

Smart booklet Urban Sharing Platform

Let your smart data sources come together and give you the bigger picture

TABLE OF CONTENTS

The value of implementing a USP for cities	3
Sharing Cities solutions	5
Does a USP respond to my needs?	7
Technical options	8
Funding and financing	11
Common challenges and recommendations	13

List of acronyms

API	Application Programming Interface
DSM	Digital Social Market
GDPR	General Data Protection Regulation
IoT	Internet of Things
SaaS	Software as a Service
SEMS	Sustainable Energy Management System
SEPS	Sustainable Energy Planning System
USP	Urban Sharing Platform

LIGHTHOUSE CITY KEY

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This booklet was prepared through the collective knowledge from Sharing Cities and building on the experience of the wider context of the SCC01 Lighthouse programmes involving 17 projects, 116 cities and hundreds of partners. More information about the Lighthouse programmes can be found <u>here</u>.



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THE VALUE OF IMPLEMENTING A USP FOR CITIES

WHAT?

An Urban Sharing Platform (USP) is a data platform which integrates a range of data from different sources, such as smart lampposts, smart energy meters and mobility sharing services. A USP collects and processes raw data to create 'smart data' which creates new insights and information for cities. This can be used to make informed decisions enabling cities to allocate resources more efficiently and improve quality of life for citizens.

A USP helps to build an integrated smart city by digitally integrating a wide range of Information and Communication Technology solutions in urban areas.

WHY?

A USP is imperative within a smart city vision. A USP equips a city with the tools it needs to manage the vast quantities of data created by increasing digitalisation and expanding Internet of Things (IoT) devices.

A USP provides real-time and forecast information gathered from sources such as sensors and smart devices to enhance monitoring and decision making and deliver new or improved services with greater efficiency.

A USP enables information sharing by providing public authorities and citizens with an interoperable platform based on open standards.

A USP provides data storage facilities as well as components for analysing, processing and refining data to create new added-value information. It will eventually offer the possibility of creating a data marketplace to drive city-wide innovation.

A USP also enables and supports the secure exchange of information, as well as privacy and data protection, with respect to European and national regulations.





Enabler for several emissions saving services (SEMS, DSM, SEPS, etc.), maximising their potential

Measure, track and improve the environmental impact of all smart city measures

VALUE Emissions savings



Open data empowers citizens Enabler for open digital ecosystems Secure exchange of information together with privacy and data protection



ECONOMIC VALUE

Smarter governance

Evidence based decisions

Business development and innovation opportunities



CAPABILITIES OF A USP

- » A USP can support real-time data collection from field sensors, devices (connected objects) and platforms that collect data from other IT solutions, or potentially other USPs. At the same time, it provides components for data storage and analytics.
- » A USP can support public engagement by enabling the development of information visualisations, city dashboards and applications for citizens to exploit data collected and processed through the USP.
- » A USP enables the creation of federated ecosystems of open, multi-stakeholder service environments, thus enabling digital interoperability between different players to effectively support the smart city.

SHARING CITIES SOLUTIONS

A USP gives cities better data. It makes existing data easier to understand, combine and visualise. It also combines and delivers data in real time, so that you can respond better to live events and have solid information for on the spot decisions. It allows you to share certain data with citizens and other partners, so that you more easily provide useful information, invite participation and stoke innovation.



The Milan USP is the result of the incremental integration and enhancement of three existing solutions:

- » the Monet EMS component by Siemens Italy;
- » the Interoperability Platform of Milan;
- » the E015 Digital Ecosystem national initiative.

The USP combines these components for an overarching IT solution that provides full support to the needs of the different smart interventions that Sharing Cities is creating in the city, in particular:

- building retrofit (acquisition and elaboration of data from sensors deployed in private and public buildings);
- » smart mobility and e-logistics;
- » smart lampposts.

Thanks to the USP, end-user applications such as the service layer can access project data in a seamless and homogeneous way via a single Application Programming Interface, or 'API.' An API is a technology that links users or computers to databases, while controling which kinds of access different users can have.

The Milan USP adopts an ecosystem-based approach in line with the latest API trends. In particular, the USP enables interoperability – both at technical and business level – between different entities through common guidelines, technologies, standards etc. that can foster participation of stakeholders from both the private and the public sector.

Milan's USP has a special focus on governance processes, in particular those involving the city administration. Also central is the replicability of the model by other initiatives and cities, as well as sustainability over time, so that, by design, the USP has horizons well beyond the scope and duration of the Sharing Cities project.



The USP in Greenwich and wider London has demonstrated that data from a broad range of suppliers can be shared to monitor, analyse and visualise the impact of smart city solutions, and offer greater insights to inform policy and improve services. Data sources and services currently integrated into the London/Greenwich USP include smart parking sensors, e-bikes, electric vehicle charging and sustainable energy sources.

The 'London DataStore' lets local authorities see things like readings for each of the city's sensors, or combinations of these sensors, over the past few weeks, months or years. It can do the same with data shared by other partners through data sharing agreements. This 'metadata,' descriptions of data and links, is supported by a cloud-based database, rather than being kept in the city's servers. This system took six months to develop and has been operating for two years.

The USP is also able to support and integrate more advanced analytical modules such as the London/Greenwich SEMS, which will be able to draw on the data held in the USP and use the USP to communicate its suggestions for the most efficient running of energy systems to assets on the ground. The USP in Lisbon easily integrates data from a broad range of sources, including: smart parking, e-vehicles, electric vehicle charging, energy consumption sources (e.g. public buildings, personal consumption, aggregated city energy consumption, street lighting), waste collection, and information from the city bike sharing system.

Through the USP, different service providers, using different interfaces, can easily access information from a range of sources and put it together regardless of the original format of the data.

A good example is the Lisbon Digital Social Market (DSM) mobile application, which is an app designed to promote sustainable behaviours among citizens. This app takes data about energy use from all kinds of sources, anonymises and combines it, and lets individual users see what is relevant to them.

Other services, such as the city's Sustainable Energy Planning System (SEPS), get information from the USP. SEPS processes energy information and correlates it with other data to offer the city a single and integrated energy portal. This is used for KPI calculation and can visualise the data according to the city's needs.

Lisbon's USP focuses on aggregating data, providing ease of access and making sure that data is reusable. The solution brings together a wide range of stakeholders, such as data providers, service providers, citizens and municipalities.

The USP in Lisbon includes a real-time IoT broker called SmartIoT (<u>https://iot.alticelabs.</u> <u>com</u>). This is connected through an API to different data providers, service layers and dashboards. It was implemented by Altice Labs, a Sharing Cities partner.

DOES A USP RESPOND TO MY NEEDS?

Your local context, including legislation and cultural conditions, affects the kind of USP that is ideal for your city, and the adjustments to the standard model that you may have to make. Here is a brief overview of key factors you will have to consider when planning your approach.

National as well as local polices and The needs and preferences of citizens legislation need to be considered as should be considered when planning Early consultation context for your USP design. Elected USP. a and representatives and city officers are engagement is advisable with a cokey stakeholders to be engaged. creation approach being especially valuable. Political leadership Security Governance Lifestyles Smart city & data strategy Demography Citizen engagement Cultural heritage Legal and regulatory **SOCIAL &** POLITICS, POLICY & REGULATION CULTURAL CONDITIONS CITY ECONOMIC 'PHYSIOLOGY' PERFORMANCE Climate Market readiness Assets and infrastructure Technology Natural assets Performance Investment Geography Appetite for risk and innovation Sharing Cities. Through Entrepreneur ecosystem Milan, London and Lisbon deployed Data is increasingly a key resource solutions, measures and devices for a city and a USP can help to which produced data intended use that resource by fostering the for ingestion into the USPs. By development of an interoperable

for ingestion into the USPs. By integrating those, new insights could be rapidly provided quickly showing the value of a USP. This value is then expanded by the addition of new sensors and devices from which further data is integrated.



system between the private and

public sector, offering an interesting

set of data that can create added

value. An example of such added

value would the sharing of mobility

data between cities and transport companies to serve the public more

efficiently.

TECHNICAL OPTIONS

A USP integrates a considerable variety of data available from many different sources, through a federated open API approach. This approach unlocks the potential of city data and makes disparate data more readily available for use and reuse by a greater range of stakeholders, again through open APIs.

To facilitate the creation and evolution of a USP for the three lighthouse cities, a reference architectural model was needed that provided a template for each city's design and architecture, as well as a common vocabulary with which to discuss implementation, aiming to stress commonality and sharing of functions and components. For this reason, partners created a common USP reference model.



The main elements of the Sharing Cities USP

Sensing

 » Data to populate the platform must be collected. The data comes from any measure or solution that



produces data and is able to communicate this data to the USP (sensors, IoT devices, gateways, etc.).

» Data from third party platforms (e.g. car or bike sharing schemes) can also be integrated to populate the platform with more data to be processed.

Sharing

»

This layer supports the seamless sharing and presentation of platform information and functions



with city stakeholders (citizens, city managers, commerce etc.) with a variety of tools: API and service marketplace, business intelligence capabilities, data visualisation and dashboards.

Interoperability and open APIs

The platform should support » ingestion of data from applications and devices using continuous or non-



continuous connectivity in real time.

- The platform should provide processing » and analytics capabilities to allow the city and citizens to consume and refine information.
- platform must provide The open » interfaces to ensure interoperability with applications, devices and enablers. APIs are provided to support standard interfacing with the platform.
- This layer also encompasses supporting » functions such as identity management, service brokering, service monitoring, integration with external cloud-based 'XaaS' features which allow anything, from mobility to software, to be delivered as a service.

The basic functions and stages of implementation of the USP have been broadly consistent across the three lighthouse cities. First, the parts of the USP, such as the search and indexing function, were introduced one by one.

Data

A core function of the USP » is a data storage and analysis capability which facilitates the processing and fusion of raw data into smart insights.



Support services

Transversal services » are needed to globally support the operation of the USP, such as governance processes,



federation mechanisms and data protection.

Next, different data sources, such as energy consumption data from public buildings, were added to the system one by one.



The aim in London is not to create a single 'data warehouse' or 'data lake', but to develop a central register of data (including metadata, links, URLs and data sharing agreements). Work has focused on building on the London DataStore to develop:

- secure sharing features (or metadata » and/or the data itself)
- upload API, so that datasets can be » updated automatically
- query API so that data visualisations, » tools and dashboards can be driven by the original data

Near-real-time data is available from a number of the smart mobility and building retrofit interventions and this is being collected into a single cumulative database with an open API.

The platform in Lisbon under the Sharing Cities project is based on what is gradually becoming a product, the smart cities solution from Altice Labs.

Its main components are: an IoT broker (SmartIoT) for real-time data ingestion and aggregation, a data management component (Dataplaxe) for data storage and analytics, a KPI and dashboard layer (City Governance Centre) that allows city visualisation of data, parameterisation of rules and performance of different infrastructures in order to promote urban space management based on knowledge.

Additionally, there is an adaptation layer for data provider transformation and a city multitechnology gateway for integrating sensors at the edge of the network.

Together, this set of components composes the smart cities solution from Altice Labs that will sustainably support the creation and development of urban intelligence and will allow the development of specific applications for the various domains of operation. The main objective is to cope with the new challenges of cities by presenting solutions that will improve people's quality of life and to create more modern, efficient and sustainable cities.

All components have clear and well-defined APIs and most are cloud based, which makes the product more flexible, modular and easy to operate with other vendors' solutions. The municipality of Lisbon procured a City Operations Centre which will be provided by NEC utilising its Cloud City Operation Centre platform.

Under the Sharing Cities pilot Altice Labs is integrating city information provided by the Portuguese partners into the IoT broker and making it available to other services developed in the project, e.g. DSM, SEPS and Service Layer/Dashboard.

Since the beginning of the project, Milan partners aimed to give extra value to existing infrastructure and investments planned in the short, medium and long term, in particular the Monet EMS component by Siemens Italy, the Interoperability Platform of the city of Milan, and the E015 Digital Ecosystem initiative.

Each of these solutions has further evolved during the project, according to an open approach based on APIs and in line with the IT strategy of the respective providers.

The Milan USP is composed of a set of components (mostly open source) that support the full path from ingestion of raw data from sensors to presentation of elaborated data to end-users. In particular:

» The Monet EMS solution is in charge of ingesting part of the data available from the field (e.g. energy data from buildings). Other data sources are capable of providing

their data via APIs (e.g. bike sharing service, smart lampposts) that can be directly integrated into the USP.

- » An API-based integration mechanism is in place between Monet EMS and the Interoperability Platform of the city of Milan.
- The Interoperability Platform provides several functional components to store, process and manage data, including support to publish and subscribe, API registry and portal, monitoring, analytics, and authentication and authorisation mechanisms for users and applications.
- » The Interoperability Platform is integrated with the E015 Digital Ecosystem to take advantage of specific APIs already available in the ecosystem. It will also be possible to share the data created by the Sharing Cities project in E015.

OWNERSHIP

Platforms can be owned by the city, either entirely or within a public-private partnership.

The data collected can be owned by the city or the companies that deliver a service. All sets of data can be either shared openly or restricted to the municipality's use.

SELECTION OF A BUSINESS MODEL

The business model used by many cities is to start with a specific project with its own business case, creating a core USP solution which can then be extended by the city to create a more general smart city platform. Typically, these 'pathfinder' projects include air quality monitoring, traffic monitoring, smart waste, smart parking, car and bike sharing, electric vehicles and energy management. These pathfinder projects may be grant funded and are useful to demonstrate the value of a USP to a city.

This approach also minimises the risk for the city and allows a lower upfront investment in a USP. With this approach it is important to select a technology partner that offers a modular and scalable solution. This enables a smooth investment path which can grow with the city's needs.

It is important to adhere to open standards to avoid 'vendor lock-in,' being stuck with one company or provider.

One way to fund the USP in line with this pathfinder approach is to request that a small part of the budget from new projects is allocated to connecting and developing a part of the central USP.

A unique aspect of a USP is the ability to generate value for a city and citizens from data. Value can be in the form of cost avoidance and reduction and improved services or come directly from revenue generation via the marketing of data. This opens up innovative business models around the sharing of cost savings (which is familiar to many cities) and the sharing of revenue from data. This latter mode is the most interesting with the new information possible from fusing the many data sources from a city.

BUDGET TO EXPECT FOR A PILOT PROJECT

The budget for implementing a USP depends on many different aspects such as the size of the city, the type of platform (e.g. operating platform or operating and data analytics platform) and the business models applied. Nonetheless, the potential value created by the platform will often offset the costs of implementing it. The initial cost must be compared to the potential benefits for the city when associated with specific services.

Relative to the value that can be gained, the costs will be modest, so keeping the perspective of value to cost is really important throughout the process. In some cases the value sits with the business community, which can improve its services or create new services thanks to the transversal functions of the platform. This will eventually improve the quality of life in the city and offer new services to citizens.

There are no fixed business models for a USP and they range between in-house development based on open source software, through publicprivate partnerships to commercial turnkey SaaS (cloud based) solutions. The choice is often led by the preferences and capabilities of a city and its partners. It is important to consider all aspects of cost when evaluating options. For example, in the case of an in-house developed solution using license free open source software, there is a considerable cost of developing and maintaining the solution but benefits include greater flexibility for the city and the generation of intellectual property. For a commercial solution, the city can benefit from proven solutions and wide experience, guaranteed service levels and lower risk for the city.

The following section outlines the experiences of the USP partners and the different approaches taken to provide some idea of the scale of costs involved. It should be noted that Greenwich is a district or borough scale solution, while Lisbon and Milan are city wide.

PRICING



The London DataStore solution used by Greenwich was developed in-house with the Greater London Authority using open source software. Example costs:

- » 1 full time equivalent developer to configure software and systems, to make connections with other existing systems and to research new innovations: approximately €70,000 per year
- » 0.5 full time equivalent analyst/data engineer to work with the data itself and transform it into actionable insights for city staff: approximately €30,000 per year
- » Server/hosting costs can vary tremendously but allow approximately €20,000 per year
- » Giving a total of €120,000 per year

In Milan, a public-private development approach was taken. The main costs for the setup, operation and management of the interoperability platform infrastructure are:

Current annual costs:

- » €0 for software licenses (an open source product family is used)
- » Approximately €100,000 for specialised support, assistance and maintenance of the products
- » Approximately €80,000 for 2 full time equivalent city staff (developer and system administrators, data and content managers, totaling €180,000 per year

Once off costs for initial setup:

» Approximately 1 full time equivalent city staff + support (~€200,000)

In Lisbon, the USP acts as an integrated city governance centre, informing many city related actors, aggregating and interfacing with many diverse functional domains, each with its own

functional rules, KPIs, and associated protocols and specific infrastructure. It thus guarantees the functional all-inclusiveness, scalability, flexibility and ease-of-use required to address the present and future city dynamics from a functional perspective.

The Altice Labs SmartloT solution is a cloud based SaaS which can be scaled to meet a city's needs. With this requirement in mind, the USP service business model comprises an initial onboarding fee for the city and business partners, plus an additional pay-per-use (PPU) monthly fee related to the USP capabilities' effective usage over time.

The onboarding fee comprises the city domain set up, one basic functional domain and metrics, and initial dashboard configurations and image context, as well as USP operation training. An additional fee will be due per additional specific set-up and configuration.

- » Onboarding: €50,000 per city and/or business partner
- » Additional specific set-up and configuration: €10,000 per extra vertical business domain (e.g. smart lampposts, waste management)

The monthly PPU refers to the subsequent usage of USP service capabilities over time and will comprise several different components such as volume of storage, database and processing consumption, connectivity utilisation, active user accounts, specific metrics calculation, special algorithm utilisation, and so on. The PPU parameters are available as typified packs, for convenience purposes, and special cases, add-ons and specific ad-hoc integrations are dealt with on a case-by-case basis.

» Pay-per-use: ~€40,000 per year. Note that this value may vary depending on the amount of data ingestion, storage, central processing unit, external API calls, number of user accounts and number of containers needed. Also the type of extra service layers may influence the price (e.g. city dashboard, data portal, data scientist support, etc.).

COMMON CHALLENGES AND RECOMMENDATIONS

DIFFICULTY COLLECTING QUALITATIVE OVER QUANTITATIVE DATA

Focus on what you can already measure to obtain information on associated aspects. Then identify possibilities to collect qualitative data. Some things can be more difficult to measure than others. For example, measuring citizens' wellbeing might be complex, although you can try beforehand to identify some measurable things that will contribute to wellbeing, e.g. air quality or traffic.

Sharing Cities created a common project tool, the 'Use case matrix and data capture table' to keep track of all relevant characteristics of the data involved in project use cases.

DATA OWNERSHIP MIGHT BE A PROBLEM

Ensure that data ownership and use is clearly defined in contracts with suppliers and partners, especially with procurement. Where possible, data should revert to the city, not the supplier.

Consider first shared ownership of data (e.g. with utility companies) to see the platform as an enabler for a more structural change. Start small with stakeholders that wish to commit, so they can see the value and what they can obtain out of it.



RE-USE STANDARDISED SOLUTIONS AND ACCELERATE DEVELOPMENT

Look for standardised solutions and what others have already done (state-of-the-art analysis).

Adopt a common USP reference model (including a logical functional model, an architectural model, a set of potentially useful technologies). This will support gap analysis, build a 'common language' as well as enable synergies and actual sharing of local solutions. Despite many differences, what you want to achieve is probably similar to others. Many cities have already explored the possibility of implementing a USP. This experience and the standardised solutions can let you gain some precious time and resources.

In Sharing Cities, partners defined a common logical model to identify requirements and logical blocks of a USP, and thus be able to perform gap analysis at local or global level. On this basis, partners could identify and leverage the solutions existing at local level in order to build the USP. This approach also proved effective to identify components and open source solutions as well as skills to be shared between cities.



IS THE ADMINISTRATION OPEN TO CHANGE?

Develop a process to secure organisational buyin, especially ensuring that the IT department and elected representatives are considered and consulted.

Most barriers are no longer technical but are linked to the mindset of the public authority towards going through a complex revamp of its functioning. Work with good examples and mock-ups to convince easily and quickly.



CHOOSING YOUR DELIVERY ROUTE (LARGE VENDOR / SMES / GROW INTERNAL CAPACITY)

Focus on developing an open architecture, so that functional modules can be sourced and scaled up as needed, and existing components and capability can be used. Build your USP in an iterative and modular way, potentially using a mix of different suppliers, but insisting on open standards for the interfaces between systems and on retaining public ownership of your data.

SMART DATA NOT OPEN DATA

Explore the value of data for your city, from sharing to selling.

Cites are vast repositories of both historic and new data, the latter expanding exponentially driven by social media and IoT devices. A USP can offer the key for cities to unlock its data and gain value for its citizens and help to fund development of a USP.

LACK OF FOCUS ON THE END-USERS

Grant public access to data, with suitable access and identity controls, so stakeholders can also propose solutions that will benefit end-users and citizens. USPs should also provide benefit for citizens, businesses, for the industry and for researchers to develop solutions using the data available. Moving on from open data, the new era is one of smart data, where a wider range of data is made available to a wider range of users but only with strict security and access controls compliant with GDPR.

HOW TO CONVINCE STAKEHOLDERS OF THE BENEFITS OF SHARING DATA?

Demonstrate and communicate openly and in a transparent way about the possibilities offered.

Create an agile system by focusing on benefits for end-users: deliver the motivational buy-in.



DATA SECURITY, DATA PRIVACY, GDPR COMPLIANCE AND TRANSPARENT DATA POLICY

Robust security is a key enabler to a USP. Suitable budget and priority should be a core component of a USP design.

A USP can include a wide variety of data from corporate and commercial to personal and private. Sufficient resources and expertise need to be a core component of a USP and proportional to encompass all data types to be addressed.



DEFINING THE RIGHT SIZE FOR THE PROJECT TO START WITH

Start small to define your objectives and convince sceptical end-users.

It is always better to start small and gradually scale-up. First identify your objective, then start to populate the USP with what you have and what is easily available to you. Once you can show the benefits and the added value of the platform, it will be easier to involve other stakeholders.

DATA QUALITY, STANDARDISATION, MIGRATION AND INTEGRATION

Focus on data collection before standardisation.

Data collection should always be the main concern, since data cannot be invented. Usually, a standardisation process can be incrementally performed later in the process. Thus, data standardisation should never hinder the implementation of an effective data collection system. A deep knowledge of available USP technologies and resources can dramatically improve the design and implementation of all aspects of an effective data collection and integration process.

About Sharing Cities

Sharing Cities is a project to improve the lives of citizens across Europe, testing smart solutions for cleaner, more efficient cities. New systems for urban energy management, building retrofit, e-mobility and smart lampposts, are cutting carbon emissions in cities as well as making everyday life more affordable, comfortable and convenient for residents. Sharing Cities is testing and evaluating these smart city solutions together with citizens and creating channels to make them more affordable and better tailored to cities' needs. They are doing this through fostering international collaboration between cities and the private sector.

Additional information on Sharing Cities can be found on the website: http://www.sharingcities.eu

More information

Additional information and guidance about other smart cities projects can be found on the Smart Cities Information System's website: <u>https://smartcities-infosystem.eu/solutionbooklets</u>





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