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European Innovation Partnership for
Smart Cities & Communities (EIP-SCC)

EIP-SCC Urban Platform Management Framework

Enabling cities to maximize value from city data

Ver 03 October 2016

Contents

1. Introduction

This is designed for cities, by cities. An open, city-needs-led framework and toolkit to help cities deliver common solutions for shared challenges; support demand aggregation, and scale adoption of urban platforms in European cities

City Managers and their business partners should:

- Support the application of this framework and its continued development
- Work actively with city stakeholders, and with collaborating other (local) cities and city networks in that process

1.1 This management framework

The **audience** for this document is principally City Officials. These may variously include:

- Smart City lead
- Chief Innovation, Information, Digital, and Technology Officers
- Heads of Services
- Senior cross-cutting roles (Policy, Finance, Commissioning, etc)

It is also relevant for leadership within city service providers, and other principal city partners.

Its **purpose** is to improve the quality of cross-domain city service management, through: improving the selection and definition of an urban platform; speeding decision making process; readying the city as regards exploiting data; and informing implementation and city-data platform operations.

The **style** is crisp and informative, with frameworks and figures to help the dialogue and collaboration within and across sectors and tiers of government.

The **content** includes: organising frameworks that help make sense of the topic; principles; options; tools; templates; business case; service selection methods; data profiling; gap analysis; case studies (practices); key issues and means of resolution; examples and case studies, and references to additional materials of interest.

1.2 Context – EIP-SCC urban platform initiative deliverables

City data is a new and vital resource for any city, and all cities must assess how best to exploit this new source of value. Data and digital are central to how a city develops. This process is best convened by 'city hall' to ensure that the end results follow policy and political / democratic needs, and maximize 'public good' outcomes, in balance with supporting the profits of private industry.

Cities typically are not endowed with capabilities or funds to exploit city data, particularly the less advanced and / or smaller cities, so an approach that is open, common, and most importantly collaborative is much needed. This will help cities make better informed and swifter decisions, ensure their services are delivered most efficiently, and maximize the value of their city data.

This Management Framework provides the basis by which a city can determine how best to take control of their city data, develop the capabilities to manage the transition to exploit city data, and acquire the appropriate elements of an urban platform in the process. This will enable them to improve service outcomes as a result.

This framework should be considered as an evolving 'toolkit' that helps cities to make better faster progress. It is part of a suite of documents (figure 1) developed by the Urban Platform initiative within the European Innovation Partnership for Smart Cities and Communities (EIP-SCC). In relation to these other documents:

- The Urban Platform **Leadership Guide** will ideally have been applied by city leaders to ensure political and executive sponsorship is established, and focus the city on the key policy and political priorities that the urban platform can serve
- Following application of this toolkit, a city is invited to use the Urban Platform **City-Needs Specification** to define more precisely its requirements

The above documents are developed by and for the demand side (i.e. cities)

- The Urban Platform **Reference Architecture**, developed as an Industry collaboration, provides open common technical details that cities request providers to adhere to

The longer term goal is to offer this, and a number of other related documents, to international standards development organisations (SDOs) to publish as open standard, aligned with the suggested 3-tier model of smart cities guidance (i) leadership guides (ii) management frameworks (iii) technical standards.

Other complementary assets continue to be developed to support cities and their industry partners in modernising the means by which they exploit data through urban platforms. These include: business case templates and examples, case studies, benchmarks, market surveys, procurement templates, city capability development, and experience sharing networks.

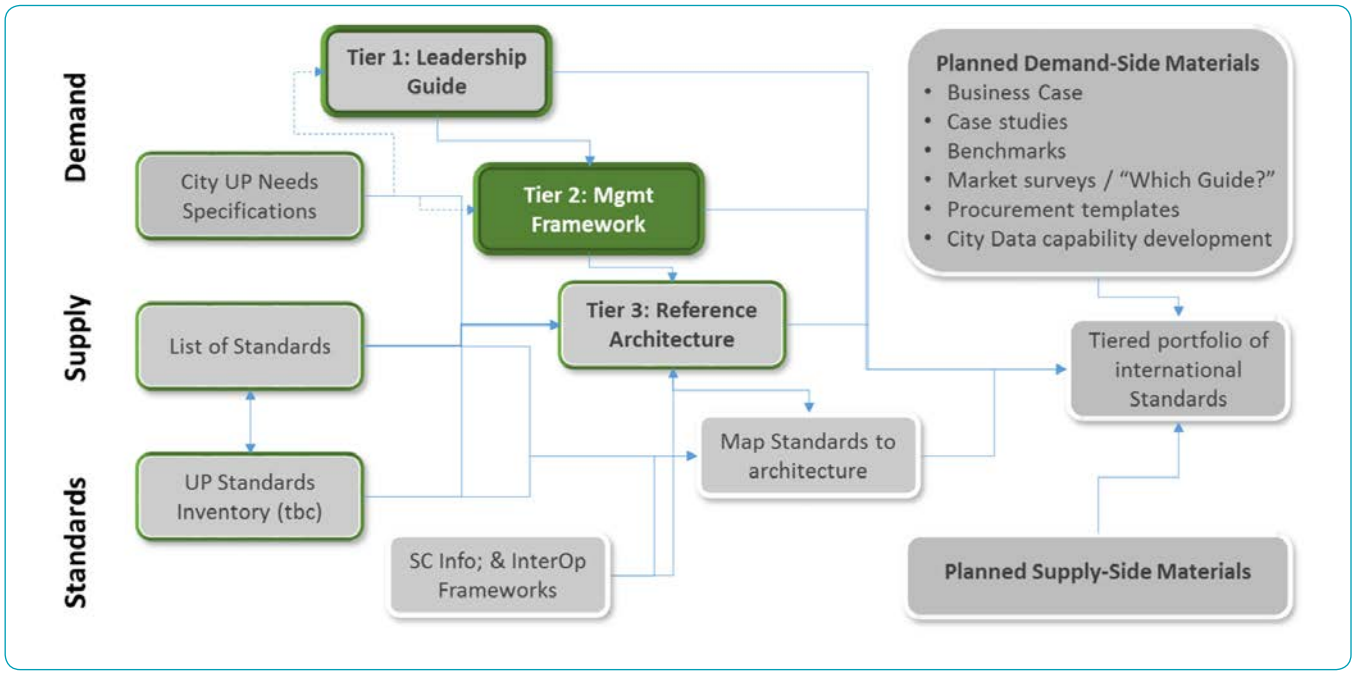

Figure 1: Overview of Existing and Planned EIP-SCC Urban Platform Material

This document and indeed the portfolio of documents referenced above are new. They will undergo continued development as the market develops, and as they are used. Early versions of these materials will be developed, shared and tested within a closed group of collaborating organisations that participate in the EIP-SCC Urban Platform initiative; i.e. those that have signed the Letter of Intent (demand-side) or Memorandum of Understanding (supply-side).

1.3 Definitions

Meanings matter. Below are two working definitions that are adopted by the EIP-SCC for urban platform and city data.

An 'Urban Platform' is...

... the implemented realisation of a logical architecture / design that brings together (integrates) data flows within and across city systems

... and exploits modern technologies (IoT/sensors, cloud, mobile, analytics, social media etc)

... providing the building blocks that enable cities to rapidly shift from fragmented operations to include predictive effective operations, and novel ways of engaging and serving city stakeholders

... in order to transform, in a way that is tangible and measurable, outcomes at local level {e.g. increase energy efficiency, reduce traffic congestion and emissions, create (digital) innovation ecosystems, efficient city operations for administrations and services}.

As a complement to the above the definition of city data is…

> ***'City data' is*** *that which is held by any organisation - government, public sector, private sector or not-for-profit - which is providing a service or utility, or is occupying part of the city in a way that can be said to have a bearing on local populations and the functioning of that place. It can be static, near-real time or in the future, real time, descriptive or operational. Further, in the future, data will be to a greater extent generated by individual citizens and this too (with due consideration to privacy and a strong trust framework) can be considered city data.*

1.4 Reader orientation

The framework is developed along the logical path a city will follow as indicated in figure 2 below

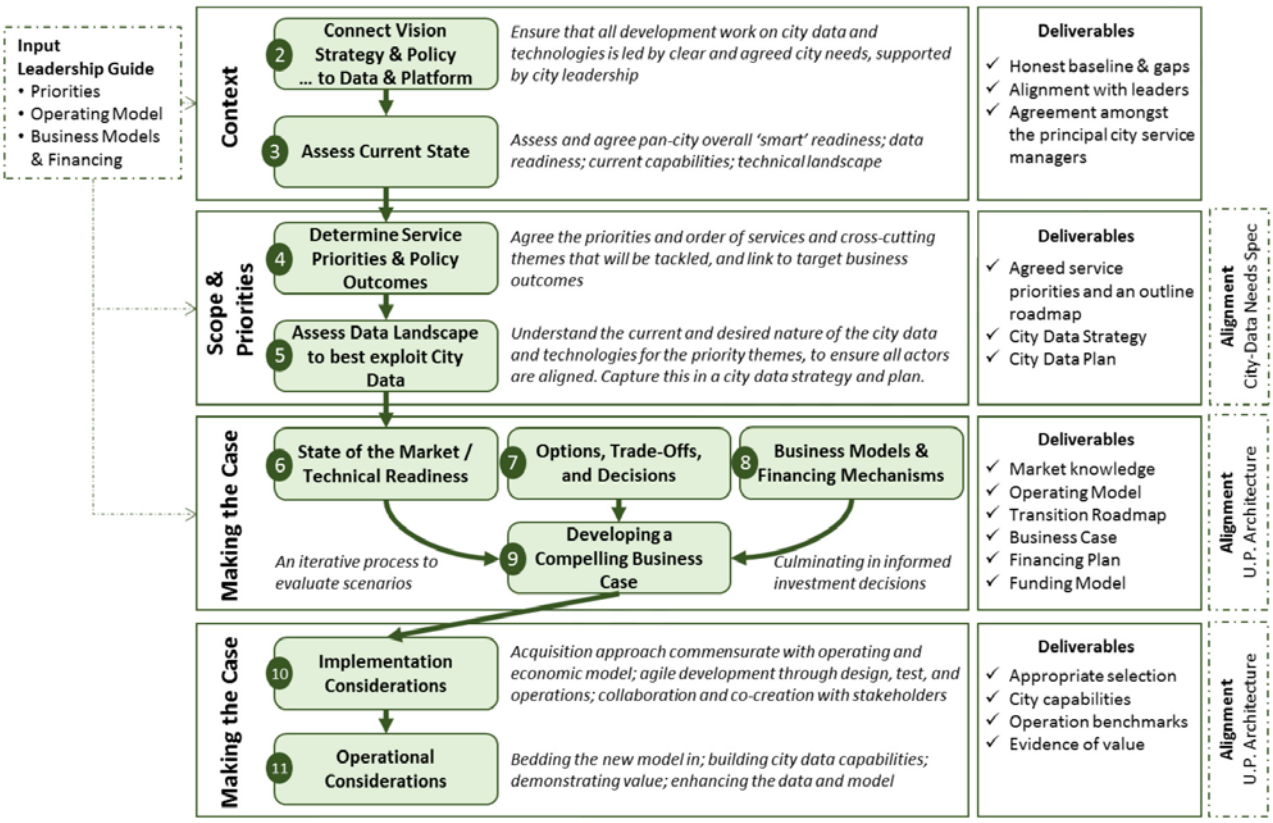

Figure 2: Reader Orientation Flowchart

1.5 Acknowledgements

Recognition is given to those that have offered their time and experience to develop the Leadership Guide and Management Framework:

Organization	Name and Role
Greater London Authority	Andrew Collinge, Chief Intelligence Officer (UP Demand-side lead) Vivienne Avery,
Amsterdam	Berent Daan,
Copenhagen	Rasmus Reeh,
Ghent	Bart Rouseau, CIO Thimo Thoeye, Data & Information Officer
Porto	Paolo Calcada
Riga	Ritvars Rimicans,
Eurocities	Nikolaos Kontinakis, Project Officer
UrbanDNA	Graham Colclough, Partner (EIP-SCC Integrated Infrastructure Chair)

Contributions of signatories of the EIP-SCC Urban Platform Letter of Intent (LoI) are also recognized, valued and will continue to be sought

2. Connecting city vision, strategy and policy, to urban platform

An urban platform and the breadth of city data it manages should be strategically led, to ensure that it is a servant of the city's vision, strategy and policies (top-down). It should also enable operational business- and societal-led improvements to be made (bottom-up).

City leaders should *have actively embraced the potential from urban platforms (ref. Ldshp Guide) and ensured that they:*

- *Align their goals and priorities to the potential that city data can offer in addressing them*
- *Visibly champion cross-organization, and cross-sector working within the city on the data agenda*
- *Give guidance on preferred operating model and financing scheme*
- *Support innovation, and manage the attendant risk that can come with this*
- *Advise themselves of the key opportunities and issues so that they make informed decisions.*

City Managers *and their business partners should:*

- *Support the process of alignment between city vision, city data, and action plans*
- *Actively collaborate with colleagues across the city to seek out value from city data*
- *Ensure capabilities and plans are put across the various city services, and ensure these are monitored.*

2.1 (Smart) city strategy and roadmap

Many cities are revisiting their vision, goals and strategy in recognition of the game-changing potential that modern 'smart' technologies can offer.

The process that they follow to do so may well differ, however an important element within that should be a dialogue on how ambitions can be achieved best by exploiting city data and new technologies.

This will require a recognition that city data is a strategic resource that deserves attention on such topics as: governance, ownership, curation, sensitivity (privacy and security), and the like. Complementing this must be sufficient understanding of how new technologies (IoT/ sensors, cloud, mobile, analytics, social media) bring additional advantage in service transformation. The nexus of these discussions centre on the role of the Urban Platform.

An urban platform provides a foundation under the entire city to enable service transformations, like:

- Providing travelers with real-time data on all travel modesand their carrying infrastructures, with personalizedsuggestions on the best means to move around the city
- Giving control and confidence to the elderly and theirfamilies that personalized and context-aware care is beingprovided by a variety of public, private and 3rd sectorproviders through appropriately monitoring conditions andsharing information
- Reducing energy consumption and energy bills bymonitoring usage and pricing levels, through automation,and remote monitoring and contro

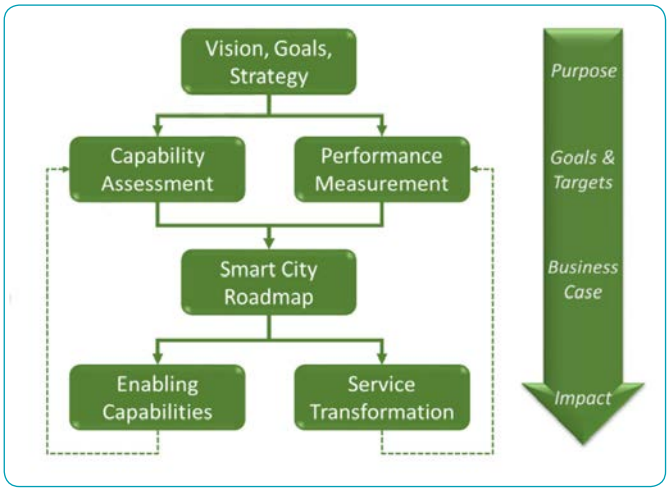

Figure 3: High -Level Strategic Roadmap

To miss the discussion at a leadership level about urban platform only risks future prosperity opportunities for a city.

3. Assessing the current state

Sound progress cannot be made through uncoordinated actions and a sense of hope, particularly on matters that are transversal. It requires an honest appraisal of the current landscape, and top-of-the-office resolve to make the very necessary step-changes in performance.

City Managers should:

- *Assess the current state of readiness of their city to address 'smart' developments in a holistic manner*
- *Assess at a high level the current state of urban platform within their city; capabilities, and technical landscape*

3.1 Current 'smart' landscape

An honest appraisal of the current state is a vital starting point from which to plan. This neither needs to be a resource-intensive nor time-consuming exercise. A pragmatic approach by individual and/or group of informed individuals from around the various functions of the city will be able to assess the position very rapidly from which priority gaps can be addressed.

A simple assessment tool is shown in figure 4 below which can inform not only the current state, also a time-horizon statement of ambition. This tool looks at the overall smart city state, rather than solely at urban platform, however it is important to set digital capabilities in alignment with other aspects.

Component	Characteristics	Maturity Assessment				
		1 Lagging	2 Developing	3 Competent	4 Progressive	5 Excelling
Leadership Environment	Providing a strong city leadership network that advocates a common vision; operates as an effective leadership team; role-models open transparent style; sets priorities; creates and maintains a coherent roadmap; and ensures city success	Fragmented Leadership	Top-down silos	Compliant	Driven Ldrshp	Sustained Ldrshp
Customer / Stakeholder Focus	A city that is built around its citizens, business community and visitors (as key stakeholders / customers); that truly understand them; engages them in an open and transparent relationship; and proactively ensures their active contribution to progress	Internal customer focus	Customer =	Customer Segmentation	Customer Focused	Customer Led
Service Enablement	Providing the enabling context for success: including policy, planning, common protocols; means of collaboration; capability / capacity mgmt.; financing; business models; procurement processes; & an underpinning operating model	Service Siloed	Cooperation	City-Wide Perspective	City-Wide Collaboration	City-Led Innovation
Service Delivery	Offering and managing quality services to city stakeholders, through direct or indirect means. Selecting the most appropriate business models and delivery agents (including society) to deliver most efficiently and effectively.	Isolated Service	Cooperative Service Delivery	Integrated Service Delivery	Collaborative Service Delivery	Service Delivery
Digital Asset Mgmt	Exploiting the power of open data sharing and modern technologies (e.g. social media, analytics, mobile, cloud, sensors) through investment in and mgmt of digital assets; including respect of privacy and digital abilities	Silo ICT management	1st steps to ICT alignment	City-Wide ICT Architecture	Reporting Data for City Purposes	Exploiting Data for Innovation
Physical Asset Mgmt	Inventorising and exploiting physical assets; for multi-purpose; managing life-cycles and investments; and integrating physical and digital assets; complete capture and open sharing of asset information	Silo Asset Mgmt	Aligned Asset Mgmt	City Perspective	Cross-Sector Asset Mgmt	City-Wide Asset Exploitation
Performance Mgmt	Setting appropriate goals and targets; establishing measures and monitoring practices; ensuring a performance culture; predictive use of data; robust public value measurement; open reporting of value to stakeholders	Low Performance Culture	Reacting to Measurement	Compliant to Goals & Targets	Insightful Performance	Predictive Value Mgmt

Figure 4: Assessing Smart City Maturity & Ambition[1]

These sorts of assessments should be performed with input from the multiple organisations that are relevant in the development of a city; across different hierarchical layers of these organisations; and involving input from key service areas.

[1] British Standards Institute, BSI PD8100 Assessment Matrix

Ambitions should match readiness. A less-developed city should take precautions not to be too overambitious in its plans

What is also important is that actions to improve particular themes (eg digital asset management) should be done in harmony with other themes. Put another way, it is unlikely that driving technology forward alone will deliver or sustain overall improvements.

3.2 The benefits of collaboration?

Businesses, residents, visitors, and indeed municipal staff expect consistency of experience in their interactions with and within a city. Indeed increasingly they expect consistency at higher administrative levels; seeing the opposite as inefficient, costly, and frustrating. With the adoption of standards for components, architectures and designs there are considerable and growing opportunities to reduce acquisition costs, manage vendor lock-in concerns, mitigate implementation and operational risks, and considerably increase the value generated from data.

There can be considerable advantages from collaborating with other public agencies. As part of the current state assessment, it is recommended that discussions take place with neighbouring cities and towns, other forms of public agency (e.g. health, environment, security), and regional bodies. So, a coordinated and common assessment, accompanied by joint multi-functional workshops (or collaboration amongst like functions between cities) is likely to deliver a more coherent overall plan.

3.3 Useful additional assets and reference materials

i. BSI PD 8100:2015, "Smart City Overview – Guide" (40 pages) includes the smart city assessment matrix shown in figure 4.

Specific tools that support deeper analysis and help close the identified gaps are in development, or being identified, including:

ii. Capabilities model ('City data links')

iii. Technology infrastructure and applications landscaping tool

iv. City Data characterization and landscaping tool

What additional materials can city colleagues offer?

4 Focus on priorities and policy outcomes

Cities cannot most effectively achieve many priority outcomes unless they understand how to best exploit data, and the role that urban platforms play in this. Constrained budgets, heightened societal expectations, and new technologies all offer motives and means to deliver better outcomes.

City Managers should:

- *Identify service / outcome priorities as a basis to steer a data and technology roadmap, linked to the city vision*

4.1 Understand the priority policy outcomes

There are many transversal policy outcomes that cities typically wrestle to address. It is because they are transversal that an urban platform can play a key role in enabling their achievement. These include:

- **Societal insights, engagement and participation:** knowing who is in the city, what they want and need,how they wish to be engaged, such that the their involvement enables a city to reduce service consumption – indeed it fosters co-production
- **Transparency:** this is a political priority in most cities involving the opening up of general information and service performance across the entire city
- **Resilience:** city resilience is a multi-faceted topic by design, requiring pan-city pan-service information
- **City assets and infrastructure:** typically cities have multiple databases on assets. A pre-requisite for exploiting the potential to use assets for multiple purposes is pan-service visibility of them
- **Procurement:** acquisition costs are a major factor of city budgets; again, typically the data for which is held in multiple systems and is structured for accounting purposes more than for service management
- **City-wide financing and value-for-money:** understanding the money flows within a city, not just of public budgets, also of other city-influenced expenditures, enables cities to make more informed investment decisions

Individual service ambitions can also importantly be supported by being far more data informed; by collecting, analyzing and sharing data more effectively. Example service area might include:

- **Transport and mobility:** where there are typically multiple providers in public and private sector across the various modes and at different spatial scales (city/region/national) that rarely share data
- **Health & well being**: where (perceived) data sensitivity and clinical preference tend to block data sharing; yet for some groups this can deliver step-change performance – if only that choice was given
- **Energy:** a value chain that is shifting from one-directional upstream driven, to two; with power shifting to the user and energy production / storage being at the 'edge'. Data is vital to enable this
- **Basic utility services:** water, waste, communications – all of which ICT plays an increasing vital role
- **Place-based safety:** where situational awareness is increasingly in the hands of the public, untapped
- **Economic prosperity:** the keystone for city prosperity, and often all too uninformed by data

Performing relatively simple mapping exercises, like that in the adjacent figure, can help cross-functional groups explore potential, align, and agree relative priorities for action; addressing both specific service domains, and enabling / cross-cutting topics.

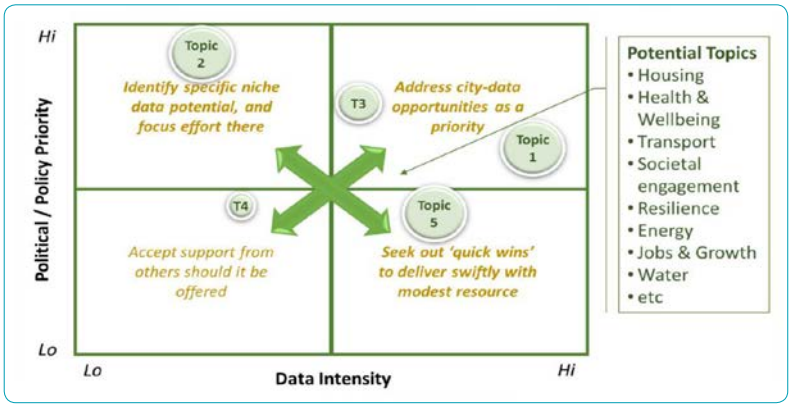

Figure 5: Determining Relative Service Priorities

5 Assess the data landscape to best exploit city data

Data is the new oil. And cities are major producers. They must learn better how to manage its value to transform service outcomes, and do so with greater resource productivity.

City Managers should:

- *Ensure capacity is in place as a matter of priority to secure appropriate management of and value from data*
- *Establish a clear and informed view of the current situation across multiple city stakeholder organisations*
- *Develop with appropriate stakeholders a technical and data roadmap*
- *Identify issues and 'blockers' to progress, and understand what can be controlled locally and externally*

5.1 Re-conceptualize the city service landscape

We tend to think in functional silos. Cities however are built of linked systems; they are deeply interdependent. This is not new news, however what is new is our abilities to exploit the city data that flows across these systems in ways that we could never do before. It requires a different perspective to be taken, and has implications well beyond just perspectives.

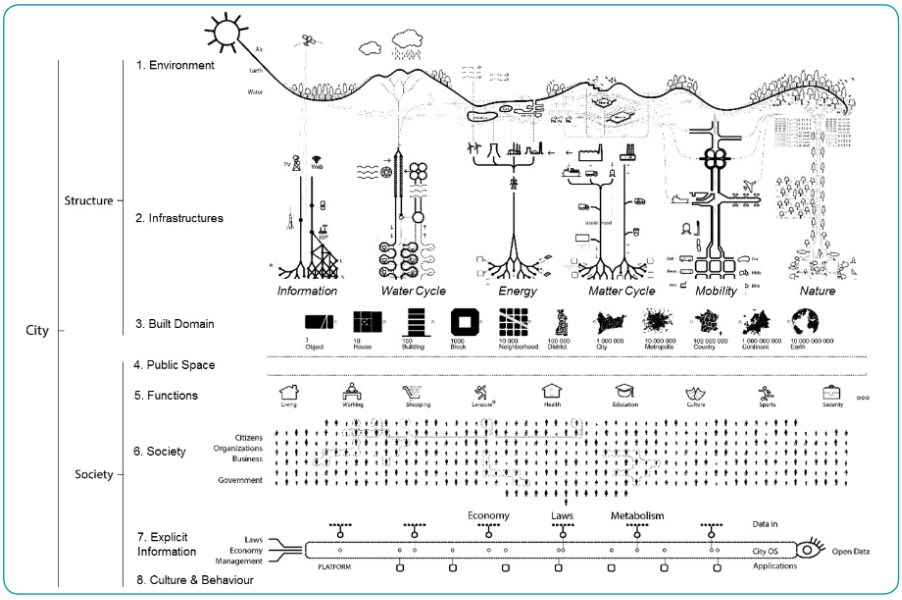

Figure 6: Systemic approach to city services (city protocol society)

The City Protocol Society depicts the various layers and cycles of a city in its 'city anatomy'[2] (see figure 6). This holistic conceptualization of a city is helpful to re-think how it operates; to reinforce the interdependencies between cycles, systems, and services. And to explicitly show the transversal nature of information – in this case recognizing things like laws, economy, and management; all of which are rich in data.

Data is the common 'oil' that flows around this system. Understanding how this will happen, and what data skills and urban platform assets need to be put in place to enable it is what we focus on here.

Taking this concept to the next level, and relating it to service management, figure 7 shows the evolution from:

- 'silo' services, within local government, local public service providers, (commissioned) city service providers, and (city) commercial enterprises
- Transitioning to connect with transversal enablers
- Towards the ambition of more outcomes based goals (the example of real-time multi-modal mobility shows how this is achieved by connecting a variety of relevant individual 'silos'.

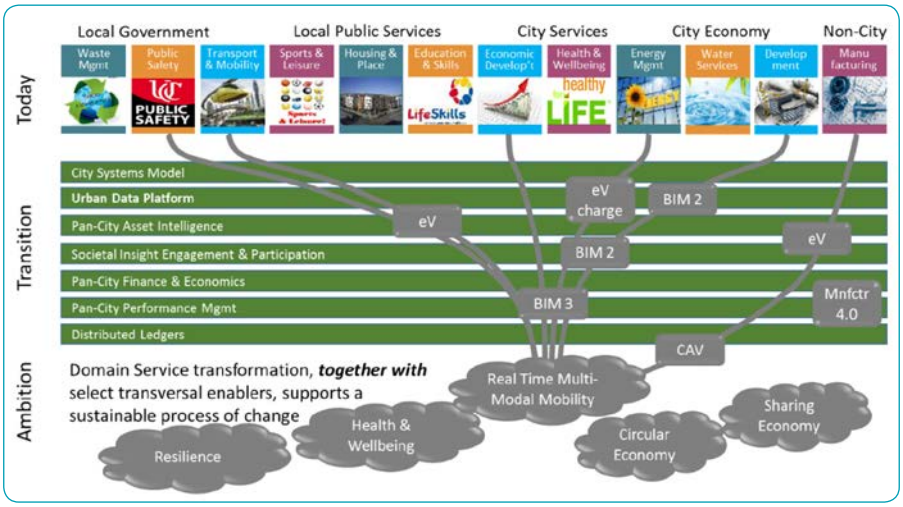

Figure 7: Transition from 'silo data' to 'systemic cross-service' data mgmt

[2] City Protocol Society: Urban Anatomy

5.2 City data mapping

City data comes in multiple forms. It extends well beyond the boundaries of public bodies. Figure 8 illustrates the "5 Pools of City Data". This is not a precise framework, however it is valuable as the characteristics and evolution of each are different and instructive to city planning. (link to City Needs Spec here also)

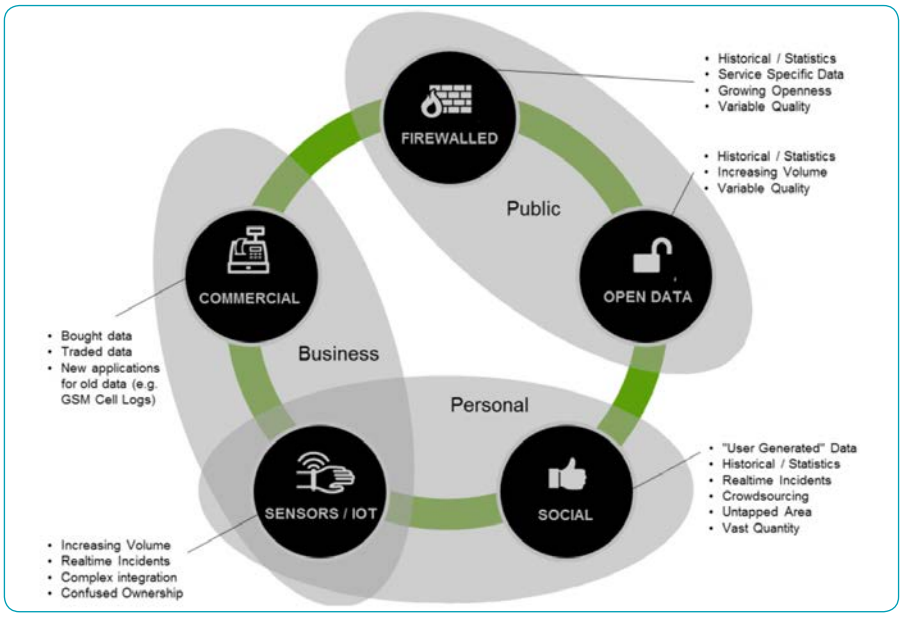

Figure 8: "The 5 Pools of Data"

1. Perhaps the largest proportion of city data resides 'firewalled' within the legacy systems of public agencies.
2. The trend is to release much of the above as open data. This is recognized and important, and receives considerable publicity, however as yet it is still a relatively small though (fast) growing portion of relevant city data.
3. With the trend to externalize city services, commissioned city service providers, utilities, and the broader business community now hold a major portion of commercial data that can play an increasingly important role in delivering policy outcomes. This typically comes at a cost, however cities are learning to be more influential about retaining or gaining access to this data.
4. Forecasts suggest that 50 billion devices will be connected worldwide by 2020. Most of these will be in cities (as most people live in cities). Thus sensor or IoT (internet of things) data will play an enormously important and fast growing role in how city services are most efficiently and effectively operated, particularly as this data is inherently structured and precise.
5. The final pool relates to societally generated social media data. This continues to grow at an exponential pace. It is highly unstructured, however it provides important societal sentiment, and thus offers real-time views on what matters to those in cities – the ultimate customer.

The contemporary issues associated with these data evolve with time.

- Initially it was just **availability of the data**. That is now less of an issue
- **Quality** still remains a matter of concern, and will continue to do so, although increasingly automated tools exist to address quality shortfalls
- **Ownership and governance of dat**a is a topic that requires increasing attention, particularly as the sharing of data across sectors and with society increases

However, two topics present particular challenges now as they often sit at the interconnection between public good and private profit, being:

- Valuation of data, which involves understanding value well beyond financial value. For instance, what is the value of air quality data that may help prevent health issues (ie personal discomfort) or premature death?
- Monetisation of data, which follows valuation, and the associated business models that manage that, is a challenge that few cities have addressed

Figure 9 Contemporary Data challenges

5.3 Data sources - linking city data to city stakeholders

For each desired outcome, there will be different levels of service(s) change required. From a data and technology standpoint this can be captured pragmatically by mapping the extent of change desired over an agreed time horizon. Figure 10 shows an example of the result of such discussions amongst the various stakeholders that are required to be involved – indicating the current and desired state (for say +3-5yrs). This assessment should be done in the context of the service prioritization discussed in section 4.1.

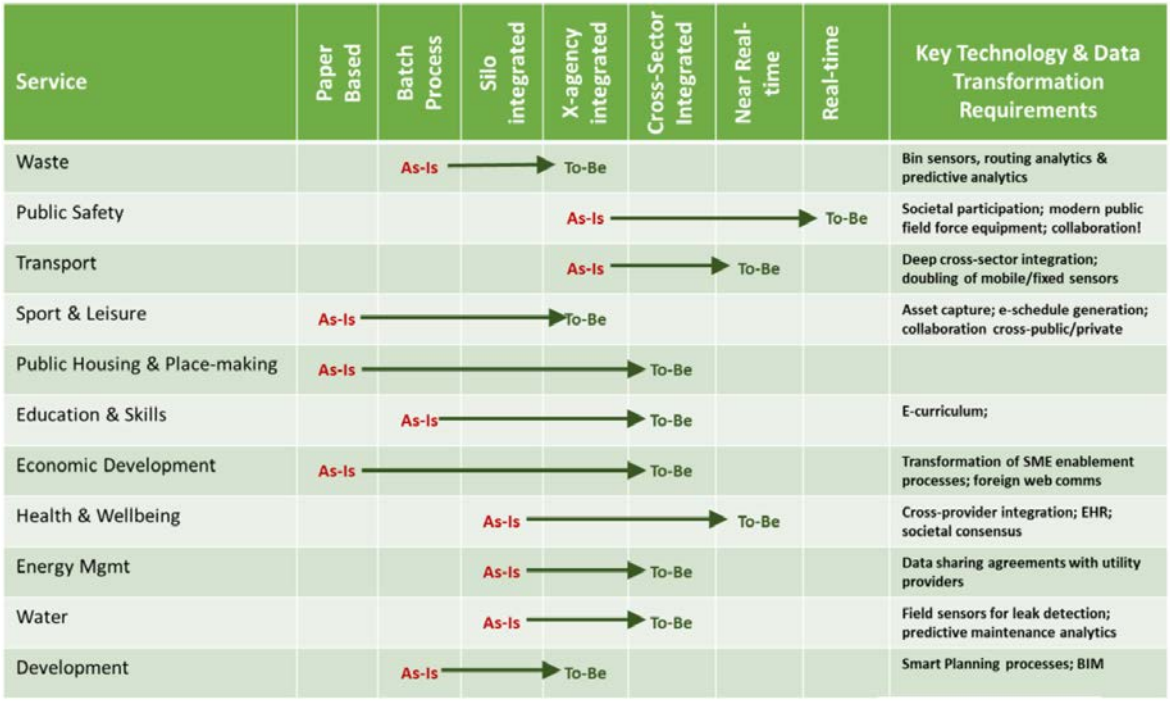

Figure 10: Assessing changes to temporal mgmt of service data

Very practically, once priority service outcomes have been determined, and ambitions set as regards the shift in how these services will operate, data sourcing can be progressed by assessing what is the most material data to support that change; who can provide it; and what characteristics and actions are necessary to manage that acquisition and its use.

5.4 Transitioning to a new technology landscape

All cities presently have some form of legacy technology. This is typically not captured collectively. However for a city to exploit data in a far better sense requires that a snapshot of the existing technology is made, in order to plan a suitable forward roadmap.

This exercise should address technologies in place throughout the architectural technology 'stack', so: base infrastructure; common cross-cutting and enabling applications; line-of-business applications; mobile and field sensing (IoT) technologies, etc. and use of cloud-based solutions.

The implementation of an urban platform is very unlikely to be a 'big bang' rip-and-replace process. It will more likely involve creating a new vision, agreeing a set of core principles, developing a future target architecture, and establishing a suitable transition process (supported by interim architectures).

The result of this process should be a clear revised technology and data strategy and plan (or 'digital transformation roadmap') that the principal stakeholders support and will adhere to.

Cities may well make a significant 'step-up' by implementing a substantial shift to new technologies on the priority "A" service areas, and at that stage establish the foundations by which further services can progressively upgrade to the new architecture and principles.

5.5 City data strategy – capturing the intent

Few cities presently have a pan-city data strategy. Such a document can provide a foundation on which the core and most important asset – the data – is managed. It should not be a lengthy dense read; that goes counter to the very dynamic nature of the market. It should be a short and agile document that is intended for regular review and update, that provide principles and broad direction for the city stakeholders to embrace and follow. In essence it should capture the culmination of the work described above.

City Data – strategy

San Francisco is actively seeking to exploit their city data. This link provides a useful summary of achievements in year 1 and plans for year 2: "Data in San Francisco: Meeting supply, spurring demand!" https://datasf.org/blog/announcing-our-year-2-plan/

6 State of the market / technical readiness

The market has been technology-led and supply-driven; it must shift to city-needs-led and demand-driven. Market uncertainty is little excuse for delay. An agile and well executed strategy beats seeking the perfect deal from the market.

City Managers should:

- *Ensure that the technology and data analytics plans match the service transformation ambitions*
- *Set up a 'market watch' role (collaborate to form one) to systematically review city needs vs tech capabilities*
- *Be proactive in exploring what future technologies might bring, yet pragmatic about deciding on action*

6.1 Market growth

Analysts forecast considerable growth in 'smart city' technologies. Analysts are generally converging at an estimated market of around $1.3 trillion by 2020, and at a growth rate (CAGR) of ~20%. This is considerable. The major areas of growth are in transport, energy, water, and buildings (see figure 11).

Analyst estimates for urban platforms however are not forthcoming. This is not surprising. Estimates, where they can be uncovered, for urban platforms vary enormously. The EIP-SCC survey conducted in Q1'15 indicated that the vast majority of cities could not or did not wish to reveal investment costs; and where costs were forthcoming, they varied from a hundred thousand euros to significant single digit millions. More recent reporting from the Horizon 2020 'lighthouse cities' programmes reinforce this cost uncertainty.

So, scope and estimates for urban platforms are expected to remain very uncertain for some time.

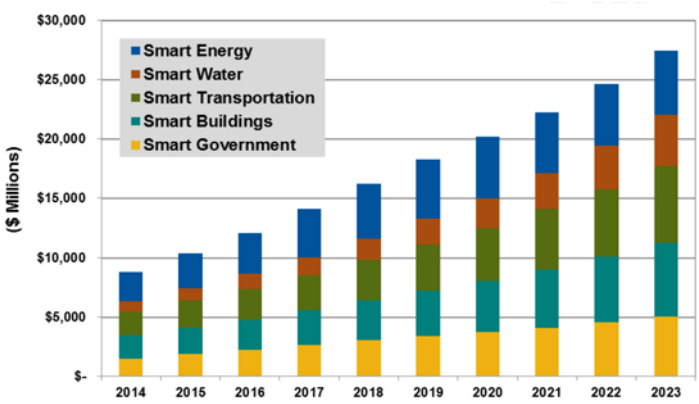

Figure 11: smart city market growth forecast (Navigant)

6.2 Demand-side developments

A number of features on the demand side are worthy of note as regards how that affects market developments in the context of urban platforms:

i. The Q1'15 EIP-SCC Urban Platform survey highlighted three key points (see insert) being issues of capacity, silos, and budget.

ii. An ISO Strategic Advisory Group (SAG) survey conducted in mid-2015 highlighted that city leaders were not engaged in the standards agenda at all. If common solutions to what are shared challenges are going to emerge, then city leaders must be more advised; and

Demand-Side Survey: "Sitting on the Fence"

The EIP-SCC Demand-Side survey elicited responses from cities with 28 million citizens from 12 Countries.

Cities appear to be "Sitting on the fence". About 75% of cities have not as yet acted on an Urban Platform, and the principal focus for urban platforms is on 'place' related services.

Feedback Suggests:

1. ***A lack of confidence and capacity** within cities is based on a poor knowledge of the urban platform landscape.*
2. *Cities struggle to get the **silos** - departments, organisations, sectors - to work together, thus prohibiting effective action.*
3. *Cities suffer **budget** and funding constraints.*

trusted neutral standards organisations would seem to be a sound source of advice – if suitable documents can be published.

iii. More than 50% of EU residents do not live in large cities; they rather live in the mid and smaller cities and towns. These are under-capacity, need assistance, and have common needs – notably in regard to digital developments. If we are to ensure we do not create a capability divide on city size, we must focus on supporting this more significant mid and smaller cities market.

iv. National city associations, as well as the European Institutions play an important role in market shaping, particularly as regards this latter smaller cities group.

v. Certain developments – for instance the GDPR (general data protection regulation) – are of particular relevance to cities, where 75% of society lives, and cities therefore play a key part in the successful deployment of such new regulations. GDPR and the like are intricately linked to urban platform deployments. Close connection between cities and the regulatory forces is important, particularly given the speed of change, to ensure that regulations are current and appropriate.

6.3 Supply-side developments

The urban platform market has been technology-driven and industry-led for a decade. That has not resulted in scale (or even significant) market adoption. In essence, an industry-led approach has proven to fail on this occasion. This is likely to have been the result of:

- Lack of knowledge on the demand side (e.g. expensive data scientists can be employed by a large industry player serving many cities, however rarely by an individual city)
- Industry has pushed technology solutions, and cities have been focused on (data related) problems
- Industry has not been sufficiently attuned to city services and how they operate (it is a new market for many industry players)
- Funders see urban platforms and data as complex, uncertain and thus risky and are unlikely to invest. (Furthermore they too often also see (smaller) cities as risky investments)
- The business case for the urban platform remains unproven

As a result industry has on occasions invested, however has often not (as yet anyway) benefited from that investment. And many have absorbed substantial sales costs in positioning product with cities: "kissing a lot of frogs"; with little reward. This situation is unhelpful for all parties: suppliers, buyers and society.

6.4 Keeping pace with technical advancements

Technologies and analytical capabilities continue to advance at profoundly fast rates; often faster than the administrative processes can cater for. This will continue to be a significant challenge.

Some of the technical advancements that are worth noting as a city goes through the process of establishing the right urban platform configuration include:

6.4.1 Mobile Technologies

Mobile and smart phones are now well embedded in society, notably in developed countries. They have reached somewhat of a plateau of development technically, however the penetration of increasingly value-adding applications continues. Examples include the multiple new applications in the arena of multi-modal real-time urban mobility and shared / peer-to-peer transport. This is one example of the evolution towards the 'sharing economy'.

6.4.2 Cloud Delivery

The move from on premise storage of data to shared cloud storage is a fundamental strategic choice a city must take. The answer does not need to be one or the other, indeed the optimum configuration may well include a mixture of data storage options to suit service, privacy and security, risk, and economic considerations.

6.4.3 Edge Technologies

The move from monolithic centralist technologies to 'edge' technologies is considerable. In simple terms edge technologies involve sensors with increasing controlling functions at the point of measurement and actuation.

This means data does not need to travel from a sensor to a central processor and back out to the field actuator. This can have considerable advantages to communication system load; responsiveness and performance; system resilience; and cost. With the exponential deployment of sensors on all sorts of things (fridges, people, vehicles, trees, etc). Assisted and autonomous driving can only be enabled through such technical advances.

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6.4.1 Communication Networks

Fibre deployment and the resulting step-wise increase in connection speeds offers enormous potential. The current shift to 5G is seen to be a major factor affecting the potential to actually use the massive number of sensors that are being deployed.

6.4.1 Predictive Analytics

Data analytics capabilities are likewise advancing at significant rates as computing power continues to increase, and prices reduce.

6.4.1 Visualisation

Cities can benefit from the considerable developments taking place in how assets and space can be modeled and represented visually. This is particularly helpful for urban planners, developers, the engineering profession, and the like. It is increasingly becoming useful to the public, for consultation purposes, with some impressive examples in many cities around the world.

BIM (building information modelling) involves the collection of information in great detail at a building level (BIM1-2), and this approach is moving outside of the building to address 'place making'. This development is nascent and important. BIM combines with visualisation to enable layered 3D views of city systems at different levels of abstraction which can be of enormous value right through the life-cycle of a place.

6.4.1 Artificial Intelligence (AI); Drones; Robotics; Nano-technology

More nascent developments continue to take place in a variety of other technical domains, which as yet have had limited impact in cities, however will most certainly do so. For instance, a patent has been filed for drone landing pads on city lampposts.

All the above emphasize the very dynamic nature of technical advances. It is within this context that city officials and their partners must make difficult choices about how best to modernise the wide variety of city systems and services. This steeps of uncertainty and risk. And that is the reality. It therefore requires considerable innovation, imagination, cross-service and discipline collaboration – and leadership – to help a city char the appropriate course.

The Urban Platform is the machinery that sits at the centre of all of these technical advancements.

6.5 The EIP-SCC urban platform initiative

The objectives of the EIP-SCC is to scale up and accelerate market adoption of smart city solutions, and demonstrate their value through seeking common (more standard) salutations, considering cities as integrated systems, and taking a collaborative approach. The "Integrated Infrastructure, Processes and Data" Action Cluster launched the "Urban Platform" initiative specifically to resolve the market gap that was identified.

The EIP-SCC is a collaboration right across the market, involving demand, supply, investors, science and (to a lesser extent) society.

In addition, the Horizon 2020 programme includes a growing number of Smart City Lighthouse programmes for which most include in scope the development of an urban platform. This brings influenceable scale. Finally, there are a number of EC projects that complement the overall development of technologies, or data.

This portfolio of action across EU cities both provides visibility of actions, an increasing pool of experience to learn from, scale to influence the market, and learning to inform policy and regulatory developments.

Continued active collaboration between EU cities and the EC, via the EIP-SCC marketplace, will address the ongoing need for market development.

7 Operating model options, trade-offs, and decisions

The business and operating model that a city selects for its urban platform will play a vital role in the flexibility and opportunities to exploit data. Scenarios must be openly explored; this is the city's decision.

City Managers should:

- *Set a clear plan to get to a decision, with the right level of analytical rigour*
- *Establish a set of guiding principles with senior staff involved in the process from across the city*
- *Ensure the capacity is in place to manage the process of developing and evaluation scenarios*
- *Collaborate with and actively learn from other cities that are in the process of, or have selected a platform*

7.1 Operating model options

Having got clarity on the current state of pan-city capabilities and assets, service and outcome priorities, the extent to which the city may collaborate with other cities, and an informed perspective of market capabilities, the next task is to develop and evaluate what development path is likely be best for the city. This is best done by developing a number of scenarios or options.

Scenarios and options should consider things like:

- The time horizon(s) that the city seeks to address
- Any significant political or physical developments in sight
- Societal expectations
- Likely technology evolutions
- Current and anticipated regulatory and policy changes
- Ownership of assets and intellectual property (IPR) considerations
- Levels of control (governance) of data
- Operating models and requisite capabilities
- Collaboration within and between public entities in the city; between cities; or with other (e.g. regional / national) public agencies
- Collaboration with the market – both local SMEs and larger
- Financing requirements and need for capital investment
- Funding mechanisms and any ambitions, policy or constraints around that (e.g. revenue generation from city data)

Emerging scenarios may include the likes of:

i. **"Big bang" implementation of a city-wide urban platform** – e.g. where the current assets may well be old, and incapable of delivering economically or reliably to current and future ambitions)

ii. **Transition path** – e.g. where considerable (recent) assets are in place

iii. **Federated or Central model** – e.g. dealing with a city containing several municipal entities and / or other public or collaborating agencies

iv. **City-to-city (or regional) collaboration** – e.g. where a smaller city or set of co-located cities or aggregation of cities/towns seek to acquire capabilities together

v. **Public Private Partnership** – e.g. where constrained capabilities or investment suggest benefits from accessing investment from industry or financiers

vi. Open Standards, or Open Source – a choice as regards the form of technical development, with considerations on flexibility and control (reliance and influence of vendors), and commonality with other market developments. NB Proprietary often big international company solutions can lead to vendor reliance ('lock-in'); open standards mitigates this and opens up greater potential for sharing; open source (i.e. 'free' software) tends to lead to a fragmented component-based solution that is highly heterogeneous offering greater potential involvement of SMEs and social involvement (crowd-sourcing). That latter offers cheaper capital investment, nimbleness, often redundancy in design, and potential for uncertainties in operations (cost, risk).

vii. On-premise vs Cloud storage – as discussed earlier, a hybrid model is also feasible

viii. City as 'platform' – whereby the city may seek to stimulate local economic development by providing a city data asset that can be exploited by others; and indeed capabilities to accompany the asset.

ix. Revenue Generator – the 'platform' model can also include the city becoming more 'commercial' and reaping revenue from its ability to exploit data to improve or create new services for businesses or society (residents / visitors).

These are not mutually exclusive, and the process of developing the scenarios itself is instructional for the city stakeholders and decision makers.

7.2 Being stakeholder aware

In developing the scenarios the city should also map out its various stakeholder groups and understand their motives and ambitions to be (or not) involved in developments. This involvement will be enabled to different extents by the scenarios and this is an important factor in the evaluation. For instance the extent of desired community involvement in for instance energy (or other resource) conservation through exploitation of smart phones and in-home IoT devised, combined with economic incentives affects the overall architecture of the urban platform and how it is implemented.

7.3 Developing a set of principles to underpin city data exploitation

The city should collaboratively develop a set of principles appropriate to their setting and circumstances. These will help guide the development path of the city's urban platform. They should be aligned with the leadership vision and service priorities. They provide a useful sense check that helps alignment across the city stakeholders, and communication beyond. Examples of some such principles might be:

1. City-needs led approach
2. Collaboration and co-creation
3. User-centric and user-value at the heart of the platform
4. Focus on data and the relative value of it; technology being the means
5. An open approach (this may be understood more as transparency, or open standards, or open source)
6. Respectful of personal privacy, and catering for personal choice
7. Compliance with data security needs
8. Affordability and value for money
9. Suitable exploitation of legacy assets
10. Modular approach to cater for transition and change founded on a common overall design
11. Nimble, agile and flexible development path to cater for the certainty of change
12. Aligned with capacity and skills to exploit

Big City – Small City Decisions

London is structurally complex with 33 boroughs, one pan-city planning authority (GLA); and multiple public bodies

Darmstadt is a 100,000 popltn city in DE, which is piloting an urban platform

7.4 Decision criteria & decision making

The city should also (together with any collaborators) develop a set of decision criteria to help address the inevitable situation where option may be or appear contrary, or where guidance is required on the relative merits of different factors (e.g. time to value). These will be city specific, however much can be learned from peer cities. Development of criteria in advance will also help align stakeholders before piloting or procurement activities are too advanced. Criteria should of course be consistent with the former materials (service priorities, principles, scenarios etc). Who makes what decision is important. The decision-making process and parties should be established with a reasonable degree of formality, and in good time.

7.5 Useful additional assets and reference materials

The following are considered as useful reference materials:

The decisions regarding business model, financing and funding are perhaps the most important ones concerning urban platform implementation as they can open-up or close-off routes to potential value.

*City Managers **should:***

- *Ensure early discussions on potential business models and financing arrangements*
- *Explore, inform and involve a potentially wide pool of investor types*
- *Not view this as a technology-only financing decisions*
- *Involve city service providers as active potential participants in the financing and funding process*
- *Consider shared investment with other cities*
- *Carefully consider funding sources and the stability and reliability of these*

7.6 Having bm&f discussions at the appropriate time

Discussion on business model and financing (BM&F) – ie the financial and value releasing aspects of an urban platform implementation – cannot be dealt with in isolation. Neither can it be left too late.

Too many cities have addressed the topic of urban platform as a technical matter, focusing solely on the purchase of hardware and software to perform specific tasks. That is a narrow and risky / siloed view.

Financing (i.e. getting the money to pay for things) and funding (i.e. the means to recover and pay back / make money) discussions and decisions are an integral part of the overall route to successful implementation, and must be factored in to evaluations during the process; not after. Not all cities have the necessary commercial wherewithal to evaluate such matters, and where this is the case external advice should be sought.

The investment for an urban platform is not profound when put in context to the operating budget for the majority of cities. It may be significant, however it is very likely a small single digit percentage of the service budgets that it enables. It is important to see things in that context.

It is also vitally important to recognize that the savings enabled by an urban platform through exploiting city data in more intelligent ways, are predominantly made within the services – not in the technology function. Those latter savings are very modest in comparison. The former, unfortunately, are rarely actually measured, and where they are, they are rarely attributed to the implementation of an urban platform. This conundrum is typical of such cross-cutting developments, and can have a major impact on the scenarios that are developed, and that actions that are taken. In too many cases, it results in inaction; or inadequate developments that erode value rather than enable value. This is precisely why the set-up discussed in the former sections is so important. The business case process and details are dealt with more in the next section, however these issues and considerations must be adequately addressed **before** going into the details of the business case.

7.7 Accessing investment

Investors and investment comes in many forms. As part of the development of scenarios the city should identify the various optional sources of finance and do some form of SWOT analysis on these. They may include:

1. Internal financing from capital budget
2. Internal financing from operating budgets (possibly shared between organisations and/ordepartments)
3. Public grant or competition funds
4. .Industry RD&I investment (typically partial, and for pilots)
5. Industry PPP (potentially bundling a number of services)
6. Market Funds (loan; project; equity; concession)

Bundling of the urban platform together with a number of services can incentivize a collaborative approach and, when well managed through to benefits realization, deliver better value. For some investors this is considered advantageous; others less so. Which is why involving potential investors early in the cycle gives time to inform and educate both sides.

Demand aggregation – i.e. sharing urban platform investment amongst public entities – can reduce individual investment (through economies of scale) and also mitigate risk.

Investor categories to be considered may include:

- EU public banks
- National banks
- Sovereign funds
- Impact investors
- Global private banks
- City) investment funds
- Pension funds
- Insurance companies
- Philanthropic
- Industry

Each will have different motives, views (notably of risk), understanding of the solution and its purpose, preferred investment / business models.

The recipient of value is often not the expender of costs. For instance: where the technical function invests and the service provider benefits; where city hall invests and other public bodies benefit; or city hall invests and industry benefits (through the liberated data). So, understanding who pays for what, and when; and who received reward, and when, is important in developing the BM&F mechanism. Also how these arrangements will be formalized and managed.

7.8 How much does an urban platform cost?

Both the EIP-SCC survey, the more recent H2020 Lighthouse cities analysis, and the EIP case studies project show that budget data is very scant. The relationship of the business model applied (financing/funding) and the city's budget estimate is reportedly vague. So any cost estimates must be treated with great caution.

Remember that in terms of the value that can be liberated, the costs will be modest, so keeping the perspective of value to cost is really important throughout the process. As is ensuring the accountability for evidencing the value sits with the business community, enabled by the transversal functions.

Data points that do emerge include:

- €100,000 for a pan-city open data store and analytics function for a large city
- €1-2 million for a mid-sized city operating platform for select services
- €5 million for a mid-sized city-wide operating and data analytics platform

8 Developing a compelling business case

The skepticism that can surround new digital solutions and the risks that they can be perceived to introduce can only be overcome by a sound value case being documented and discussed with decision makers.

City Managers should:

- *Ensure adequate capabilities are in place, and time freed up to develop a comprehensive business case*
- *Involve stakeholders and decision makers as the various cases emerge, particularly principal service providers*
- *Check that the protocols in place within the city are appropriate to the case in hand*

8.1 Why the benefits of an urban platform should not be considered in isolation

An Urban Platform tends not to deliver much visible and measurable value of itself. However it can deliver considerable value when linked to specific services; both within the service area, and particularly when working across services to deliver substantial efficiencies, or underpin a completely new operating model.

The core value of an urban platform tends to be about softer, enabling topics, like greater transparency, better quality information, the ability to open public data sets, a sense of better internal efficiency, improved collaboration – all good things; however also things that it often does little good to try to quantify financially. Unless support of these enabling benefits can be sustained at political levels in particular, the ongoing development and use of any urban platform that is put in place is at risk.

By combining a platform with a set of high priority services the constant focus on demonstrable financial value (a contemporary concern of finance director, political resource portfolio holder, and ultimately the public) can be satisfied.

8.2 The business case development process

The prior sections 6 through 8 will invariably be somewhat iterative alongside this section on the more formal process of developing the business cases – and there will be a number of cases that need to be developed over time and from different perspectives.

Each city will have protocols for development of their business case so we do not wish to suggest a specific method. What is most worthwhile doing is to ensure that the protocols in place align with the characteristics discussed thus far. If there are discontinuities, it is worthwhile raising and dealing with them openly and early. Investment and decision making processes for digital cross-cutting solutions are not necessarily business-as-usual, yet.

A practical framework to consider is the 'green book' process described in the table below. It addresses specific business cases:

1. **Strategic case** – does this fit with political, strategic, policy and other key considerations?
2. **Economic case** – have the appropriate options been adequately considered against value forinvestment?
3. **Commercial case** – has the appropriate operating and commercial model been established?
4. **Financial case** – have the necessary sources of investment been evaluated to come to a preferred andaffordable source of financing and funding?
5. **Management case** – are the necessary capabilities and processes in place to implement and ensurevalue is evidenced?

All cases consider risks.

The "Green Book" Business Case Development Process

1. Strategic Case

- Strategic Context
  - Organisational Overview
  - Current Business Strategies
- The Case for Change
  - Spending Objectives
  - Existing Arrangements
  - Business Needs – current and future
  - Potential Scope
  - Benefits and Risks
  - Constraints and Dependencies

2. Economic Case o Critical Success Factors

- Long listed Options o Short Listed (3-4) Options (incl do minimum)
- Status quo; vs do nothing option (if credible)
- Economic Appraisals of Costs and Benefits with cost/benefit analysis
- Distributional Analysis (where relevant)
- Optimism Bias adjustment o Risk Assessment
- Sensitivity Analysis o The Preferred Option

3. Commercial Case

- Procurement Strategy
- Service Requirements
- Charging Mechanism
- Risk Transfer
- Key Contractual Arrangements
- Personnel (TUPE) Implications
- Accountancy Treatment

4. Financial Case

- Public Capital and Revenue Requirements
- Net Effect on Prices (if applicable)
- Impact on Balance Sheet
- Impact on Income and Expenditure Account (if applicable)
- Overall Funding and Affordability
- Commissioner Support (if applicable)

5. Management Case

- Programme and Project Management Method (PPM) and Structure
- Programme and Project Management Plans
- Use of Specialist Advisers o Change & Contract Mgmt Arrangements
- Benefits Realisation
- Risk Management
- Monitoring during implementation
- Post Implementation Evaluation
- Contingency Arrangements

8.3 Useful additional assets and reference materials

The following are considered as useful reference materials:

- "Green Book" business case process:
  https://www.gov.uk/government/publications/the-green-book-appraisal-and evaluation-in-central-governent

9 Implementation considerations

Success rests on implementation. The best strategy and planning is only an adequate start at best. The impact of an urban platform can be profound and positive; addressing change is likely to be the principal challenge.

City Managers should:

- *Ready the organisations' for change*
- *Ensure city leaders sponsor and will actively commit to the change process (application of Leadership Guide)*
- *Establish a competent implementation team, and progress monitoring method*

9.1 Pre-procurement and procurement

In the pre-procurement process (ie sections 6 through 8) decisions will have been made as regards the boundaries of implementation.

Market testing may have been undertaken to some extent. Procurement rules vary by country / city and will steer the extent by which this is done. Typically, it is valuable as it enables a city to take the various operating models to the market (and public) for their consideration – notably as the market has a major impact in the success of implementation.

Where collaboration with other cities will occur, and / or where a major pan-city (and large city) investment is planned the initiative may have a significant impact on the supply market, notably local SMEs. This should be considered. Where potential future collaboration or service to other (smaller) cities in the region is possible, this should be considered (e.g. provision in procurement documents based on some form of stated and captured intent by others).

9.2 Implementation

Sound implementation is best supported by the captured experience to date. The table below is a summary of Critical Success Factors and "Watch Outs" from the cities that have undergone the process thus far.

Critical Success Factors (CSFs)	"Watch Outs"
• **Agile flexible development: build, test, produce, improve** • Readiness for change; within and across all affected organisations • Address and resource procurement strategically	• Never underestimate the challenge of change • Legal involvement can increase price and limit agility • Procurement as a straight jacket

9.3 Useful additional assets and reference materials

The following are considered as useful reference materials:

i. Procurement template and/or examples?

ii. What additional tools and templates can help speed the overall process, and make delivery more efficient and more secure?

iii. ESPRESSO standards mapping as input to technical specification

10 Operational considerations

The fast-moving development of technology and data analytics offers continued and significant potential for cities; however cities must remain agile and tuned to these changes, and 'future-proof' their developments.

City Managers should:

- *Introduce a regular (at least annual) and cross-functional review of the forward plans for exploiting city data*
- *Ensure value is evidenced from urban platforms*
- *Manage the engagement of city stakeholders (society, science, SMEs) to maximize innovation and local value*

10.1 Bedding the system in

Cover the likes of

Like any new asset, there will be a bedding in period

Initial proof of value

Data challenges – availability, quality, ownership/ governance, valuation, monetisation

Organisational & cultural

10.2 Continuous improvements

Cover the likes of

Continued proof of value

Agile technical advancement – innovation and experimentation process (not just hackathons!); development sandpit; build-test-embed-assess-improve

Capability development – general data skills, and specific data science

Comparison and shared learning amongst cities

Benchmarking

Experience and knowledge exchange (role of national networks; EIP-SCC)

11 Conclusions

Urban Platforms present the potential for game-changing value in cities right across Europe, enabling them to exploit city data to improve strategic outcomes. This opportunity will be magnified through the active and managed collaboration and sharing of experience and solutions amongst cities and with their partners.

Technological advances make this arena highly dynamic, which introduces both risk and opportunities. This reinforces the need for collaboration amongst cities

The market must move to be city-needs-led and demand-driven. To date it has been too supply-led and technology-driven.

Sound governance of internal processes throughout the life-cycle is vital for its success of urban platform selection, implementation and operations.

Demand aggregation through joint acquisition and shared operations amongst cities can reduce city investment, speed market adoption, share assets and learning and thus secure lower risk better outcomes.

Engagement of the investor community early is essential where external investment is envisaged.

The 'convening' role of city leaders and senior managers is vital to engage stakeholders and maximise value.

This is an evolutionary document. The intent is to continue to develop it so that it generates a compendium of useful guidance, frameworks and tools to support scale adoption of urban platforms amongst European cities, acting in collaboration. The intent is also to offer this document forward to international standards development organisations (e.g. ISO) to legitimize it and support its broader use.

The EIP-SCC provides a useful vehicle to support continued collaboration, and to share materials and learning in the process.

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