SmartImpact Action Planning Network

URBACT III

Management & Governance of Urban Data

Thematic Report

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SmartImpact

Local Impacts from Smart City Planning

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Executive Summary

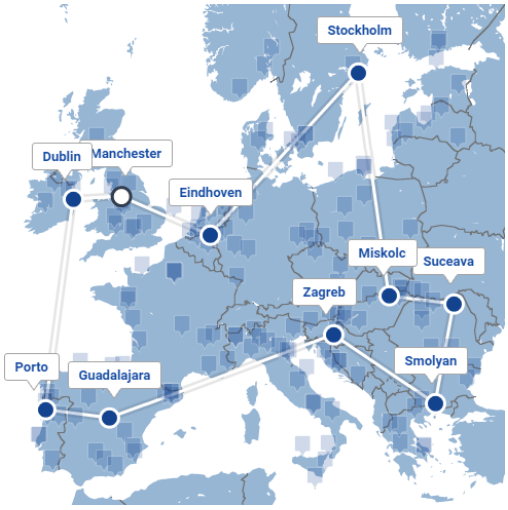
The SmartImpact network, (funded by URBACT III) aims to develop innovation management tools for municipalities to support them to finance, build, manage and operate a smart city. The focus is on governance structures, processes, business model innovation and integrated action planning.

SMARTImpact

Local Impacts from Smart City Planning

Lead Partner: Manchester - United Kingdom

Partners: Dublin (Ireland), Porto (Portugal), Guadalajara (Spain), Zagreb (Croatia), Smolyan (Bulgaria), Suceava (Romania), Miskolc (Hungary), Stockholm (Sweden), Eindhoven (Netherlands),



A key question in the process of becoming a smart city is how to setup and govern a data infrastructure that allows for the integration of multiple urban datasets and the delivery of digitally supported city services.

The SmartImpact transnational meeting in Guadalajara in October 2017 focused on the question "How can cities work with data to deliver better services, be more sustainable and grow their local economy?". The host city, Guadalajara, demonstrated how it integrates data at municipal level to improve city services like street lighting, waste management, public transportation, parking or citizen communication to the next level.

This report summarises the results of that meeting. It introduces the concept of urban data governance and shows what cities can do to manage data for the benefit of its citizens without jeopardising potential business opportunities that lie within urban data sets. The details:

- How cities can successfully set-up pilot projects on urban data
- Strategies and approaches to get 3rd parties to share their data with the city
- Ways cities can ensure ownership of the data in public contracts
- What data should be provided as open data by the municipality
- How urban data platforms can be applied for what purpose

The content aimed at city officials and policy makers who wish to improve their data governance by providing real examples of how cities can harness the potential of data for the sustainable development of the city.

1. Introduction: Urban Data Governance & Infrastructures

Smart city technologies and connected solutions offer significant opportunities to improve the efficiency of city services and to increase the sustainability of city operations. Ultimately, we can create more liveable and prosperous cities by using data and working with connected technologies. Data is a key element for harnessing the benefits of smart technologies for a sustainable development and in recent years several factors have enabled the exploitation of this potential. These are:

a) A roll-out of strong fibre optic backbones in many cities across Europe.
b) The introduction of low-cost sensor networks allows connection millions of devices and sensors within a limited geographic area e.g. Lora-Net.
c) The exponential growth of data processing and storage capacity.
d) New solutions from data-science e.g. self-learning algorithms and artificial intelligence to support patterns in large and unstructured datasets.

All of this creates a pathway to develop and operate intelligent solutions for urban challenges. By connecting technologies, devices and people through data, we not only have the potential to increase efficiency but also produce a range of wider benefits for urban societies. These benefits can translate into social, economic and environmental returns on investments and make smart city solutions attractive investments for public and private sectors alike. Solutions can range from a simple visualisation of data on a map, or the provision of online services to fully-fledged city applications that rely on real-time information e.g. virtual power plants, autonomous shuttle buses.

Figure 1 highlights different types of data uses in cities. A growing database to smart city solutions can be found at BABLE[1] and Bee Smart City[2].

Municipalities that have embarked on the journey to become data driven have found that data based solutions for cities do not automatically generate added public value. Data driven technologies are powerful instruments and can serve the owner, the developer or the operator. This depends a range of factors e.g. the design, the data, the code, algorithms as well as the data architectures.

Consequently the management and governance of data and related infrastructures, along with the technologies and services that on urban data are a key requirement for municipalities. As representatives of citizens and local communities, municipalities are mandated to ensure digital solutions improve liveability and well-being. While many large companies have shifted significant budgets to the development and operation of city solutions and built-up an impressive pool of skilled data scientists, most municipalities are still challenged to get to grips with the implications of data on their organisation, policies and operations.

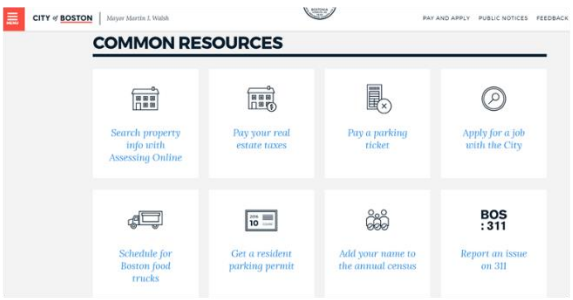
The role of a Chief Digital Officer at city level (especially for medium sized and large cities) cannot be under estimated. This is key to driving policy and strategies. Helsingborg and Grand Lyon are good examples from within the digital transition partnership.

[1] www.bable-smartcities.eu/usecases
[2] https://www.beesmart.city/

FIGURE 1: TYPES OF DATA USE IN CITIES

Digital maps

http://www.virtualcitysystems.de/en/



Digital city services

https://www.boston.gov/

https://urban-software-institute.de

Real-time information

https://gateway-project.org.uk/about/

Data-based city applications

SmartImpact member cities have defined a set of key questions on urban data governance in order to enhance the municipal levers and harness the urban value. These are:

1. How can cities successfully set-up pilot projects on urban data?
2. What are the strategies and approaches for 3rd parties to share their data with the city?
3. How can cities ensure ownership of the data in public contracts?
4. How to cities decide what data should be provided as open data?
5. What architectures and urban data platforms can be applied and for what purpose?

This document aim to elaborate on these questions.

1.1 Urban Data Systems

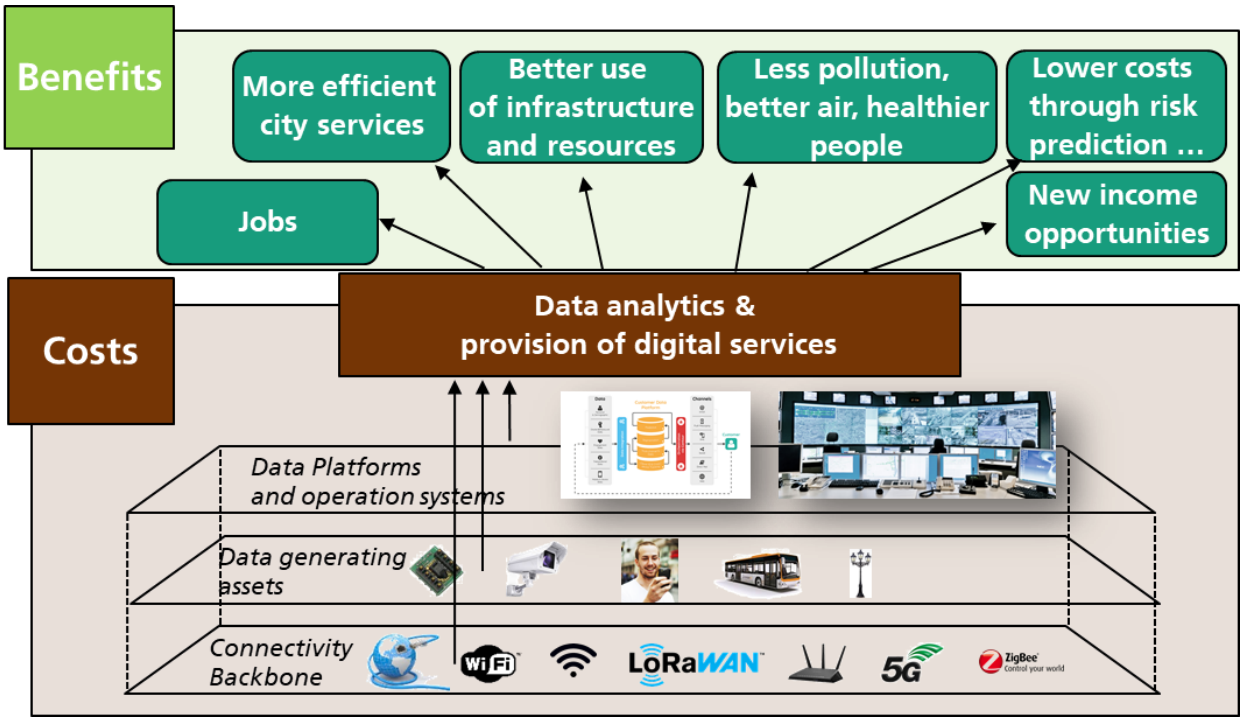
Figure 2 shows an outline structure of an urban data system over two levels: costs and benefits. The cost represents investments from municipalities and other actors needed for a smart city infrastructure and the provision of data-driven services. This is structured across three layers:

1. **The connectivity layer**: communication infrastructure such as fibre optic cables, sensor networks or telecommunication networks, along with data storage facilities like cloud servers, represent the basic infrastructure required to support data based activities.

2. **The data generating layer**: on top of the data infrastructure sits sensors and devices. These operate with a reciprocal relationship for interoperability, standards, and data transaction volume.

3. **The data intelligence layer**: all data produced from different devices is stored and processed. Smartness comes into play when datasets from different sources are brought together in a common data platform or with the purpose of providing a value-added service. To this end a common data architecture is needed. This will specify the interfaces, protocols, standards etc. for the different datasets. In addition, human or artificial intelligence is needed to make sense of the data and to identify and compute those use cases that allow city services to be operated intelligently and efficiently.

FIGURE 2: URBAN DATA SYSTEM



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While we are able to calculate the resources that need to go into the cost side of an urban data system, calculating the benefits that are created through the interaction of the three layers is more challenging. We are still lack the adequate cost-benefit analysis tools for data-drive city solutions. It is however evident that several positive effects in cities can be directly or indirectly attributed to the use of data-based solutions.

1.2 Types of City Data

We tend to think that city data sits within the municipality. This is only true for a fraction of the data produced and processed in our cities. Figure 3 shows a schematic overview over the types of data that are available in cities and their sources. These can be categorised as follows:

- **Open data**: this is all data that is (a) non-privacy-restricted and non-confidential, (b) produced with either public or private resources and (c) made available without any restrictions on its usage or distribution.

  The municipal methodologies to manage open data are an **open data portal** and an **open data policy**.

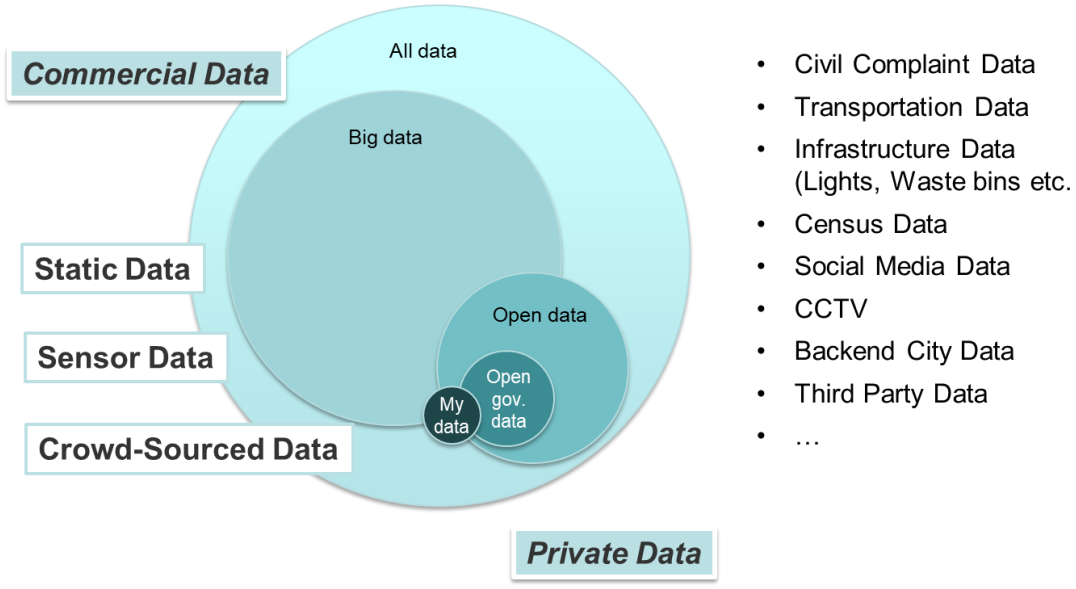
- **Private data**: this is data that is restricted and/or licensed and requires permission to be published or distributed; it includes data held privately because its value has not yet been identified. Produced with either public or private resource.

  The municipal instruments to manage private data are **data security and privacy regulations** (GDPR on EU level) as well as **authentication and access control.**

- **Commercial data**: these are all types of licensed data with a financial value for use and distribution. Commercial data may be produced with either public or private resources.

  The municipal instrument to manage commercial data are **ccontracts, licenses, data transaction platforms, and data policies** and **principles.**

FIGURE 3: TYPES OF CITY DATA[3]



[3] Source: https://social.shorthand.com/LaraSuzuki/ngfK7ll00Nf/data-as-infrastructure-for-smart-cities

1.3 Challenges to Coordinating City Data

A large amount of different types of data exist and interact simultaneously within a city. There is data that could be publicly available but is not released due to a lack of capacity to process, data that should be protected but may not be, public data that is available free of charge and as data provided as a commercial service etc. This section highlights some of the challenges to coordinate data:

- **City-wide fragmentation** in the logistical distribution of city data;
- Provision of **obsolete, non-valid, and non-value-adding** data;
- **The human resources required** to clean the data for machine processing and to ensure it is interoperable;
- **A lack of widely-accepted standards** for expressing the syntax and semantics of city data;
- The need for **policies, licences and regulations** for city data re-use and commercial exploitation;
- **Unrealistic scale ambition** for "data platforms";
- The **range of stakeholders** and delivery partners involved in the delivery of a data system and infrastructure;
- Managing the **tensions and conflicting expectations** between the providers and consumers of data.

2. Urban Data Governance

Urban data governance is the process of decision making about data-related issues that impact questions of common good, business value and civil society. Data governance is therefore value and policy driven and lies beyond just the management of data.

At the core of urban data governance lies the question of what cities can do in order to manage data in the best interest of their citizens and the public without jeopardising potential business opportunities that lie within urban data sets. This eventually leads to a fundamentally new form of public private partnerships with data as the instrument.

A strong municipal data governance system needs to help a city define answers to the following:

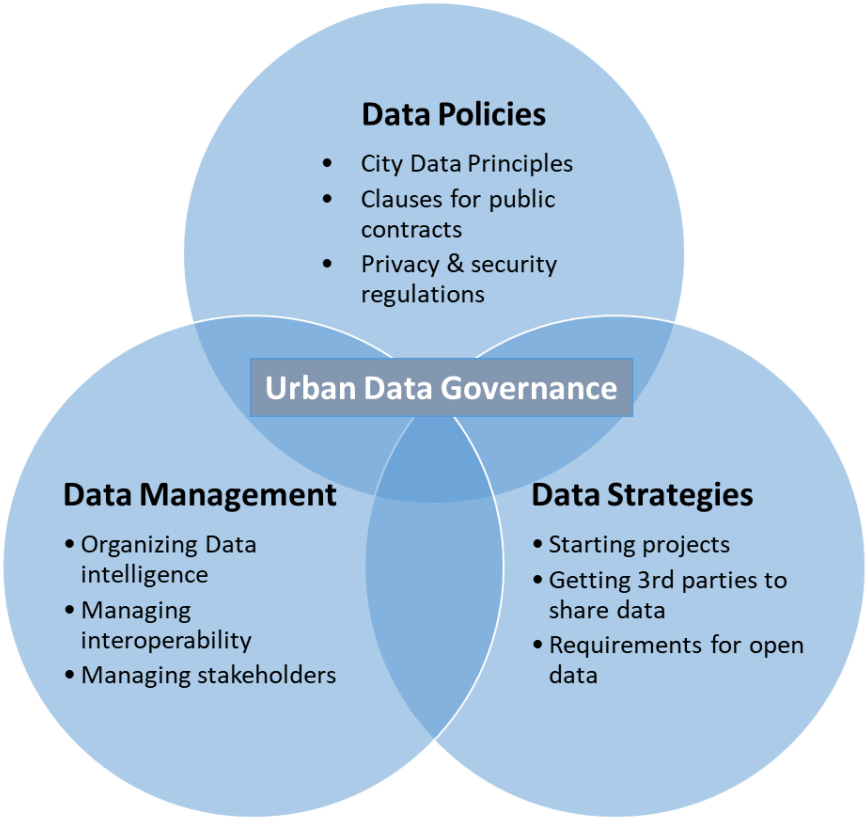
- What strategies and approaches do cities need to follow to enable 3rd parties to share their data with the city? This relates to regulations and incentives.
- How can a city remain the decision maker about data usage in public-private partnerships or in data-driven projects that impact the common good?
- What are the lines of decision making and how can cities create transparent systems that show the existing trade-offs between public- and private interests?
- What resources and skills are needed in a municipality to moderate data-related decision making?
- How can cities successfully initiate and steer pilot projects on urban data?
- How do cities ensure ownership of the data in public contracts?
- What data should be provided as open data by the municipality and how can cities arrive at a decision about this?

- How can cities embed their policy requirements in urban data platforms?

While proven concepts for urban data governance are still lacking, the insights from SmartImpact hint at defining urban data governance at the intersection of **data policies**, **data management** and **digital strategies**.

Figure 4 shows a simplified concept for urban data governance.

FIGURE 4: URBAN DATA GOVERNANCE SCHEME[4]



The following section examines each of these areas and provide insights from the knowledge exchange between the SmartImpact member cities:

2.1 Data Policies

Currently no overarching coherent city data policy exists in Europe. Municipalities have no guidance to support in how to deal with different types of data in the best interest of citizens and local communities. This is a multi-level issue as there are some issues that can only be addressed at national or even EU level. The importance of cities working with national government is crucial. However individual municipalities

[4] Own concept

have well developed data policies. However the state of play of city data policies is uneven across Europe. There are front-runners such as Grand Lyon and Eindhoven).

The IoT (Internet of Things) charter and open data principles established by SmartImpact member city Eindhoven (see below) is a good example of progress in this area and provides a blueprint for introducing flexible and locally adapted policies to deal with data and the IoT. A second prominent example of a municipal data regulation comes from the USA. In a much discussed decision, the City of New York issued a local law that requires companies operating with data to provide open access not only to the data, but also to the algorithms applied to compute digital services.[5]

On EU level, the General Data Protection Regulation (GDPR)[6] represents the current legal framework for the management and protection of data, this applies to city data too. Whilst the GDPR is a good instrument to ensure protection of personal data, it does not give any support to the governance of urban data in relation to the use of data for the provision of city services by municipalities, private companies and citizens.

The Urban Agenda for the EU[7] is a policy framework in the making. It is based on the Pact of Amsterdam and a thematic partnership process started in 2016. The Urban Agenda is also address the digital transformation of cities and may eventually provide a coherent city data policy.

2.2 Eindhoven Open Data Principles

As a pioneer of the smart society, the City of Eindhoven is address the data challenge and confronting the dilemmas that technologies bring. Eindhoven Open Data Principals seven common principles have been arrived at to safeguard public interest, stimulate innovation, foster a sustainable ecosystem of partners and encourage socially responsible business models, the. These principles are designed to be applied to the architecture of all current and emerging IoT initiatives across the city.

In order that they remain sustainable, democratic and act as a true reflection of Eindhoven's city's ecosystem, the principles were developed in cooperation with a range of stakeholders, including commercial partners (of all sizes), independent IoT developers, academic and research institutes, citizen-driven initiatives and other public organisations.

These seven principles reflect the common values of local stakeholders, contribute to the development of the city and improve the quality of life for everyone. They were drawn up by IoT parties in Eindhoven, as well as SmartImpact's UK and European partners. Smart city agents could adopt, extend and reflect on these principles when building new or improving existing IoT and data infrastructures, platforms, services and applications.

The principles are as follows:

Privacy first

First and foremost privacy for citizens and users should be guaranteed. In addition, everyone should be given insight into the data that is collected and from there, control over the way it is

[5] See: http://thegovlab.org/new-york-city-moves-to-create-accountability-for-algorithms/

[6] All necessary information on GDPR are compiled at https://www.eugdpr.org

[7] The Urban Agenda for the EU can be found here: https://ec.europa.eu/futurium/en/urban-agenda-eu/what-urban-agenda-eu

and will be used. An ethical framework should always overlay new projects that extend practices into areas not addressed by current legislation.

Open data and interfaces
Having collated and sorted the data, a Smart city can leverage real benefit by making data publicly available and enabling access to IoT and data systems through open interfaces. This openness allows the market to rush in, stimulating new business models and emerging services that rely on generating added value, rather than exploiting licenses on data or exclusive rights on the infrastructure. Creating an open infrastructure on the lowest level and making raw data publicly available, without compromises to privacy and security, will drive genuine innovation.

Embrace open standards
Wherever available, the IoT infrastructure, connectivity, platforms, devices and services should be built on open or broadly agreed de-facto standards. Using recognisable and established standards will better facilitate the evolution of that infrastructure and its resultant services. This openness also sustains a competitive market, helping to prevent vendor lock-in and ultimately improving cost efficiency. Where standards are not yet available, maintaining openness and sharing best practices will help to lay a foundation for the future.

Share where possible
All IoT and Data developments should provide well-defined, easily accessible stable interfaces for sharing and reusing existing assets. Shared use of grids, sensor networks, connectivity and software components will lower the barriers for their adoption, increase connectivity and stimulate interoperability. The IoT and data infrastructure should be available for re-use, as well as open to innovation and expansion.

Support modularity
The adoption of a modular architecture with well-defined open interfaces should be the core of any IoT or data-driven development. This modularity helps to ensure flexible growth through interoperability between platforms, services and applications. It facilitates re-use and cooperation between partners, driving efficiency and change.

Maintain security
The reliability of components, platforms, solutions and services must be constantly safeguarded. Ensuring confidentiality, integrity and availability is vital to essential services and core parts of the infrastructure, which need to be safeguarded to the highest possible degree. Continual investment and maintenance into all digital assets is a must, ensuring they remain be well protected from attack, damage or unauthorized access.

Accept social responsibility
Providing new technologies and services, collecting and combining data may result in unforeseen affects for both citizens and our society. No one collaborating in the growth of a Smart City can predict the future but they can contribute to experimentation and change.

For more information on the Eindhoven Data Principles

https://smartimpact-project.eu/case-studies/smart-society-data-charter-eindhoven

2.3 Embedding Data Requirements in Public Contracts

Increasingly municipal companies and third parties providing services to cities, generate data from their operations. Traditional supplier contracts do not refer to this type of data, leaving the ownership and rights for exploitation automatically with the third party. In this situation municipalities find themselves in the position of having to pay twice: once for receiving a service (waste management, public transportation, street lighting, parking etc.) and again for obtaining the data. In some circumstances they do not have access to the data.

Municipalities who wish to avoid the unintended consequences of an unregulated data aspect to their operations need a means to ensure their city councils agree on a contract clause which ensures use and ownership of the data. The following example is could be adapted to the specific scope of the city and the contract:

Data provision clause[8]

All data generated during the time and for the purpose of the contract must…

1. Be provided to the municipality without additional costs or licences
2. Be interoperable and provided in a mutually agreed data format *[please specify]* which corresponds to the *[e.g. Dublin]* data standard *[add reference].*
3. Be provided in full granularity (real time data wherever possible) and via a suitable API

[The city] shall be granted a non-exclusive, worldwide, royalty-free right of use to the data as to the protected and unprotected results arising from the provision of the service for the purpose of application on which the contract is based.

NB: API (Application Programme Interface)

The next step is to define individual KPI's (Key Performance Indicator) to measure the service level that is provided by the third party by referring to the data provided by as agreed in the contract. The SmartImpact partner, the City of Guadalajara provides an example of this:

Case Study: Guadalajara

The operator of streetlights in Guadalajara is required to provide real-time data of streetlights into the Guadalajara FIWARE city platform. City officials have access to the real-time information about the street lighting system of Guadalajara at any time. Each street light is equipped with a real time sensor which informs if the light is broken or out of service. The city manager has defined a KPI for the 3rd party stating that replacement of dysfunctional street lights need to happen within 24h. Based on the data from the lighting system they can measure the service level of the third party on daily, monthly or annual basis and adjust payments (according to contract) on this basis.

[8] Additional data ownership sample clauses can be found here:

- https://www.lawinsider.com/clause/data-ownership?clauses%5B0%5D=Data%20Ownership
- https://www.innovation-procurement.org/fileadmin/editor-content/Guides/Intellect_Property_Rights_guide-final.pdf

3. Urban Data Management

There is a significant amount of material on urban data management. The SmartImpact focus is the organisation of data intelligence within municipal organizations and on the integration of multiple different data-sets in an urban platform.

3.1 Managing interoperability of data-sets

The first and foremost challenge faced by cities aiming to become smarter is how to synthesise and make useful the data produced from differing formats and categories. Urban data can now be gathered from a wide range of organisations and places, it can be static or real time, public, private or commercial.

There may be substantial human resources needed to clean up the data in preparation for machine processing. Even more challenging is the provision of interoperable data sets. For example, real time data from the public transportation system indicating where in the city buses and trams are located and the speed they are moving. Linking this data to real time information from the traffic management department, predictions about arrival times can be made. However, while public transportation data may be provided in one format, the traffic management data may be a CCTV video stream. Interoperability means that both datasets would be able "to talk to each other". Open standards mean that they continue to communicate even when solution providers change in the future.

To achieve interoperability, cities need to refer to a common reference architecture as underlying design principle for any urban data platform, even for specifying data requirements towards municipal organizations and third party suppliers of data. It is typical for these reference architectures that they do not try to explain in detail the functioning of a particular system, provide an abstract description, mapped to or able to accommodate a large number of concepts, ideas, and solutions. In this way, a reference model provides a general structure and taxonomy for the ICT (Information Communications Technology) eco-system within a city. It serves as a theoretical platform which can be applied to a range of use cases and solutions.

Within the European Innovation Platform on Smart Cities and Communities (EIP SCC) several partners have joined forces to develop a reference architecture as well as design principles for open urban data platforms. In autumn 2017 the outcome of this work was released and is now becoming the blueprint for urban data platforms all over Europe. Figure 4 gives on overview over the capability map that has been drafted as key result within the reference architecture.

FIGURE 5: OVERALL EIP SCC OPEN URBAN PLATFORM CAPABILITY MAP[9]

Urban Platforms are a core building block by which cities could manage the current explosion of of city data and more easily share data between city services in order to improve outcomes for society. Few cities in Europe have implemented these. Obstacles include capacity, finance (it is an investment with an unclear business case), cross-silo breaking commitment (a leadership role) but also a lack of a practical framework that is able to safeguard universal (human) rights ensuring citizens' freedom of choice and guaranteeing privacy and security.

To make sense of data and provide better (digital) services, cities need to organise the data sets, use intelligent platforms and connect the data with real world use-cases. For example traffic control, monitoring of infrastructure, building energy efficiency etc.

Although the reference architecture is in place now[10], reference implementations are still lacking. To establish a reference implementation of an "Open Urban System" based on cities' demands and requirements, a new alliance is currently forming between key EU stakeholders, developing an open source code, Open Urban Platform Protocols (OUPP), and a list of tender-related questions on Open Urban Systems (based on the reference implementation).

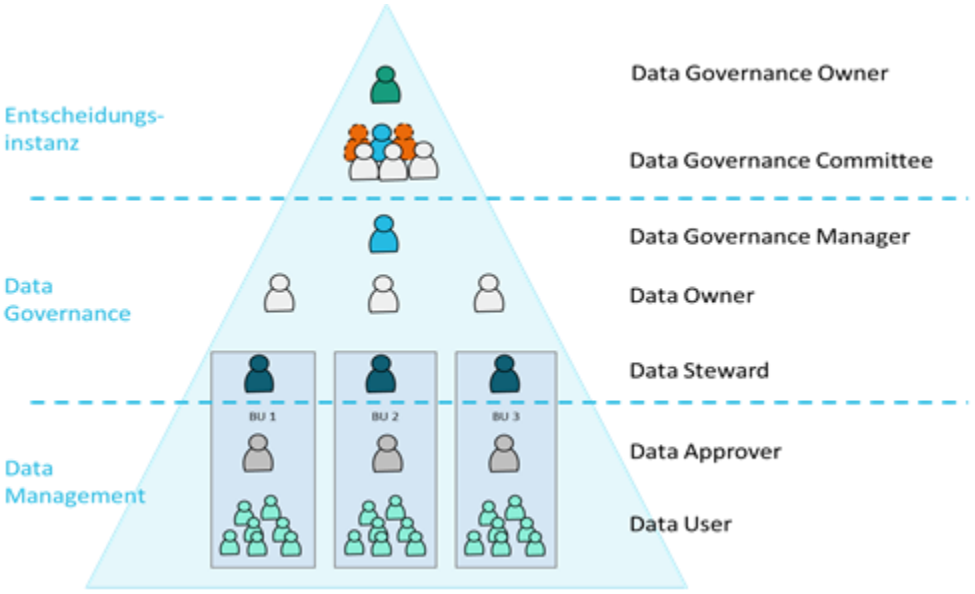
Cities planning to implement an urban platform are advised to closely follow this process and eventually implement a jointly developed open source standard urban platform that will allow them to achieve full interoperability of their data sets.

[9] Source: https://www.din.de/de/wdc-beuth:din21:281077528/toc-2780217/download
[10] See: https://ec.europa.eu/digital-single-market/en/news/din-releases-free-download-urban-platform-standard-promote-smart-cities

3.2 Organising data intelligence

In many cities the ICT department is the key department for management of data. ICT departments were originally designed to manage hardware and software for the other departments. When data intelligence comes into play a strong collaboration between several entities in the city is required to identify opportunities, take decisions, operationalise data and provide new digital services to citizens. Table 1 shows an example role-based actor setting for being able to deal with urban data in an integrated way:

FIGURE 6: ROLES AND COMPETENCES NEEDED FOR ORGANIZING MUNICIPAL DATA INTELLIGENCE[11]



3.3 Strategies for Utilising Data

It takes a long time to change policies within organisations. However there are already several practical ways municipalities can best use of data for city operations and services. It can also be useful to have break downs of data by gender, particularly around access and usage. For SmartImpact partners it proved to be a helpful exercise to exchange strategies on how to get a pilot project on urban data off the ground and how to get third parties to supply their data to the municipality. The following sections are summaries of two roundtables on these two topics.

3.4 Methodology for Starting a Pilot Project on Urban Data

1. Identify and describe the problem you want to solve / a job you need to get done, ideally by involving stakeholders from your community. Make sure you have political buy-in.
2. Once you have identified and specified your problem, define the scope and the timescale for the project. Appoint a problem owner.

[11] Source: Fraunhofer IAO

3. Try to secure a (small) budget for experimenting (e.g. using pre-commercial procurement or market consultations as mechanism).
4. Define criteria: what is in scope, what is out of scope
5. Ask questions about the data you want to collect: How will data help you solve the problem? What data do you need for this? What of this data already exists? How can you access it? What data has to be generated additionally through the project? Who will be using the data?
6. Release an open call for solutions to your problem: be broad and open with this. Utilize open marketplace platforms for this to reach out to innovators.
7. Scope it small. Keep focus.
8. Make sure the project is time limited. Use it as demonstrator. Track success by defining the right KPI's.
9. Align with existing platform but be open to adapt for the future
10. Define the data formats and standards
11. Sign-off – ownership

A good examples for data-based pilot projects are the SBIR project in Dublin https://smartimpact-project.eu/case-studies/smart-dublin-small-business-innovation-research-sbir-programme/ .

4. Ways to Persuade Third Parties to Share their Data with the City

To a large extend city data does not equal municipal data. In any larger city there are numerous sources of relevant datasets, which do not pertain to any city-related actor or institution; for example:

TABLE 1: EXAMPLES FOR 3RD PARTY DATA IN CITIES

• movement data from in-car navigation systems,
• distribution data from logistics companies and retail,
• real-estate and rent data from rental platforms like Airbnb or Booking.com,
• data on private (or even public) events
• data from private CCTV cameras,
• data about energy and resource consumption from private companies,
• mobile phone data,
• data from wearables and smart watches
• data from bike and car-sharing schemes
• data from construction sites
• consumption data from restaurants, bars, clubs, shops
• health data from hospitals
• transaction data from credit card companies
• risk-related data from insurance companies

To improve city processes and operations it is crucial to have access to the relevant data sets. Numerous municipal services can be optimised when a (sometimes light) municipal data set is augmented by rich third party data. Because the relationships between municipalities and potential providers of data are as diverse as the nature of different datasets, strategies are often required to convince third parties to share their data. During the SmartImpact workshop in Guadalajara the following options were:

1. Identify and map your third parties. Who can provide what type of data e.g. energy, environment, transportation, production, waste, labour markets, housing etc.?

2. Understand how you/the city can provide a benefit to the data generating company. What's is in it for them?

3. Provide incentives for voluntary data sharing (e.g. tax reductions or access to restricted municipal data).

4. In some cases it may be appropriate to purchase data from third parties. The costs and benefits need to be assessed carefully.

5. Some cities have experimented with urban data transaction platforms. These allow trade and exchange of data on an open marketplace.

6. Provide the city (public space and public infrastructure) as a testbed to create and analyse data. This is often referred to as a Living Lab. Many companies are keen to trial new data-based services and business models. Make sure you also receive access to the data.

7. Create "Data Partnership Agreements" between companies, the municipality and research institutions to ensure added value from the data and to develop pilot applications. This can provide value to the company and the city. The requirement for receiving the value is that the companies share their data.

8. Provide checklists, APIs and pro-formas for data sharing. Make it easy to share.

9. Use incentives and deregulations to get access to data e.g. on energy consumption of buildings (Tokyo) or shared bikes used in the city (Manchester).

10. Make the provision of data a condition for all city-related contracts e.g. providing licenses, concessions, selling or renting land, awarding contracts etc. For example, mobile phone data allows walking data to be used for mobility planning, but when the licenses are handed out by national governments they do not require the networks to make it available to municipalities who then have to pay to get back data that should be available for free in anonymous form. This raises the concept of data commons.

5. Knowing What Data to Provide as Open Data

Recently open city data was the most important concept for city digital officers. Open data platforms have been created in several cities throughout Europe consuming a considerable amount of resources (staff resources and finances). In addition to the intention of providing open citizen access to city information, many open data officers hoped that a local innovative start-up might be able to invent applications or even the next big digital business using the data provided.

Today we know that only a fraction of the data provided on the open data platforms has generated a notable amount of downloads and only a very limited amount of data-sets has been used to create city-related IT applications. The most prominent ones are mobility planning assistance that build on real-time data from the public transportation system.

Municipal costs for providing open data and benefits from the use of open data do not seem to be in balance. This imbalance is increased by the fact that only high quality data (machine readable, interoperable, clean, provided via an API, etc.) generates actual value for citizens, local companies or the creative ecosystem. High quality data requires a huge effort in (often still manual) to clean and refine.

Taken together, these findings suggests that cities increasingly need to find smart ways to decide which data to publish openly.

The example from Eindhoven demonstrates ways to drive towards open data. Helsinki is also well known for its open data policies and also the way that this has helped develop the start-up ecosystem. The Helsinki Region Infoshare (https://hri.fi/en_gb/) publishes all of its data in formats that make it easy for software developers, researchers, journalists and others to analyse, combine or turn into web-based or mobile applications that citizens may find useful. In four years of operation, the project has produced more than 1,000 "machine-readable" data sources such as a map of traffic noise levels, real-time locations of snowploughs, and a database of corporate taxes. In Manchester, the CityVerve project is working on a similar data platform.

Overall The SmartImpact cities concluded that cities by default should release data that is

a) Trustworthy
b) Up to date
c) And all other data “unless there is a good reason not to”

The intricacy lies within the definition of “usefulness”. While SmartImpact member cities agreed that we should not define “usefulness” of data ex ante (great ideas for the use of data often emerge out of applying the data), there needs to be some cost benefit analysis associated to providing open city data.

The resources used for open data need to sit in a reasonable relationship with the value that is expected to be created. This is often impossible to know. Cities need to publish a core set of data with good APIs (e.g. transportation data) and create a process that enables stakeholders to request access to city.

For example, this process could consist of a simple **list of data sets published on the city open data portal** and a **request button** or **dialogue opportunity** next to the datasets. Analysing the numbers and types of requests helps cities to focus resources on the refinement and publishing of those datasets that correspond to a demand.

Another tool for deciding on open data comes with General Data Protection Regulation (GDPR). GDPR a new powerful EU regulation on data privacy and security and will shape our future relationship with data. Personal data, or data that may be related to individuals need to be protected in a robust and rigorous fashion. Although GDPR for many city officials is an immediate challenge, it can help municipalities in defining and prioritising datasets for publishing. By conducting a privacy impact assessment (PIA) on the data before publishing, cities will be able to prioritise their list of datasets. Legally, personal, identifiable data cannot be made publicly available. It is crucial therefore to understand the data and for datasets to be classified / mapped.

The Digital Transition partnership under the urban agenda published its draft Action Plan in spring 2018 (https://ec.europa.eu/futurium/en/system/files/ged/full_draft_action_plan_05feb18.pdf The objective is to provide improved public services to citizens, to support European cities in exploiting the possibilities of digitalisation, and assist European businesses to develop new innovations and create new business opportunities for global markets. It included specific actions concerning data:

6. Conclusions

While the amount and complexity of city data is increasing exponentially, we still lack important tools to govern and manage data for the provision of value-added city services and for the improvement of existing city operations.

Municipalities have no guidance to support in how to deal with different types of data in the best interest of citizens and local communities. This is a multi-level issue as there are some issues that can only be addressed at national or even EU level. The importance of cities working with national government is crucial.

SmartImpact cities like Dublin, Manchester, Eindhoven, Miskolc, Porto and Zagreb show that creative approaches to the governance of city data ultimately leads to more efficient city services and a more sustainable urban development. Among the most important tools to govern urban data are:

- The use of open data principles as a policy instrument
- The embedment of data requirements in tenders and public contracts
- The introduction of interoperable data platforms based on open standards
- The organisation of data intelligence within the municipality

Progress has been made to utilise and integrate data from various sources for building smart cities, but cities still lack an adequate understanding of the rationale between costs and benefits that are associated with urban data. Future research needs to address this and provide adequate cost-benefit analysis tools for city managers in order to assess the impact and value of investment in urban data.

References

1. Barbosa, L et. al. (2014) “Structured Open Urban Data” Big Data. Copyright 2014 Mary Ann Liebert, Inc. http://liebertpub.com/big, used under a Creative Commons Attribution License: http://creativecommons.org/licenses/ by/3.0/us/ http://online.liebertpub.com/doi/pdf/10.1089/big.2014.0020
2. BABLE (2018) - www.bable-smartcities.eu/usecases
3. BEESMART (2018) - https://www.beesmart.city/
4. European Commission (2018) “GDPR Portal: Site Overview” https://www.eugdpr.org
5. European Commission (2018b) “Urban Agenda for the EU” https://ec.europa.eu/futurium/en/urban-agenda-eu/what-urban-agenda-eu
6. Kitchin, R. (2014) “The real-time city? Big data and smart urbanism” GeoJournal February 2014, Volume 79, Issue 1, pp 1–14; https://link.springer.com/article/10.1007/S10708-013-9516-8
7. Law Insider (2017) “Data Ownership Sample Clauses” https://www.lawinsider.com/clause/data-ownership?clauses%5B0%5D=Data%20Ownership
8. Meijer, A. Rodriguez Bolivar, M. (2015) “Governing the smart city: a review of the literature on smart urban governance”, International Review of Administrative Sciences 2016, Vol. 82(2) 392–408 http://journals.sagepub.com/doi/pdf/10.1177/0020852314564308
9. NYC Committee of Technology (2018): *„NYC regulation on automated decisions systems used by agencies“* http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=3137815&GUID=437A6A6D-62E1-47E2-9C42-461253F9C6D0
10. Procurement of Innovation Platform (2017) “Introduction to intellectual property rights in Public Procurement of Innovation” https://www.innovation-procurement.org/fileadmin/editor-content/Guides/Intellect_Property_Rights_guide-final.pdf
11. Rathore, M. et. al. (2015) “Urban planning and building smart cities based on the Internet of Things using Big Data analytics” Computer Networks, Volume 101, 4 June 2016, Pages 63-80 http://www.sciencedirect.com/science/article/pii/S1389128616000086
12. Suzuki, L.C.S.R. (2015) "Data as Infrastructure for Smart Cities", PhD Thesis, University College London'. https://social.shorthand.com/LaraSuzuki/ngfK7ll00Nf/data-as-infrastructure-for-smart-cities
13. Verhulst, S. (2017) “New York City moves to create accountability for algorithms” Govlab Digest, 19.12.2017, http://thegovlab.org/new-york-city-moves-to-create-accountability-for-algorithms/
14. Draft Digital Transition Plan https://ec.europa.eu/futurium/en/system/files/ged/full_draft_action_plan_05feb18.pdf