and big data analysis are used to better assess and predict areas of potential crime and disorder and suggest effective ways to respond.
Process purpose	The purpose of the Safety and Security process is to ensure that through the usage of ICT the city becomes safer and more secure for its stakeholders and more resilient to natural and other disasters.
Process outcomes	As a result of successful implementation of this process: — The city uses a holistic approach to manage safety, security and resilience. — The city aggregates data from multiple sources to manage safety and security. — Data privacy standards are developed and deployed to ensure that the citizen can have confidence that the data being used to enhance their safety will not be used to compromise their privacy.
Base practices	1) Data about city crimes is collected and analysed. 2) Various scenarios for how to make the city safer are developed and analysed using Big Data and AI. 3) The appropriate use of smart street furniture and other technologies to make the urban environment safer is investigated.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus C3. Smart Infrastructure and Building C6. Environment Management C8. Economic Development C9. Culture and Entertainment C10. Tourism S5. Knowledge Management

Principal work products	
Inputs	**Outputs**
City crime risk analysis	City quick response mechanism and management
Real-time city data related to public safety	Solutions for dealing with city risks and malfunctions

6.9 Economic Development

Process ID	C8
Process name	Economic Development
Brief description	This process integrates the processes that underpin all city issues that impact the local economy. This enables them to be managed holistically so that the city can offer the best possible environment for its economic development.
Extended description	The process analyses what sort of industries should be encouraged in the city to support the local economy, while not undermining its sustainability goals. It ensures that the right processes are in place to support those businesses and that local people are provided with the educational and training support to allow them to take advantage of the job opportunities in those industries. It analyses where those industries should be located in the city to ensure the best quality of life and develops transport plans that facilitate commuting. It also sets up processes that support wages being spent within the local economy.
Process purpose	To ensure that there are sufficient and appropriate well-paid and interesting jobs available for its citizens without undermining the city sustainability goals.
Process outcomes	— High employment in meaningful jobs. — Money circulating in the local economy to enable additional job opportunities. — Healthy tax revenues to allow the provision of high-quality services.
Base practices	1) Regular reviews of the skills and other requirements of local business and industry. 2) Provision of flexible and affordable retraining opportunities. 3) Support for local retail and entertainment venues.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G4. Sustainability and Resilience Management C2. Education and Research C4. Integrated Transportation C5. Resources Management C6. Environment Management C7. Safety and Security C9. Culture and Entertainment S4. Open Innovation S5. Knowledge Management

Principal Work Products	
Inputs	**Outputs**
Analysis of the local job and skills market and how that will potentially align with probable future changes in employment opportunities and with preserving environmental sustainability	Development of economic development strategy
Analysis of existing flows of money in the local economy	Development of a strategy to support the circulation of money in the local economy

6.10 Culture and Entertainment

Process ID	C9
Process name	Culture and Entertainment
Brief description	This process integrates the processes that underpin all city issues that impact culture and entertainment. This enables them to be managed holistically so that the city can offer the best possible environment for the cultural and entertainment life of the city.
Extended description	Data are used to help people find out about relevant cultural and entertainment opportunities that are of interest to them and to make it easy for people and businesses to set up cultural and entertainment events, knowing the likely take up.
Process purpose	To provide citizens and visitors with the entertainment and cultural events they enjoy and thus make the city an attractive place to live and visit and improve the local economy.
Process outcomes	— A successful and varied cultural and entertainment life. — Happy citizens.
Base practices	— Continual review of entertainment and cultural events in the city and participation. — Making available comprehensive, useful and easily searchable information about events and entertainment activities locally. — Ensuring that there are affordable and convenient public transport options for people participating in cultural and entertainment activities.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G1. Health, Social, Care and Wellness C4. Integrated Transportation C7. Safety and Security C8. Economic Development C10. Tourism S5. Knowledge Management

Principal work products	
Inputs	**Outputs**
Audit of entertainment and cultural events and activities	A number of apps making it easy for people to search for entertainment and cultural events

Identification of what entertainment and cultural events are valued by both existing residents and visitors and by those the city's economic strategy identifies as being important to attract into the city	Support for the development of new and relevant entertainment and cultural events

6.11 Tourism

Process ID	C10
Process name	Tourism
Brief description	This process integrates the processes that underpin all city issues that impact tourism This enables them to be managed holistically so that the city can offer the best possible environment for tourists.
Extended description	The identification of the potential assets of the city that would attract tourists. An effective strategy to attract the most appropriate type of tourists to the city and encourage them to stay and spend significantly to support the local economy. Support for the transportation and accommodation requirements of potential tourists. Promotion of relevant cultural and entertainment events to tourists.
Process purpose	To attract the kind of tourist that would bring significant income into the local economy and enhance the reputation of the city.
Process outcomes	— Large but manageable number of tourists bringing significant income into the local economy.
Base practices	— Development of apps that make it easy for tourists and potential tourists to find out about and book attractions, events, hotels and restaurants. — Collection and analysis of data about the types of tourist that visit the city and the events and places that they visit.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G4. Sustainability and Resilience Management C4. Integrated Transportation C6. Environment Management C7. Safety and Security C9. Culture and Entertainment S5. Knowledge Management

Principal Work Products	
Inputs	**Outputs**
Research into the kind of tourists that would be interested to visit the city and would benefit the city and the best channels to reach them Research into the assets and potential assets of the city that might interest such tourists	City Marketing strategy City plans which include appropriate proposals re hotels, restaurants and transport services to meet the needs of potential tourists Implementation of a relevant set of KPIs and a process to measure and evaluate the results.

7 Smart city Supporting processes

7.1 General

As mentioned in Clause 4, there are 6 processes in this category:

S1. Enterprise Processes

S2. Legal and Regulatory Systems and Services

S3. Integrated Portfolio Management

S4. Open Innovation

S5. Knowledge Management

S6. Integrated Engineering

7.2 Enterprise Processes

Process ID	S1
Process name	Enterprise Processes
Brief description	The normal business processes of the key agencies of the city become smart city enterprise processes when they are fully integrated with the business processes of other key city agencies, capitalize on the effective use of data, focus on the requirements of the citizen and are able to bend to meet rapidly changing needs and opportunities.
Extended description	These processes include all the business processes that are common across modern organizations such as human resources, finance, customer relationship management, service provisioning, service fulfilment, procurement and supplier management, and channel management. Many of these are enablers and part of what is commonly known as e-Government. For the Smart City, they also include processes that empower community-led service transformation and deliver digital inclusion. In a smart city, the business processes of the various agencies providing services to the city need to have the following characteristics: — Holistic – allowing the easy flow of information between and across agencies in the city and supporting cross agency decision-making and management. — Customer centric rather than organization centric – in other words, based on as complete a picture as possible of the needs of individual citizens and citizen groupings. — Informed by the extensive gathering and analysis of data. — Agile, flexible and open to innovation to meet rapidly changing needs and opportunities.
Process purpose	The purpose of the smart city Enterprise Processes is to support and enable the business operation of the smart city.

Process outcomes	As a result of successful implementation of this process: — The city has a continuously evolving state-of-the-art e-government infrastructure providing services to its stakeholders. — The city enterprise processes and their ICT infrastructure are 'Smart Ready', e.g. able to integrate with the smart services deployed in the smart city. — Useful data held within the different organizations is shared effectively and analysed to provide a comprehensive picture of the city and its people. — IoT data can be handled by the relevant enterprise processes ICT infrastructure. — Pertinent IoT data is processed and integrated in the city's CRM systems. — Pertinent IoT data is processed and integrated in the city's financial system. — Pertinent IoT data is integrated in the relevant service provisioning and fulfilment systems of the city.
Base practices	1) See ISO/IEC 33071 for detailed generic practices for enterprise processes. 2) IoT data is integrated in the city enterprise data architecture and used in integrated applications to provide smarter IT enabled services. 3) Useful data held within different organizations in the city is shared and analysed appropriately.
Relationship notes	G1. Leadership G3. Integrated Management G4. Sustainability and Resilience Management C5. Resources Management C8. Economic Development S2. Legal and Regulatory Systems and Services S5. Knowledge Management S6. Integrated Engineering
Reference documents	ISO/IEC 33071 describes in detail enterprise processes using the same approach as this document. ISO 37106 describes how the city operating system needs to change in order to fully exploit the value of technology and data in the city. The TM Forum's Digital Maturity Model[7] contains comprehensive information as to best practice in smart city transformation.

Principal work products	
Inputs	**Outputs**
Audit of existing business processes in the key stakeholders Agreement on cross-sector business process mapping Agreement on common data models and data sharing protocols	Roadmap for the linking of city enterprise processes, starting with basic interoperability and moving towards closer and closer integration Roadmap for sharing city data related to enterprise processes between agencies

7.3 Smart Legal and Regulatory Systems and Services

Process ID	S2
Process name	Smart Legal and Regulatory Systems and Services
Brief description	This requires a legal and regulatory system that focuses on outcomes so that it is able to deal with the continual transformation in the way we live our lives in the city resulting from the implementation of new technologies.
Extended description	The legal and regulatory system needs to be able to quickly recognise disruptive technologies and assess their impact on citizen safety and quality of life. Whatever new regulations and assessment processes might be needed to ensure that citizen safety and quality of life are maintained, and any negative impacts of the transition are minimized, need to be rapidly implemented. The new regulations and processes need to be regularly evaluated to ensure that they are delivering the required outcomes.
Process purpose	The purpose of the Legal and Regulatory Systems and Services process is to ensure that the city has an adequate and efficient legal infrastructure to ensure the wellbeing of its citizens and enable the city's economic activities and that it is flexible enough to maintain this, at a time of rapid change due to digital transformation.
Process outcomes	As a result of successful implementation of this process: — Legal issues that arises during the deployment of new technologies are noted and properly handled to support innovation while mitigating potential harm to the citizen. — City managers are properly advised about legal and regulatory issues. — Citizens are well informed and can easily gain appropriate advice with respect to any legal issues that arise through the deployment of new technologies.
Base practices	1) Legal professionals work cooperatively with city managers and technicians to discuss and raise any potential legal issues throughout the deployment of new technologies. 2) Legal professionals and technicians check and review city services to guarantee that they obey the laws and regulations. 3) Legal professionals provide information and advice to citizens to inform them about their rights and risks throughout the deployment of new technologies.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus G3. Integrated Management G5. External Interface Management C3. Smart Infrastructure and Building C8. Economic Development S1. Enterprise Processes S4. Open Innovation S5. Knowledge Management

Principal work products	
Inputs	**Outputs**
Reviews of all new technologies deployed or to be deployed into a city	Review of laws and regulations relevant to the technologies Review of any new regulations needed
Regulations regarding city services	Checks on legal and regulatory conformance of all city services with notifications where regulations are not obeyed

7.4 Integrated Portfolio Management

Process ID	S3
Process name	Integrated Portfolio Management
Brief description	This process provides the city administration with the ability for overall project management of the portfolio of projects in the city, whichever sector or organization is delivering them.
Extended description	This process deals with the challenge of cross-sector project management in the city. It enables the city to have a multi-objective and optimization view of city management and enables it to review the current projects and modify their goals, where necessary, through cross-sector negotiation and analysis.
Process purpose	The purpose of the integrated portfolio management process is to gain an overall picture of, and manage, the city's project portfolio.
Process outcomes	As a result of successful implementation of this process: — Short- and middle-term issues are properly set up, taken into consideration and addressed. — Delivery strategies are optimized. — Dependencies between elements of the project portfolio are identified and taken into account. — ICT infrastructure investment is synchronized with application services evolution. — The enterprise architecture plan is respected. — Project charters are elaborated. — Deviations from schedule, budget and/or delivered functionality of elements of the work project portfolio are assessed and corrective action is taken. — Project post-mortems are conducted, and lessons are learned.
Base practices	1) The city project portfolio management has a 'systems of systems' scope that includes ICT as well as other infrastructure and business projects. 2) The city project portfolio represents the best business requirements fit, given financial and resources constraints.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus

Selected work products	
Inputs	**Outputs**
City goals Aim of different city sectors/systems Aims of each city project City project action plan	Revised city projects action plans with timetable, demonstrating how they fit into the wider city strategy

7.5 Open Innovation

Process ID	S4
Process name	Open Innovation
Brief description	This enables city government, industry and research institutes to work together to identify and implement new transformational services in the city based on technology innovation and provide a platform to support this.
Extended description	City government, industry and research institutes should provide the city with: — Proper places such as incubators for technologies to be piloted. — ICT enabled test bed for start-ups. — Events such as hackathons to promote the emergence of new technology-based solutions to city problems.
Process purpose	The purpose of the Open Innovation process is to foster open innovation in the city, thus contributing to its economic growth and citizen well-being.
Process outcomes	As a result of successful implementation of this process: — The city has a healthy rate of enterprise creation, and thus of employment creation. — The city economic and academic stakeholders cooperate to create value.
Base practices	1) Development of ICT enabled collaborative environments that support open innovation. 2) Organization of events such as hackathons to attract people with technical backgrounds to develop solutions to city problems.
Relationship notes	G1. Leadership G2. Stakeholder Engagement and Citizen Focus C2. Education and Research C8. Economic Development S2. Legal and Regulatory Systems and Services S5. Knowledge Management

Principal work products	
Inputs	**Outputs**
SWOT analysis City strategic plan ICT-enabled collaborative environments	Many new products and services

7.6 Knowledge Management

Process ID	S5
Process name	Knowledge Management
Brief description	The Knowledge Management process enables a smart city by enabling the re-use and easy exchange of knowledge across different sectors and stakeholders.
Extended description	The Knowledge Management process uses methods such as a domain knowledge model, machine learning, and data fusion, to extract metadata that can be re-used in a smart city. The categories of metadata and the pool of city knowledge that can be re-used and exchanged forms a city knowledge model.
Process purpose	The purpose of the Knowledge Management process is to enable the effective use of data processes to provide the city with the ability to use data effectively to enable transformational change in the way that the city works.
Process outcomes	As a result of successful implementation of this process: — The city has a strategy to identify, capture, organize and utilize useful data and has agreed a policy to share such data by default. — The city is using a suitable city ontology to organize and map the data sets to be opened up and shared. — The city has developed a set of regulatory and management policies to ensure that any data opened up publicly complies with legal requirements and has systems in place to reward, as well as monitor, conformance. — The city makes public data available for easy access and use by citizens and businesses. — Open real-time city data is used by stakeholders. — Data and services based on city open data is provided by businesses and community organizations. — The sharing and re-use of city assets and services is facilitated by the use of a consistent city model used by all stakeholders and by data interoperability, enabled by the use of open standards. — City databases are aggregated to provide greater insight into what is happening in the city. — City services can be described in such a way as to enable services designed within one city system to be easily ported across to other systems, and to other cities. — It is easier to compare cities through benchmarking and support shared learning. — Data privacy standards are defined and implemented.
Base practices	1) Implementation of human and machine accessible, open-data platform.
Relationship notes	This process is further detailed in ISO/IEC 30145-2.

Selected work products	
Inputs	**Outputs**
City services data Real-time city data Data sharing polices covering all city systems	City metadata set City core knowledge set

7.7 Integrated Engineering

Process ID	S6
Process name	Integrated Engineering
Brief description	This process provides a smart city with a high-level overall vision of the engineering and technology infrastructure of the city.
Extended description	This process integrates city engineering to reduce investment, improve efficiency and promote cross system interchange to fulfil information and data sharing and business process optimization. The city takes a systems engineering approach, integrating the ICT and operation of assets delivering across the core and supporting business processes. The integrated city systems engineering covers periods such as city planning, project planning, system design, system deployment, system operating and maintenance, etc.
Process purpose	The purpose of the Integrated Engineering process is to assist the city in developing business objectives and strategies that are deliverable from an engineering perspective; to provide the city with the engineering roadmaps and project portfolio required to meet the city business objectives and to assist in the implementation of these roadmaps.
Process outcomes	As a result of successful implementation of this process: — The city has the ICT enabled business processes required to meet its vision. — The city has a defined city-wide system and systems of system architecture based on clear requirements and the city's vision. — A blueprint has been established for an open, city-wide, service-oriented and interoperable ICT platform in the city, based on the requirements that have been identified. — The city's interoperability needs have been identified at the technical, semantic, organizational, legal and policy layers and all stakeholders have agreed to follow the specific open standards required to address those needs and to require conformance to those standards in all procurement exercises. — IoT requirements in the city are elaborated with the aim of avoiding unnecessary duplication and maximizing re-use across application domains. — The city-wide system architecture is integrated and coherent with city planning. — The city-wide system architecture is enforced and managed. — The city project portfolio is designed to reinforce and develop the city target system architecture. — The city has a security architecture that meets security, business continuity and privacy requirements. — The city is proactively aware of the evolution of ICT technologies and their associated markets. — The city usage of ICT technologies is managed to balance issues such as engineering benefits as well as operational, maintenance and financial impacts.

Base practices	1) There are processes and technologies in place to support service continuity; dealing both with avoiding service failure and with ensuring fast recovery. 2) A collaborative infrastructure has been implemented to support cross-functional collaboration and open innovation.
Relationship notes	G1. Leadership G3. Integrated Management S3. Integrated Portfolio Management S4. Open Innovation S5. Knowledge Management S6. Integrated Engineering The framework to deliver the ICT engineering process of the city is further detailed in ISO/IEC 30145-3.

Selected work products	
Inputs	**Outputs**
Requirements of stakeholders and citizens	City ICT infrastructure
City vision	City ICT roadmap
City projects	City ICT financing

8 Mapping the business processes of a smart city

8.1 General

This document identifies 21 high-level business processes of a smart city, divided into three types, and provides a common format to describe them. At the core, the document shows how each smart city business process can be broken down into a set of base practices, which together aim to achieve a certain set of outcomes. In this way it provides a framework which enables a city to review its own practices and assess how well they are designed to deliver a truly smart city and identify where its own practices need to be strengthened.

This section provides a methodology for doing this.

The first step in the mapping process is to list which of the outcomes for each smart city business process the city has already adopted and to describe how these are defined for that particular city. This will also give the city the opportunity to consider adopting any of the other suggested outcomes for this process.

The mapping exercise will then focus on the base practices that are aimed at delivering those outcomes. It will allow the city to identify all the sub-processes that are required to deliver the base practices. Having done this, each sub-process can be broken down into a number of action steps and each action step can be reviewed in detail.

This will enable the city to identify how those sub-processes can be improved, specifically including how the use of data and digital technologies can help, and thus ensure that it has the smart business processes it needs to become truly smart.