



Inspire Policy Making with Territorial Evidence

FINAL REPORT //

DIGISER

Digital Innovation in Governance and Public
Service Provision

Annex 1.6 Case studies // August 2022

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1 Introduction

1.1 Scope and objectives of the case studies

This annex includes the 10 case studies as part of the DIGISER project– **Aarhus** (Denmark), **Helsinki** (Finland), **Ljubljana** (Slovenia), **Luxembourg City** (Luxembourg), **Magdeburg** (Germany), **Milan** (Italy), **Porto** (Portugal), **Poznan** (Poland), **Rotterdam** (The Netherlands), **Thessaloniki** (Greece). While the Digital Public Service Value Index (DPSVI) provides quantitative information on the state-of-play of digital transformation in Europe, the case studies complement the analysis on digital innovation by taking into consideration the diversity of experiences and approaches of ten European cities of different sizes, geographies (Figure 1) and stages of digital maturity. The scope and structure of the case studies is aligned with the key components of the DPSVI to ensure consistency and relevance. They provide further information on lessons learned, success factors and bottlenecks faced by cities when progressing on digital innovation.



Figure 1- Geographical distribution of the cities integrating the DIGISER case studies

Figure 2 confirms the diversity in terms of digital maturity of the 10 cities integrating the DIGISER case studies as measured by the DPSVI. Moreover, the figure shows that three cities are below the average reference sample, while two are close to the average, and five are clearly above the average reference sample.

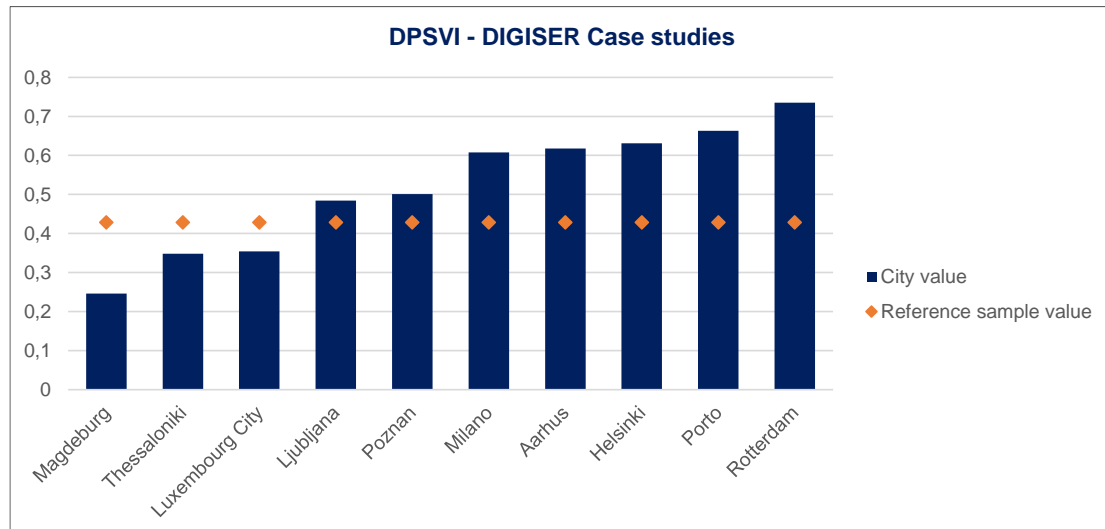


Figure 2 – Performance of the cities integrating the DIGISER case studies regarding the Digital Public Service Value Index (DPSVI)

1.2 Summary of the methodology

The choice of the 10 cities integrating the Case Studies was made based on different criteria to ensure the diversity of the European territory:

- **Size:** The sample covers cities of all sizes (according to OECD-EC classes).
- **Geographic coverage:** The sample includes 2 cities per region (north, south, east, west and central); as an additional criterion, at least one capital city or one city of a Member State that held the presidency of the Council of the European Union over the last 5 years (2017-2021) was selected.
- **Network of contacts:** The sample includes cities in which the consortium has a good network of contacts, facilitating interviews, additional interaction, data collection and information sharing.

The case studies were drafted following the process described in Figure 3. This included dedicated **interviews with city representatives** on the key dimensions linked to digital public service provision and to confirm hypotheses established at the beginning based on the desk research and the analysis of the raw data of the Digisurvey. This step was followed by **additional bilateral meetings with stakeholders and additional city divisions** to confirm and/or look for additional details on the success factors and bottlenecks of specific initiatives, including the potential for scaling-up. In total, the team conducted 25 bilateral meetings across the 10 cities. Case studies also include a **zoom-in on a specific digitally enabled service** as a reflection of the efforts undertaken by each city in digital transformation.



Figure 3 – Step-wise approach followed for each case study

2 Case Study: Aarhus (Denmark)

2.1 Overview and approach to digital innovation

Aarhus is the second largest city in Denmark with 355,000 inhabitants¹. The city is an important academic and educational centre, and the youngest city in Denmark with the student population representing 13% of the total population². The city has registered the highest population growth rate in the country which matches its business dynamics and economic growth as well³. Aarhus has an economic structure driven by trade and services, having a strong knowledge-based and ICT sector⁴.

The City of Aarhus has the vision of becoming “a good city for everyone”⁵ and wants to become carbon-neutral by 2030⁶. To support these and other city ambitions, the City developed the “Smart Aarhus” Strategy, where technology is regarded as an enabler to address the main challenges in the city.

In fact, the new strategy the City builds on what is already a long path towards digital transformation. In both 2017 and 2018, the City was a finalist in the European Capital of Innovation Awards⁷. The City shows a **significant internal capacity to develop digital solutions**. In parallel, the City promotes a **strong collaboration with its innovation ecosystem** to further advance on its digital transformation. In fact, the City has invested in advanced technology infrastructure to create a digital testbed, where the Municipality and the innovation ecosystem can test new smart city solutions. The City also **benefits from national, regional and European networks and programs** to exchange knowledge and cooperate on the development of pilots. The **communication with citizens** and its involvement in the decision-making is also regarded as a priority.

2.2 Proneness to Change

The new Smart Aarhus Strategy was designed involving all the City departments to place the strategy as an umbrella for all digitalisation efforts. The strategy was followed by an action plan with concrete actions and projects, to be updated annually. In terms of governance, the strategy followed an already embedded practice within the Municipality of working in Steering Committees where directors of departments and other key employees meet by topic to ensure coordinated actions and strong collaboration, now also applied to digitalisation matters.

The City has already a long tradition of open data, that can be consulted or re-used, being the first city in the country to create an open data portal and thus leading the way to create the national open data platform of the Danish Municipalities. The City has also been promoting a culture of co-creation with citizens through platforms of communication and citizen participation to increase the involvement in the City’s decision-making. The engagement also applies to the innovation ecosystem, where public-private partnerships are also highly promoted to achieve better and more advanced digital solutions. At the same time, the City has among its employees various expertise to support the internal development of many digital solutions.

¹ [Statistikbanken \(statbank.dk\)](http://statistikbanken.statbank.dk)

² [Study in Aarhus, Denmark | Study.eu](#)

³ [Study in Aarhus, Denmark | Study.eu](#)

⁴ [Study in Aarhus, Denmark | Study.eu](#)

⁵ [Vision og værdigrundlag \(aarhus.dk\)](#)

⁶ [The City of Aarhus' Climate Initiative](#)

⁷ [European Capital of Innovation \(iCapital\) 2017 | European Commission \(europa.eu\)](#)

Additionally, it promotes regular training opportunities to raise awareness and to better prepare the non-technological profiles for the City's digital transformation.

Regarding the **use of procurement, there is still some room for improvement**, without significant innovation procurement procedures followed, though there are some examples of joint procurement procedures, where other public organisations were involved.

2.2.1 Innovation governance

2.2.1.1 Institutional Capacity

Digital Strategic Priorities

The Directors' Steering Group in the City of Aarhus approved in the Summer of 2021 the new **Smart Aarhus Strategy**⁸. The process began in 2019, with the City recognizing **the need for a different approach for the digitalisation effort as a whole, with an alternative governance model and a "more challenge-driven approach instead of technology-driven"**. In order to do so, the City organized 49 interviews in the beginning of 2020, which involved all the Directors, heads of administration and key employees of all the six City departments. As a result, six key challenges were identified across the different City priorities for action, and in which digitalisation and innovation have a key role to play.

The challenges involved: *the adaptation to a fossil-free society, the reinforcement of the focus on value for and with citizens and businesses, the creation of more efficient solutions in the field of employment, make citizens more self-reliant on social and health domains, bring digital learning tools into play and strengthening the City's digital foundation*. The pandemic was a digital booster of some of these aspects, and while the challenges were not fundamentally changed, in the Spring of 2021 there were some readjustments of the process and the action plan. The **Smart City Action Plan** translates these challenges into concrete projects. The Plan currently comprises 15 projects, valid until the beginning of 2022. These involve all the City departments with the support of **Smart Aarhus, the unit created under this strategy to coordinate the implementation phase and the actions identified**. The projects for Smart Aarhus are selected on an annual basis by the group of directors.

The Smart Aarhus Strategy was designed building on the work already ongoing in the City and **aligned with other key strategic documents in the City**, such as the Aarhus Municipality's Business Plan Partnerships for Sustainable Growth⁹, the Aarhus Compass¹⁰ and the Joint Municipal Digitisation Strategy¹¹.

The **Aarhus Compass**¹² is composed of two main elements, namely **a new framework for understanding the "strengths the City and what is of value to citizens and society" under the ambition "less system and more citizens"**, and a **publication with concrete examples** within this new framework. **The Aarhus Compass framework was adopted on 28 April 2021** and redesigned the City's approach to management, governance and welfare development which became **more focused on a culture of co-creation and public value delivery**. The framework was defined in cooperation with the City, citizens, and experts. They

⁸ [PowerPoint-præsentation \(aarhus.dk\)](#)

⁹ [erhvervsplan-2020-23-til-web.pdf \(aarhus.dk\)](#)

¹⁰ [maalkompasset_folder_sep_2021.pdf \(aarhus.dk\)](#)

¹¹ [Den fælleskommunale digitaliseringsstrategi og handlingsplan 2016-2020 \(kl.dk\)](#)

¹² [maalkompasset_folder_sep_2021.pdf \(aarhus.dk\)](#)

expressed their views on crucial questions such as “What are the gains and pitfalls of putting a stronger focus on value?” or “What should change in terms of management, governance and co-creation?”. In this sense, the goals and the Smart Aarhus Action Plan were accompanied by a reflection on value creation for citizens, the Municipality, and stakeholders.

Governance

Denmark is a decentralized country, with **three levels of governance**: central, regional, and municipal¹³. From the Local Government Reform in January 2007¹⁴, subnational authorities were reorganised into 5 regions and 98 municipalities with more responsibilities on healthcare services, regional transport, and regional development policies. Also, within the Municipalities, responsibilities were enlarged to cover tasks as well related to Education, Healthcare, Social welfare, Employment support, among others¹⁵. The result of the decentralisation is also mirrored in the total public expenditure - in 2018, the sub-national expenditure represented 65% of the total national expenditure¹⁶.

This reform also led to the creation of *Kommunernes Landsforening (KL)*¹⁷, the association and interest organisation of the 98 municipalities in Denmark, with the mission to “safeguard common interests of the municipalities, assist the individual municipality with consultancy services and in addition ensure that the local authorities are provided with up-to-date and relevant information”¹⁸. The KL has embedded in its structure an EU office responsible for promoting the interests of the Danish municipalities in the EU.

Internally, the Municipality of Aarhus is organized around six departments, namely the *Mayor’s Department*, the *Department of Social Affairs and Employment*, the *Department of Technical Services and Environment*, the *Department of Culture and Citizens’ Services*, the *Department of Health Care* and the *Department of Children and Young People*. In total, these departments employ around 25,000 people and are composed of an alderman (politically nominated together with the mayor) and a director (hired by the City and not politically appointed, which ensures business continuity irrespective of political cycles).

The aldermen have seats in the City Executive Board, together with the mayor and three other aldermen not associated with a specific department. The City Executive Board is responsible for preparing the topics and recommendations to be discussed and approved in the City Council¹⁹. The City Council is the authority responsible for “decision-making and funding allocation”, having 31 members and seven permanent committees, each one representing a City department with two members linked to the Department of Social Affairs and Employment²⁰. The Executive Board is also responsible for the implementation of the decisions taken at the City Council.

The directors of each department meet regularly, under the Directors’ Steering Group, to ensure coordinated management at the Municipality²¹. Each department is internally composed by a Digitalisation Unit with a Head of Digitalisation associated. The Digitalisation Units also have a common steering group²², which

¹³ [CoR - Denmark Introduction \(europa.eu\)](http://europa.eu)

¹⁴ [Local Government Reform \(kl.dk\)](http://kl.dk)

¹⁵ [profile-Denmark.pdf \(oecd.org\)](http://oecd.org)

¹⁶ [CoR - Denmark Fiscal Powers \(europa.eu\)](http://europa.eu)

¹⁷ [English \(kl.dk\)](http://kl.dk)

¹⁸ [KL - Local Government Denmark](http://kl.dk)

¹⁹ [The City Executive Board \(aarhus.dk\)](http://aarhus.dk)

²⁰ [The Aarhus City Council](http://aarhus.dk)

²¹ [Aarhus Kommunes direktører](http://aarhus.dk)

²² [Medlemmer af OPI-puljens sekretariat \(aarhus.dk\)](http://aarhus.dk)

meets every second week to set the overall direction of digitalisation in the Municipality. **This organisation under Steering Groups is also common in other areas to ensure coordination and alignment across departments.**

The Heads of Digitalisation have been more focused on IT systems and infrastructure and not so much on (digitalisation and) innovation. As a result, the Smart Aarhus governance framework intends to address this gap. **Smart Aarhus is placed directly under the mayor's department** which grants Smart Aarhus an overall strategic vision across the different City Departments. The coordination is ensured by the Smart Aarhus Coordination Group with the support of the Smart Aarhus Secretariat.

The Smart Aarhus Coordination Group includes representatives from all departments that have strategic insights on digitalisation. The group is responsible for qualifying projects and initiatives to be later discussed by the group of Directors. To support and manage the work of the Smart Aarhus Coordination Group work, the Smart Aarhus Secretariat was created, with two Smart Cities Coordinators from the Business and Sustainable Development Unit and Digitalisation Strategy & Management Unit of the Mayor's Department²³. According to the City, this **new governance structure will ensure better coordination and collaboration among departments and ultimately will revamp the City's efforts on digital innovation.**

Smart Aarhus will also contribute to capacity-building within the Municipality, particularly by creating a common understanding of "digital foundations" such as building a digital culture and the digital competences needed to promote the digital agenda²⁴. In this sense, in 2020, all managers in the Mayor's Department went through a course (six full days) to boost digital skills. Similarly, in 2021, City Hall employees were offered a course on topics such as learning how to code an app and to find out more about "how technology works". Trainings are typically provided by external experts from academia or companies. In the previous example, the training was planned and organized by a private consulting firm, involving as well external speakers from academia and internal experts from the City of Aarhus to share concrete examples of projects and the respective learnings and challenges. According to City representatives, these trainings are relevant not only for capacity-building, but also to create bridges between technical and non-technical staff.

2.2.1.2 Data Management

Back in 2014, the City of Aarhus recognized through its **Open Source Action Plan**²⁵ **the importance of open-source solutions**, both open-source software and open standards, in order to not be limited by IT vendor lock-in, ensure interoperability and promote the scalability of solutions and data-reuse.

The Action Plan establishes a set of recommendations and work packages, to be implemented based on the following main topics²⁶:

- **Analysis**, to clearly set a procedure and criteria to identify where and how the open source solution is the better alternative in a certain situation.

²³ [Kontakt \(aarhus.dk\)](https://kontakt.aarhus.dk)

²⁴ [Digital kultur og kompetencer \(aarhus.dk\)](https://digital.kultur.og.kompetencer.aarhus.dk)

²⁵ [LibreOffice i Danmark - Nyheder: Budgetforlig i med open source \(libreofficedk.blogspot.com\)](https://libreofficei danmark - Nyheder: Budgetforlig i med open source (libreofficedk.blogspot.com))

²⁶ [Danish Municipality of Aarhus aims to free itself from IT vendor lock-in \(Aarhus Open Source Action Plan\) | Joinup \(europa.eu\)](https://danish.municipalityofaarhus.eu/aims-to-free-itself-from-it-vendor-lock-in-aarhus-open-source-action-plan/)

- **Culture and internal capacity development**, to overcome some internal resistance to the adoption of open source solutions stemming from the lack of knowledge or unclear information;
- **Guidelines for procurement and requirements**, to adapt to the different buying conditions when compared with license-based products.
- **Communication activities**, to present both internally and externally the City's views on open source solutions.
- **Long-term strategy**, to set clear objectives for the City, where the solutions must be based on open standards, not result in recurring payments for licence fees, and that avoid vendor lock-in products, with the commitment to more actively involve on initiatives and networks to support the objectives of the action plan.

In fact, previously to this Action Plan, the City had already in place some projects and solutions relying on open-source software or open data standards. For instance, the public library was using an open data platform built on the open-source open data portal CKAN²⁷ (Comprehensive Knowledge Archive Network)²⁸.

Also, in 2013 the City was the first in Denmark to launch a municipal platform dedicated for open data, in cooperation between the City, the Regional Authority, Aarhus University and Alexandra Institute.²⁹ In order to develop and maintain this portal the city created in 2012, established the Open Data Aarhus (ODA) working group.³⁰ The portal was created to share with citizens and remaining City stakeholders the large amount already being collected by the City (on traffic, health, waste, among others) and from there attract partnerships with private and public actors. The project was funded by the IT and Business Units internal budgets, as well as EU funds³¹.

Moreover, the City of Aarhus integrated a group of Danish municipalities that together developed a **common open data portal for the municipalities**³² in 2016 – the **Open Data DK**³³. Hence, the City's open data was moved to this shared data platform. Data is collected through an established group of "ambassadors" from each City Department and the portal was built on CKAN. According to the City, a challenge is the lack of harmonization of the data collection procedure and of the quality of the data provided by each department. This was an obstacle also identified in previous assessment, where it is specified that there is a difficulty of communication to clearly state the reasons and importance of open data to the City³⁴. While the open data portal has been an important initiative to build transparency of the public administration, these are however only punctual and small-scale projects derived from the data re-use. In the future, **with Smart Aarhus, the City also intends to leverage its open data practices** to create more significant and impactful projects.

2.2.1.3 Societal Engagement

Interaction with the innovation ecosystem

²⁷ [ckan · GitHub](#)

²⁸ [Danish Municipality of Aarhus aims to free itself from IT vendor lock-in \(Aarhus Open Source Action Plan\) | Joinup \(europa.eu\)](#)

²⁹ [Open Data Aarhus - Data Portals \(datacatalogs.org\)](#)

³⁰ [Organisational analysis of Open Data Aarhus | Andrew Nelson \(andyhub.com\)](#)

³¹ [Open Data Aarhus \(ODAA\) | Dokk1](#)

³² [Search \(opendata.dk\)](#)

³³ [Welcome - Home \(opendata.dk\)](#)

³⁴ [Open Data Speciale Final FINAL.pdf \(aau.dk\)](#)

With respect to the City engagement with its innovation ecosystem, Dockk1³⁵ is a crucial infrastructure underlining this effort³⁶. Dockk1 is a city area that was transformed from an industrial harbour to an urban space, with the relevant cultural, public and innovation services headquartered in the same building. The building hosts traditional **cultural services** such as a library, the Citizens´ service and the City´s Archive, and **innovation structures** like the Centre of Innovation in Aarhus (CFIA)³⁷ and the Innovation, Technology and Creativity (ITK) Organisation³⁸.

The Centre of Innovation in Aarhus has as its mission “to strengthen Aarhus as an organisation to create results with innovation projects and strengthen innovation capacity across city departments”.³⁹ CFIA is mainly composed by the profiles of the Centre are in fact more oriented towards service design and ethnographers, which adds a **human-centred perspective to the development process of innovative projects**. As result, the key activities of the CFIA concern innovative methods- design thinking, prototyping and business development-, and the involvement of citizens in their projects and initiatives.

The Innovation, Technology and Creativity (ITK) organisation is embedded in the Department for Culture and Citizens´ Service. In its internal organisation, the ITK has units mostly working on the maintenance and implementation of IT systems for its Department and also a unit, dedicated to the development of the new digital public services and smart city solutions, where CFIA is incorporated.⁴⁰

Dokk1 is an integrated part of the City area acting as a living testbed for new technology, managed by the Aarhus City Lab⁴¹. The Aarhus City Lab is part of ITK and resulted from a collaboration between several City internal departments. The team has diverse technological profiles and backgrounds on business development and communication⁴². The Lab is an important point of interaction with the innovation ecosystem, as companies and academia are invited to test their technological solutions which may result in partnerships with the City. For example, the CityShark⁴³ is a pilot project which combines different technologies to address the problem of pollution in the harbour⁴⁴. The pilot relies on several air and water drones to identify and collect garbage. It results from an international collaboration between ITK, Aarhus Harbour, the Danish Agency for Data Supply and Efficiency and private partners- Ranmarine⁴⁵ (from Netherlands), Eco-safe (from Denmark), Kinetica⁴⁶ and Oracle⁴⁷ (both from the United States).

The Lab is also relevant for the City dialogue with citizens, by sharing knowledge about the new technologies that are being developed in the city and with a room dedicated to debates around digital topics (e.g., data privacy, the moral limits of artificial intelligence). For instance, the Aarhus City Lab organized the

³⁵ [Hjem | Dokk1](#)

³⁶ [Hjem | Dokk1](#)

³⁷ [CFIA | Dokk1](#)

³⁸ [Hvem bor her | Dokk1](#)

³⁹ [Innovationskapacitet | cfia \(cfiaarhus.dk\)](#)

⁴⁰ [Om ITK | Dokk1](#)

⁴¹ [Aarhus City Lab](#)

⁴² [Team og kompetencer \(aarhuscitylab.dk\)](#)

⁴³ [City Shark \(aarhus.dk\)](#)

⁴⁴ [City Shark \(aarhus.dk\)](#)

⁴⁵ [The WasteShark for Cleaning Water - RanMarine Technology](#)

⁴⁶ [Kinetica: The Database for Time & Space](#)

⁴⁷ [Oracle | Cloud Applications and Cloud Platform](#)

Kids City Lab, where 1,704 young people had the chance to learn about technology through workshops and other activities⁴⁸.

The City of Aarhus has also been collaborating closely with the robotics ecosystem, notably by attracting new players, and by establishing public-private partnerships to develop solutions for supporting the day-to-day activities of the Municipality.

Indeed, **the City has partnered with Odense Robotics⁴⁹** - national cluster organisation for robot, drone and automation businesses- **and GovTech Midtjylland⁵⁰**- working community that supports the work with new technology across 16 municipalities in Central Jutland and Region Midtjylland- **to set up the Odense Robotics Aarhus Hub** to foster collaborations with robot, automation and drone companies in Aarhus and mid Jutland⁵¹. The Hub will be located at Dokk1 in Aarhus, and the City will invest over DKK 1 million in the next three years in activities to make Aarhus and mid Jutland an important centre for outdoor mobile robots.

Project 'Skodrobot'⁵² is an example of a concrete robotics solution being developed to support the day-to-day activities of the City, in this case the routines of the Construction Unit. The "first meters have been driven with a self-propelled device that will eventually vacuum the streets for cigarette butts". This solution is being tested directly with the employees at Construction Units and the overall impression has been positive. The development of the technology is under the responsibility of the company Capra Robotics⁵³ (one of the key players in outdoor mobile robots in the city), under a public-private innovation collaboration (OPI) with the City of Aarhus.

Regarding social welfare technology, robotics solutions⁵⁴ have also been analysed in the context of the Centre for Assisted Living Technology of the City of Aarhus. The City collaborates closely with private companies and research institutions and the outcome has to be "a useful solution that can be used by our municipality and other similar public authorities"⁵⁵, i.e., it has to be scalable. Solutions are implemented in municipal care facilities and in private homes.

With the view of building a well-developed startup ecosystem in the city, the Aarhus municipality is one of the organisations funding The Link⁵⁶, a non-profit organisation aiming at connecting the ecosystem to create stronger collaborations, highlighting the ecosystem and linking the ecosystem nationally and internationally to trends, corporates, partners, and investors. The Aarhus municipality acts as well as a test platform for new technologies of businesses. For example, the pilot project between Papp⁵⁷ and the City of Aarhus used sensor technology to monitor parking/charging opportunities for electric cars. Moreover, the Aarhus-based battery manufacturer VisBlue is part of a new project⁵⁸ in collaboration with the Aarhus Municipality, where excess electricity from a photovoltaic system at a local School is stored in large flow batteries thus leading to optimized use of solar power.

⁴⁸ [Kids City Lab | Dokk1](#)

⁴⁹ [About us - Odense Robotics](#)

⁵⁰ [GovTech Midtjylland](#)

⁵¹ [Aarhus Hub - Odense Robotics](#)

⁵² [Robot skal opsamle cigaretskod \(aarhus.dk\)](#)

⁵³ [Capra Robotics | Outdoor Mobile Robotics | Multiple Applications](#)

⁵⁴ P.375, [What Social Robots Can and Should Do: Proceedings of Robophilosophy 2016 ... - Google Livros](#)

⁵⁵ [Development \(aarhus.dk\)](#)

⁵⁶ [The Link – We link relevant stakeholders](#)

⁵⁷ [Papp - Nem, bekymringsfri og mulig parkering](#)

⁵⁸ [Home \(visblue.com\)](#)

Another priority for the Municipality relates to reducing energy consumption. To this end, the City Council adopted in 2017 the project "**Intelligent Data-based Energy Management**" to reduce total consumption by 5% or DKK 7.1 million annually⁵⁹. In order to be successful, the project needed high-quality data, to be able to e.g. identify those buildings with exceptionally high consumption and the measures that should apply. For this reason, the City worked with the company KMD EnergyKey⁶⁰ to collect and structure water, heating and electricity data. Initial results show already a "5% reduction even before the corona crisis, and from 2019-2020 alone an additional DKK 20 million has been saved". This is an example of a need identified by the City and aligned with its priorities that benefited from the involvement of an external partner with expertise on the topic.

Citizen engagement

The City of Aarhus relies on platforms to actively engage and communicate with citizens and integrate their perspectives into decision-making. For instance, **DeltaG Aarhus**⁶¹ is a portal launched in 2018 that gives citizens, companies and other City departments the possibility to introduce and **participate in public consultations on a wide variety of topics**, such as urban planning, mobility, education, or healthcare services. The portal also includes an events section where citizens can participate in different initiatives (dialogues, workshops, info days) organized by the City. For 2022, the City has planned visits to present to the community the evolution of one of the main City Projects, the Aarhus Island⁶². This is one of the largest waterfront projects in Europe, that will be home to approximately 12,000 residents and will generate approximately 10,000 jobs⁶³.

Together for Aarhus⁶⁴ is an ongoing project that encompasses different participatory approaches to increase the influence of citizens on the decisions undertaken by the Municipality. The current platform includes a section for Citizens' dialogues, so that citizens can discuss and give suggestions on official texts related to a specific policy area. For example, previous debates have been on City Council proposals to fund more voluntary activities⁶⁵ and on the collection of citizens' proposals to get more young people into jobs or training⁶⁶, to later **include the most voted proposals in the new Social Sustainability Plan**⁶⁷. The platform also covers **participatory budgeting**. For example, the young people's corona budget is a recently concluded initiative in which participants had to present proposals that would help mitigate the spread of infection among young people between 16-30 years old⁶⁸. In total, this specific participatory budget counted with DKK 50,000, to support 6 proposals⁶⁹, with each having a maximum cost of DKK 10,000, selected by the Youth Crisis Management Group⁷⁰ and Healthcare professionals. The Youth Crisis Management is an initiative promoted by the Municipality comprehending representatives from different young associations, to collect their views and recommendations throughout the management of the Corona crisis.

⁵⁹ [Aarhus kommune har reduceret energiforbruget med over 7 mio. årligt \(kmd.dk\)](#)

⁶⁰ [IT solutions and services for the public and private sector \(kmd.net\)](#)

⁶¹ [Hearings | The Consultation Portal - Aarhus Municipality](#)

⁶² <https://deltag.aarhus.dk/node/382>

⁶³ <https://deltag.aarhus.dk/node/382>

⁶⁴ [Sammen om Aarhus](#)

⁶⁵ [Få handicapmidler til frivillighed \(sammenomaarhus.dk\)](#)

⁶⁶ [Se forslag til at få flere unge i job og uddannelse \(lukket for nye forslag\) \(sammenomaarhus.dk\)](#)

⁶⁷ [En ny strategi for sociale indsatser i fremtidens Aarhus \(sammenomaarhus.dk\)](#)

⁶⁸ [Krav til corona forslag \(sammenomaarhus.dk\)](#)

⁶⁹ [De unges corona budget - Resultater \(sammenomaarhus.dk\)](#)

⁷⁰ [Ungekriseledelsen \(aarhus.dk\)](#)

In a complementary way, the City developed the **Aarhus Borgertip**⁷¹ (**Aarhus CitizenTip**), a mobile app that allows citizens to report and georeferencing the city problems (e.g.: broken tile, road pothole or a fallen tree). The app forwards the request to the competent City department and updates the users on the different stages of the resolution process. The project also includes a web version with the same functionalities⁷².

The City has also been involved in the creation of alternative channels of communication with citizens, to target and involve specific groups. For instance, the Citizens' Service in Aarhus partnered with the Alexandra Institute, to develop the **Digital Neighbourhood project**⁷³. The project placed four physical and interactive phone booths through which citizens could share their opinions and reply to the City specific questions. The project started in 2014, and since then it has collected over 2,000 ideas⁷⁴.

Since 2020, citizens can participate in the **Rehab-Lab**⁷⁵ inside Dokk1 to design their own aids and then print them in a 3D printer. Citizens are assisted by technical staff to come up with the idea that better meets their needs.

2.2.1.4 Procurement

Traditional and innovative procurement

The national assessment of innovative procurement practices promoted by the European Commission places **Denmark as a low-performing country**⁷⁶ due to the lack of a “structural approach to mainstream innovation procurement”, with no action plan or dedicated centre for capacity-building. The previously mentioned decentralization governance structure in the country is also reflected in the public procurement domain- procurement is mainly used by municipalities, with the central government and regions having lower shares of procurement. However, local procurers represent low percentages on both the procurement of innovative solutions and ICT-based procurement of innovative solutions, with 2% of the total in both situations.

In the specific context of Aarhus, the City does not rely on pre-commercial procurement practices in the context of digital solutions. However, **the City follows public procurement of innovative solutions (PPI) with its own internal resources to overcome the limitations of the standard procurement procedures** on the digital domain.

According to the **City's Purchasing and Supply Policy Framework**⁷⁷, the purchasing and procurement practices should also be aligned with the City's main priorities. For example, in what concerns sustainability objectives, the City sets minimum corporate social responsibility requirements when they are reviewing the conduct of suppliers in a tender process. This policy framework also highlights the efficiency gains that can be derived from joint public procurement processes with other public organisations, in certain situations. In this process, the Association of Danish municipalities, KL, through the Danish Public Procurement Centre,

⁷¹ [Aarhus Borgertip – Apps on Google Play](#)

⁷² [Citizen \(dw3.dk\)](#)

⁷³ [About Digital District | DigitalBydeJ](#)

⁷⁴ [Digital Neighbourhood \(aarhus.dk\)](#)

⁷⁵ [In Rehab-Lab, citizens create their own aids \(aarhus.dk\)](#)

⁷⁶ [Results of EU wide benchmarking of innovation procurement investments and policy frameworks across Europe | Shaping Europe's digital future \(europa.eu\)](#)

⁷⁷ [aarhus-kommunes-indkoebspolitik.pdf](#)

*Statens og Kommunernes Indkøbsservice (SKI)*⁷⁸ has a role to play. **SKI is the purchasing organisation of the municipalities to “streamline and professionalise public procurement” in the Danish public sector.** Both aspects are aligned with KL’s **Joint Municipal Purchasing Strategy 2020-2024**⁷⁹.

According to the City, joint procurement practices with other public authorities on the domain of innovative digital services/goods remain sporadic and mostly focused on sharing solutions in open source. An example of a recent joint public procurement procedure in this regard is the **OS2iot project**⁸⁰, **where Aarhus partnered with other cities of the OS2 community network, to develop an IoT message distributor**, that can be used to “standardize” the data to be sent and received between the suppliers of the sensors⁸¹. This solution is now made available through the OS2 network and can be acquired and implemented in other cities and alternative contexts. The City of Aarhus belongs to both the steering group and coordination group responsible for sharing this solution and further upgrading it.⁸²

Financing digital solutions

According to the City, the most relevant funding sources to finance digital innovation are national and regional sources, as well as European funds. In particular, 11 out of 16 digital projects financed were financed under Horizon 2020⁸³.

Additionally, in 2013, the City set a Public-private Innovation Fund (PPI) to “increase the use of technological solutions across the municipal organisations for the benefit of both citizens and companies”⁸⁴. The Fund receives annually 4 million DKK, to support through funding, financial advice and project management, assisted-living technology projects. The project started by considering mostly assisted living technology applied to the elderly and disability care, but over time it has been extended to more areas and targets where this technology can also be applied, e.g., children and other vulnerable groups of the society.

Regarding the activities of Smart Aarhus, the City allocates specific budget to support events and current expenses, with the financing of the projects being project-based. The Smart Aarhus Secretariat has also within its responsibilities to guarantee the funding needed to finance projects, counting with the support of budgets allocated to other City Departments to do it (for instance the Climate Fund, the Budget of the Digitalisation Steering Group or from the Business Development Department).

2.2.2 Change Management

The City of Aarhus is an active player in both national and international cities’ networks. At the national level, the City is a **partner of the Danish Smart City Network**⁸⁵. The network, initiated in 2013, is a national collaboration bringing together 140 representative stakeholders from municipalities, public administration, organisations, universities and companies. The network was created with the purpose of promoting knowledge exchange activities and to support the development of Smart Cities in Denmark. According to

⁷⁸ Statens og Kommunernes Indkøbsservice A/S (or in short: SKI)

⁷⁹ [faelleskommunal-indkoebsstrategi-2020-2024.pdf \(kl.dk\)](#)

⁸⁰ [OS2iot | OS2 – Offentligt Digitaliseringsfællesskab](#)

⁸¹ [ITK-chef Bo Fristed, Aarhus Kommune om OS2/IOT beskedfordeler: "Over halvdelen af landets kommuner er på inden udgangen af 2021" | Itchefer](#)

⁸² [Styregruppe og koordinationsgruppe for OS2iot | OS2 – Offentligt Digitaliseringsfællesskab](#)

⁸³ [Funding & tenders \(europa.eu\)](#)

⁸⁴ [English \(aarhus.dk\)](#)

⁸⁵ [Danish Smart City Network \(au.dk\)](#)

the City representatives, this was a very active network a few years ago at the development phase of the National Smart City Strategy, but currently it does not have significant interactions with the City.

On the other hand, an important network for the City is the Nordic Smart City Network⁸⁶ that results from a collaboration between 20 cities of the five Nordic countries initiated in 2018. The objective is to stimulate collaborations on Smart City projects and exchange knowledge among partners. **The City representatives highlight that this is one of the networks that they benefit from the most, as there are regular and informal contacts between the cities on new insights and solutions.** Apart from these regular informal exchanges, the network also organises four annual meetings to share experiences and discuss future collaborations. The network also counts on funding from the Nordic Innovation Organisation⁸⁷ to support certain initiatives, such as the Nordic Health Cities⁸⁸.

The Nordic Healthy Cities has a budget of about EUR 1 million⁸⁹ to test five projects of innovative solutions in the field of Health, with a member city leading and managing it, and involving other interested participating cities. The initiative will run until April 2022, and will also involve private partners to then scale-up the most successful solutions to address health-related challenges⁹⁰.

In the context of this initiative, **Aarhus presented its Sleep Monitoring tool⁹¹** designed to monitor and improve the sleeping conditions of citizens with cognitive impairments living in nursery homes. The project is led by Aarhus and involves Forum Virium from Helsinki, Torshavn from Faroe Islands and the Danish municipality of Syddjurs. The Nordic Healthy Cities initiative will support the development of new technology to adjust the existing sensor infrastructure so as to monitor the quality of sleep and to comply with data protection regulations⁹².

As mentioned before, **an important structure fostering regional collaboration is GovTech Midtjylland, a collaboration between 16 municipalities in Central Jutland and Region Midtjylland,** including the City of Aarhus. GovTech Midtjylland started out as an idea in 2019 and it took a couple of years to form and shape it. The rationale behind is that many of the municipalities' problems are similar so by pooling resources it is possible to "do more for less", while making service improvements across organisations. This is particularly relevant for the smaller municipalities, who have the same requirements such as GDPR and day-to-day operations as bigger municipalities, so they may lack the resources to invest in these modern technologies. The idea is hence to find the similar needs across the municipalities, do some collaborative projects together and integrate solutions from companies in the region (locally) to stimulate the tech sector in the region (and in Denmark). The focus has been on IoT but a new project on Artificial Intelligence and Buildings is also starting. In addition, the organisation is also looking into Robotics and Virtual reality/Augmented reality solutions.

Currently, four people are working full-time in GovTech Midtjylland. **In terms of governance⁹³, there is a strategic steering group with an anchor point at the directors' level** across all these municipalities as

⁸⁶ [Welcome to Nordic Smart City Network | Nordic Smart City Network \(nscn.eu\)](#)

⁸⁷ [About Nordic Innovation | Nordic Innovation](#)

⁸⁸ [Nordic Healthy Cities | Nordic Smart City Network \(nscn.eu\)](#)

⁸⁹ According to ECB Euro foreign exchange reference rates of 14 December 2021.

⁹⁰ [Nordic Healthy Cities | Nordic Smart City Network \(nscn.eu\)](#)

⁹¹ [Sleep Monitoring of citizens with cognitive impairments | Nordic Smart City Network \(nscn.eu\)](#)

⁹² [Sleep monitoring to improve the sleep of citizens with dementia \(aarhus.dk\)](#)

⁹³ [Organisering \(govtechmidtjylland.dk\)](#)

part of **KD-net**⁹⁴ - the Municipal Director Network in the Central Jutland region. Additionally, there is a more operational “day-to-day” steering group comprised of IT and digitalisation managers from some of the municipalities helping to choose the “day-to-day” focus areas based on real needs and pressing topics of municipalities. This has led to an extensive list of possible IoT needs-driven projects now subject to prioritisation and leading to different IoT tracks in 2022.

Regarding the financing of this initiative, the base funding is coming from the partners (i.e., the municipalities and the region), but there are also e.g., an AI project financed by national or state level money, also part of the European Digital Innovation Hub trying which will provide further resources.

The engagement with local companies is an important element for GovTech Midtjylland to stimulate the ecosystem. Collaboration can take different forms- an open call to the market, investigation of technological possibilities, being aware of some companies that have a product that is suitable to the municipality, a tender process, or public-private innovation projects to collaborate on building something new, for instance.

In terms of lessons learned, as this initiative is only running for some months, the learnings are still limited. According to the City, the fact that GOVTECH is anchored at the directors’ level is a strength of the governance model. On the other hand, the reality is that **it can be difficult to prioritise and keep the engagement high across all municipalities**; currently, five municipalities are very active. One of the key aspects for consideration is to keep a steady flow of information and meetings to keep the feeling of belonging to this group. Nowadays, everyone is involved in the ideation of the project, and then the three or four most interested municipalities join a project group. Based on the learnings achieved, that solution could then be scaled up to other municipalities.

Within the data management framework, the participation in international city networks and initiatives is also prioritised. For instance, **the City is a member of OASC**⁹⁵, the cities’ network that establishes shared standards and promotes “data-driven solutions based on Minimal Interoperability Mechanisms (MIMs)”⁹⁶. Also, since 2013⁹⁷ the City is also a member of the (open source) OS2 community⁹⁸, where 77 public members and 65 private partners share knowledge on the use of open-source solutions in the public sector. From this community, 22 open-source software solutions were developed and made available to the community⁹⁹, including for instance a solution to handle the distribution of tasks and responsibilities of a Municipality, or a platform to manage and exhibit learning courses. The involvement in this kind of cities’ networks and communities also supports the participation of the City in other European projects, such as **SCORE (Smart Cities and Open data Reuse) Project**¹⁰⁰.

The SCORE project (2017-2021) is funded¹⁰¹ by the European Regional Development Fund (ERDF) and involves nine cities and four universities from the North Sea area¹⁰². The partners are working towards improving the “efficiency and quality of public service delivery based on smart, open data driven solutions”. At the end, the project aims to create 12 innovative solutions from different domains (mobility, water,

⁹⁴ [KD-Net](#)

⁹⁵ [Our Cities - Open & Agile Smart Cities \(oascities.org\)](#)

⁹⁶ [History - Open & Agile Smart Cities \(oascities.org\)](#)

⁹⁷ [Aarhus Kommune | OS2 – Offentligt Digitaliseringsfællesskab](#)

⁹⁸ [OS2 – Offentligt Digitaliseringsfællesskab | Offentligt Samarbejde, Open Source](#)

⁹⁹ [OS2 Produkter | OS2 – Offentligt Digitaliseringsfællesskab](#)

¹⁰⁰ [SCORE \(aarhus.dk\)](#)

¹⁰¹ [SCORE Partners, Interreg VB North Sea Region Programme](#)

¹⁰² [SCORE Partners, Interreg VB North Sea Region Programme](#)

environment) that can also be re-used by other cities from the North Sea Region¹⁰³. The consortium has already developed some strategies, guidelines and plans (Develop Integration and Demonstration Plan¹⁰⁴, Social Media Strategy¹⁰⁵ and the Guidelines for Solution Selection¹⁰⁶ and Requirement Specifications) to further create its solutions.

The City is also a regular participant in other European initiatives and programmes, such as the Intelligent Cities Challenge¹⁰⁷, Eurocities¹⁰⁸ or the Living-in EU initiative¹⁰⁹, which have also been contributing to the recognition of the City has a reference in the European context. For instance, the **City is one of the mentor cities in the 100 Intelligent Cities Challenge** from the European Commission¹¹⁰. In this initiative, the mentor cities are selected as experts with proven record of accomplishment in at least one of the ICC's thematic areas, having "the responsibility of sharing knowledge and helping to scale intelligent solutions".

2.3 Digital Service Innovation Maturity

The City of Aarhus has made significant efforts to digitalise its services and create conditions for the integration of more advanced technologies into its public service provision. The City is one of the first cities in the world to have public-owned **Low-Power Wide-Area Network technology** (LPWAN) designed for the deployment of Internet of Things (IoT) sensors and devices¹¹¹. This network is connected to the Aarhus City Lab and is being used in different areas, from school buildings to measure the indoor climate in the classrooms¹¹², up to the measurement of water pH level, air temperature, humidity, water level, pressure, and soil moisture¹¹³. LPWAN infrastructure has also improved the city's energy efficiency management, to e.g., detect heat leaks on the wire's infrastructure¹¹⁴. Additionally, the City also participated in the EU project, IoT Crawler¹¹⁵, a research project involving research institutions and technological companies¹¹⁶. In this project, Aarhus is the only Municipality involved, and its City Lab is the experimentation facility to test IoT Crawler prototypes¹¹⁷.

The high-precision technology infrastructure is also connected to the City's large test bed facility, which allows the testing and development of advanced autonomous vehicles systems that was used and further developed under the TAPAS project¹¹⁸. The TAPAS project was a research project funded by the Danish Agency for Data Supply and Efficiency¹¹⁹ with the collaboration of the Aarhus Municipality and the National

¹⁰³ [SCORE Solutions. Interreg VB North Sea Region Programme](#)

¹⁰⁴ [20190828191256_SCORED5.1ULLguidance.pdf \(northsearegion.eu\)](#)

¹⁰⁵ [20181211144657_SCORE2.6SoMestrategy-1.docx \(live.com\)](#)

¹⁰⁶ [20181211145528_SCORED3.1GuidelineforSmartCitychallengedetectionandsolutionselection.docx \(live.com\)](#)

¹⁰⁷ [Cities | Intelligent Cities Challenge](#)

¹⁰⁸ [Aarhus - Eurocities](#)

¹⁰⁹ [Join us in building the European way of Digital Transformation for 300 million Europeans | Living in EU \(living-in.eu\)](#)

¹¹⁰ [Cities | Intelligent Cities Challenge](#)

¹¹¹ [Narrowband Network in Aarhus | Nordic Smart City Network \(nscn.eu\)](#)

¹¹² [The IoT effort in Aarhus Municipality \(smart-aarhus-dk.translate.goog\)](#)

¹¹³ [Aarhus City Lab | STARTS](#)

¹¹⁴ [Narrowband Network in Aarhus | Nordic Smart City Network \(nscn.eu\)](#)

¹¹⁵ [IoT Crawler | A search engine for the Internet of Things](#)

¹¹⁶ [Partners | IoT Crawler](#)

¹¹⁷ [IoT Crawler \(aarhus.dk\)](#)

¹¹⁸ [TAPAS | Nordic Smart City Network \(nscn.eu\)](#)

¹¹⁹ [About Us \(sdfe.dk\)](#)

Space Institute at the Technical University (also known as 'DTU Space')¹²⁰. The aim of this project was to “verify to which extent an improved precision positioning infrastructure can contribute to exploit the full advantage of the technical achievements of the new Global Navigation Satellite Systems (GNSS)”¹²¹.

The City is also relying on Artificial Intelligence to digitalise one of the less technology-advanced city structures, i.e., the Social and Employment Services. The platform under development will collect the professional information of unemployed individuals, identify its skills and match them with the job postings available, also suggesting competencies that everyone could develop to further increase his/her chances of finding a job.

Indeed, the City has been leveraging digital tools to improve its public service provision on several domains. For instance, on waste management, the City has developed a **waste management platform, My Waste**¹²², that allows citizens to request several services such as the request for an extra emptying of a container or to wash it.

Below we present an example of a digitally enabled service to citizens of the Aarhus municipality as an illustration of the efforts of the municipality to ally digital technologies with social goals (Box x.1).

Box 1 - Zoom-in: Social robot for brain training to counteract dementia

○ Overview

The use of a **social robot for brain training** in the municipality aims both at **reducing the costs associated with dementia care** and **promoting active ageing**. In other words, the original idea was to “postpone” the time needed to go to a care facility and hence stay longer at home. The expectation was that this would not only be beneficial for citizens’ wellbeing, but also for reducing/saving costs in nursing homes of the municipality.

In this context, the Aarhus municipality imported the technology – a **robot ('Silbot') and games/tasks to solve with a tablet** - already ten years ago from the **Korean Institute of Technology (KIST)** following a visit of a municipal manager from Aarhus municipality to South Korea¹²³ including on the topic of Assisted Living technologies. Originally, the robot was developed to teach English in Korean schools, but the manufacturer showed that it could be also used in a senior care facility to prevent and counteract dementia with the support of iPads and the Silbot robot that established tasks almost like a ‘brain fitness program’ that trains the memory and focus of the elderly and those with dementia.

The third part of the project ('Silbot-3) is also targeting light dementia to train cognitive abilities through 16 types of games using a tablet, with the robot at the center of the playing field.

While the **target audience** have been citizens with memory problems, citizens with dementia, healthy pensioners in all, as well as citizens in rehabilitation courses, new uses of the robot beyond counteracting dementia have been explored/tested mostly thanks to the social part enabled by the games.

○ Relevance and uniqueness

¹²⁰ [Forside - DTU Space](#)

¹²¹ [TAPAS \(aarhus.dk\)](#)

¹²² [MitAffald – Your digital self-service solution for waste \(affaldvarme.dk\)](#)

¹²³ [Asterisk91-s23-25.pdf \(au.dk\)](#)

This solution is relevant to diminish the negative effects of dementia and enable better cognitive development of the elderly. Moreover, besides preventing memory losses, this service wants to “increase older people’s self-reliance and ability to master their own lives as well as to create greater coherence and/or effect in rehabilitation courses by strengthening both cognitive and physical skills”¹²⁴.

The robot ‘Silbot’ is in the center of the room to interact and motivate participants to participate in games and puzzles that boost cognitive abilities.

○ **Challenges & Drivers**

Initially, participants were sceptical about the use of a robot and how controlling it could become. However, this perception quickly changed to the view that it is a “robot without prejudice” that does not criticise opinions.

Moreover, it took some time to transfer the South Korean robot and adapt it to elderly care¹²⁵.

A characteristic appreciated in the robot was the focus on participants, rather than singling out specific participants which fosters the sense of community.

○ **Implementation and Monitoring**

The technology has been running for almost 10 years, and there have been always people willing to participate in the games (*i.e.*, this has been a stable and long-lasting project relative to other projects). However, the technology is starting to get obsolete, and an updated version is being considered by the Municipality to acknowledge cultural differences and better incorporate feedback from the users of the solution, despite the end of the collaboration with South Korea on the solution.

The activity has been running in a dementia home and in a care facility specifically allocated to test new types of technology (“**test care facility**”). Some of the revamped **features** of Silbot-3 include “much lower noise levels, rigorous data collection, facial and mood recognition, voice recognition and intelligent navigation so that it does not bump into objects or people. The appearance of the robot has changed and is now more complete. Weight is greatly reduced as well as mobility improved”¹²⁶.

○ **Impacts**

Anthropologists have observed some of the classes and there have been measurements based on cognitive improvements based on an internationally recognised cognitive skills scale. **Half of the participants have registered cognitive improvements.**

The interaction with the robot and the participation in the different games is also expected to increase self-reliance and autonomy to lead one’s own life thus enabling a **greater sense of independence.**

Half of the participants is positive about the service, others are moderate about the results, and only a few is not satisfied with the robot and the games. The fact that Silbot is positive and enthusiastic using expressions such as “Well done” motivates the elderly to engage in the games¹²⁷. Additionally,

¹²⁴ [Silbot 3 \(careware.dk\)](http://careware.dk)

¹²⁵ [Dances with Robots - Forskning - Aarhus Universitet \(au.dk\)](http://Dances with Robots - Forskning - Aarhus Universitet (au.dk))

¹²⁶ [Silbot 3 \(careware.dk\)](http://Silbot 3 (careware.dk))

¹²⁷ [Brain gymnastics with the robot Silbot - training with a robot \(vital.dk\)](http://Brain gymnastics with the robot Silbot - training with a robot (vital.dk))

participants report that the robot helps them transfer the strategies to the tasks of everyday life and to improve memory. Learning about how to use the tablet so motivates the elderly.

Concrete cost reductions have not yet been documented, considering that the focus has been on wellbeing and cognitive improvement though indirectly cost savings are to be expected in the rehabilitation area.

Finally, employees of the dementia and care facilities have also learned from this experience by exploring novel methods to prevent and rehabilitate cognitive functions.

2.4 Conclusions and lessons learned

The City is already in an advanced stage of its digital transformation journey. While the City has internal capacity to develop digital solutions, it also promotes significant collaboration with the innovation ecosystem including through public-private partnerships in fields such as social welfare, health and energy management. Furthermore, the City has prioritized infrastructure to enable the testing solutions in the Municipality. The City is also an active participant in national, regional and European networks and programs exchanging good practice and developing novel solutions. There are also channels of communication with citizens so as to involve them in the decision-making of the City.

Below we explore in more detail some potential lessons learned from the experience of Aarhus in transforming its public service provision through digitalisation:

- i) ***The new Smart Aarhus Strategy provided an opportunity to align the different smart initiatives within the City around its main challenges, involving all City departments in this effort.***

The definition of the main challenges of the new Smart Aarhus Strategy involved all the Directors, heads of administration and key employees representing the six City departments, which aligned the digitalisation efforts with the City priorities for the future. For the implementation and governance of the Strategy, the City replicated an already good practice within the municipality, to create a steering group with key people at the level of decision-making (e.g., directors) and digitalisation. This type of governance breaks silos and promotes coordination and collaboration among departments. The Strategy has produced an Action Plan containing concrete projects associated with the challenges, being revised on an annual basis to be updated and fit-for-purpose.

- ii) ***The City of Aarhus created conditions to promote a strong environment of collaboration with its innovation ecosystem.***

Aarhus City Lab is an outcome of a significant effort of the City to build well-advanced technological infrastructure, in which both public and private partners are incentivized to engage and test new smart technologies. This infrastructure has important elements such as Low-Power Wide-Area Network technology relevant to promote projects around IoT and a high-precision technology infrastructure useful for developing autonomous vehicles systems. The City already has some examples of projects already derived from it as it is the case of CityShark, a pilot project dedicated to address the problem of pollution in the river through technology.

Moreover, the City also often promotes public-private partnerships when the City does not have full capacity to develop a certain digital solution. For example, there is a specific Public-private Innovation Fund for assisted-living technology projects.

iii) **The City is an active agent on national, regional and European networks to foster knowledge exchange, collaborate on the development of pilots and import advanced practices from their peers.**

Aarhus is a member of OASC, Eurocities, Danish Smart City Network, Nordic Smart Cities Network, GovTech Midtjylland, OS2 Community and participates on several EU initiatives and projects such as the Intelligent Cities Challenge, Living-in EU initiative or the SCORE project. This allows the City to create its own network where informal contacts are promoted and collaborations on the digital domain emerge naturally.

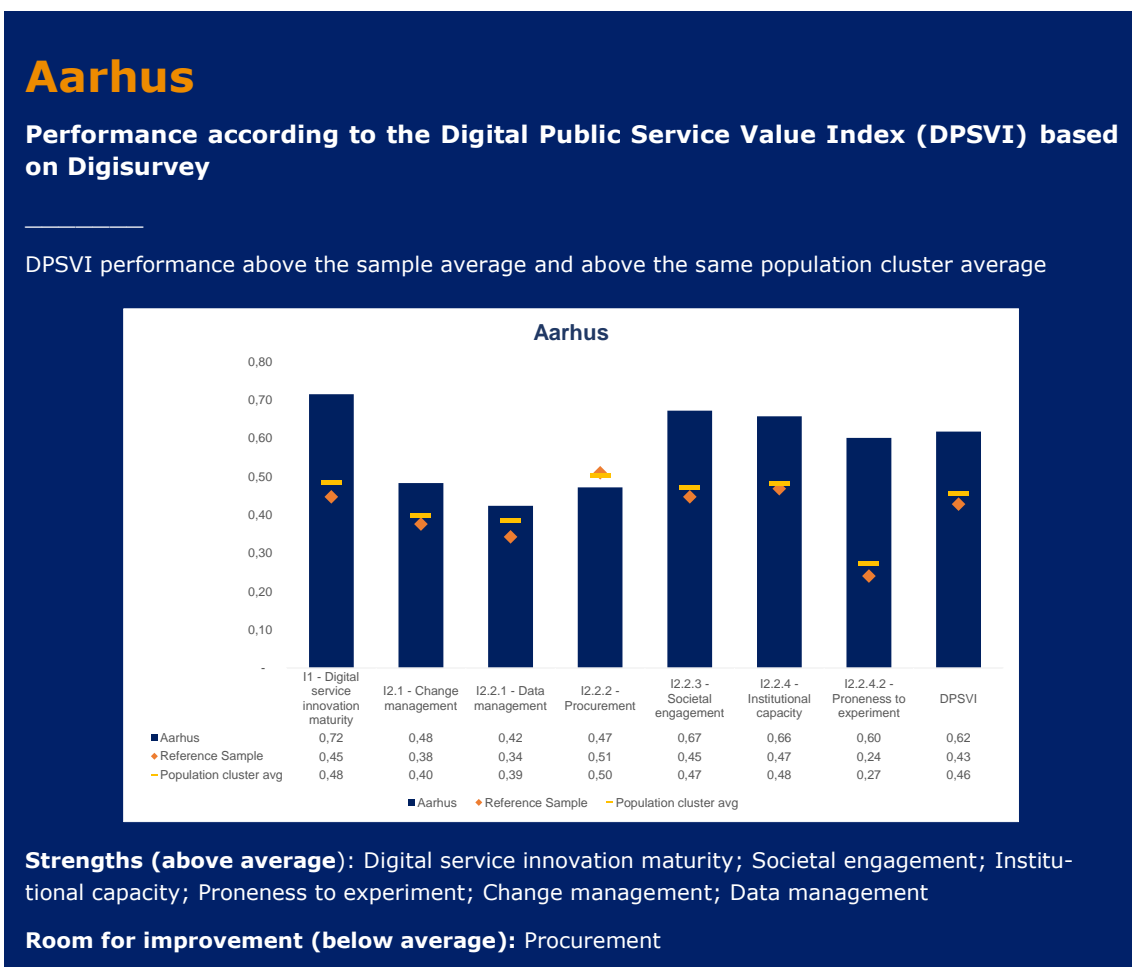


Figure 4 - Performance of the city of Aarhus in the DPSVI relative to the reference sample and the population cluster average

3 Case Study: Helsinki (Finland)

3.1 Overview and approach to digital innovation

Helsinki is the capital and largest city in Finland, with 650,000 inhabitants¹²⁸. The Helsinki metropolitan area includes the cities of Helsinki, Espoo, Vantaa and Kauniainen with a total population of 1,5 million. The Helsinki region also concentrates most innovation activities in Finland¹²⁹. In terms of economic structure, it is mostly a service-based economy - healthcare, social welfare and business services are the largest employers.

The city wants to become the “**most functional city in the world**” that provides solutions to make everyday life smoother, through a paradigm shift “from reactive to proactive” services that anticipate the needs of the population and can provide more targeted solutions. This approach will also be helpful to address population ageing which is expected to increase the costs of health care provision. At the same time, the renewed City strategy in 2021 places **sustainable growth** high in the agenda for the upcoming years and the objective is that Helsinki becomes carbon-neutral by 2035, thus implying a reduction in greenhouse gas emissions of 80%.

Helsinki’s efforts in digital transformation have already been recognized internationally. For example, the city ranked second in the IMD Smart City Index. Helsinki was also awarded the title of European Capital of Smart Tourism in 2019¹³⁰. The City also won the ‘Digital Cities’ category at the Global Year in Infrastructure conference organized by the Bentley institute¹³¹.

The digital strengths of the City lie partly in the openness of public data since 2008 which has led to new opportunities for businesses and new services in fields such as smart mobility, energy management, environment, among others. Moreover, **procurement processes are also conducive to innovation** in line with the national efforts over the years on this domain. The **innovation ecosystem is well-connected**, with the City’s innovation company- Forum Virium- bringing together the relevant actors in its projects. **Citizen engagement through participatory models and user feedback channels are also encouraged** and at the core of the City’s vision. Also, the **City leverages national, European and global city networks** to develop together projects of strategic importance and it has also become an influential city in topics such as the management of personal data.

3.2 Proneness to Change

The City of Helsinki is agile and forward-looking. Anchored in well-structured priorities for the future and solid digital foundations, the City has become more resilient and agile both to address short-term challenges such as COVID-19 and long-term challenges such as climate change and population ageing.

The early on pioneering open data efforts of the City allow for more data-driven solutions and decisions. There is a strong experimentation culture embedded in the City, fostered by Forum Virium Helsinki and a network of testbeds that enable new applications to flourish. The use of procurement and its processes

¹²⁸ [About the city - welcome.helsinki](https://www.helsinki.fi/en/about-the-city)

¹²⁹ [Economy and competitiveness | City of Helsinki](https://www.helsinki.fi/en/economy-and-competitiveness)

¹³⁰ Jointly with Lyon- [Competition winners 2019 \(europa.eu\)](https://www.europa.eu/competition/winners/2019)

¹³¹ [Helsinki wins the Digital Cities category at the global Year in Infrastructure conference | City of Helsinki](https://www.helsinki.fi/en/news/helsinki-wins-the-digital-cities-category-at-the-global-year-in-infrastructure-conference)

are at the top of the EU which also enables the creation of new markets, with strong collaboration with academia and businesses. More and more, the City looks for user-centric solutions that make everyday life better.

3.2.1 Innovation governance

3.2.1.1 Institutional Capacity

Strategy and priority-setting

Helsinki's City Strategy for 2017-2021 sets the vision of making Helsinki "The Most Functional City in the World"¹³² to enable the best everyday life for residents and visitors. In practice, the City wants to become a citizen-centred city to deliver high-quality public services and to build trust in the administration.

Moreover, the role of digitalisation as an enabler of the transformation towards a "functional city" is fully acknowledged in the Strategy which highlights that **"Helsinki Aims To Be The City In The World That Makes The Best Use Of Digitalisation"** in order to make everyday life more convenient. In other words, this means a **paradigm shift from reactive to proactive and personalised services and recommendations**. It is also about automating processes and services under the logic that "no service is good service", and to create 24/7 self-services that are available when needed.

In order to deliver on this promise, the City of Helsinki put forward a Digitalisation program¹³³ in 2019 which introduces changes and novelties at various levels- technology, development culture, organisation, management and staff skills- to make the City more user-centric, agile and with more data-driven service creation and decision-making¹³⁴. Highlights of the program alongside some concrete examples include, quoting from the plan:

- *"Developing better services together:*
 - In participatory budgeting, residents come up with ideas and choose plans for the City to implement.
 - Service users' satisfaction is measured, and feedback is considered in development. Services are tested with residents.
- *Making full use of data:*
 - City and traffic planning, as well as construction decisions, can be visualised and tested using a virtual city model.
 - Tourists can visit, experience and shop in a virtual Helsinki.
- *Tools and infrastructure up to date:*
 - Modern tools facilitate mobile and remote working. Internal human resources and financial systems have automated routine tasks and made managers' daily lives easier.
 - Many homecare visits can be replaced by new virtual telecare services.
- *Leadership and structural change:*

¹³² [helsinki city strategy leaflet.pdf](#)

¹³³ [HKI_Digiohjelm_a5_haitari_englanti.indd \(hel.fi\)](#)

¹³⁴ [Digitalisation can make Helsinki the most functional city in the world - Digitaalinen Helsinki](#)

- Agile projects will be funded with operating capital. There will be fewer heavy investment projects and the focus will move from projects to managing and developing products and product portfolios.”

The **six objectives of the Digitalisation program** are the following:

1. “Customers are to be served proactively and in a targeted manner.
2. Residents can have their say on how their data is used.
3. Thanks to automation, employees can focus on being truly present for customers.
4. Data will support leadership, decision-making and the development of services.
5. Helsinki will produce, utilise and share the best open data in the world.
6. The City will provide services in collaboration with other operators.”

The design of the Digitalisation program followed an internal co-creation approach involving the different units working on digital aspects so as to increase cross-functional collaboration and better alignment with the City’s overarching strategy. To this end, in 2018 the City partnered with the consultancy firm Peoplegeeks¹³⁵ to facilitate and organize large-scale workshops¹³⁶, accordingly, to “co-create elements to the digital roadmap, validate some of the most important digital development streams and create a platform and network for people to start collaborating over the silos”. The results showed that people became more willing to work cross-functionally in topics of mutual interest, and it was also easier to map responsibilities in “leading and facilitating the common digital work within the City”. In addition, participants were more aligned on the development streams to follow.

Thanks to the Program, 24 services have already been created “to make everyday life easier”¹³⁷. The new digital services have been applied to various fields namely Healthcare, Education, Citizen Engagement, Procurement, Tourism, Data Privacy, Culture, Climate change, Environment, Social inclusion, etc. Two concrete examples are the proactive pre-school placement, and the proactive health benefit check. We present those examples in more detail in sections 2 and 3.

The key initiatives part of the Strategy to contribute to digital city services, an user-centred agile culture, use of data, AI and robotization, better digital foundation, and to the new mode of operation and organisation include, for example: a Profile and portal for consent management, Reservation system for city’s facilities, **Citizen engagement platform**, Support for lean service creation, Centralised IT-support, API management, **Data Strategy, Digital Twin**, Cloud Strategy and O365, Multi-channel customer support, **Digital management team**, PMO and Change management training, One well-managed network infrastructure, among others.

Considering that the Strategy “Helsinki: the Most Functional City in the World” was defined for the period 2017-2021 (it is updated every council term), recently there was an update for 2021-2025. **“Helsinki City Strategy 2021—2025: A Place of Growth”¹³⁸** builds on previous achievements to promote sustainable growth, especially considering climate change and population ageing while also keeping in mind the recovery

¹³⁵ [Peoplegeeks - Let's co-create a healthy future of work.](#)

¹³⁶ [City of Helsinki: Creating Digital Strategy in Large-Scale Workshops \(peoplegeeks.net\)](#)

¹³⁷ [Helsinki's New Digital Services - Digitaalinen Helsinki](#)

¹³⁸ [helsinki city strategy 2021-2025.pdf \(windows.net\)](#)

from the pandemic. The key guiding principles¹³⁹ identified in the renewed strategy include, among others, the importance of “data and digitalisation to help run a smart city” **Specifically on this topic¹⁴⁰, the City wants to continue its path towards digitally enabled city services**, also because these will contribute to increased efficiency and thus to resource and cost optimization and savings. Digitalisation will also enable further transparency of city operations. For example, the automation of the City’s Financial Management system and the transparency of operational expenditures will be raised to at least the same level as the other cities in the Helsinki metropolitan area”.

Besides, the idea is to further explore the concept of **automation and self-service**, and to prioritise services that will improve the City’s predictive capabilities and even act as preventive solutions. There will also be investments in capacity-building so that City employees and residents can fully benefit from digital transformation.

Another point raised is that of **openness**- participation and engagement of citizens and businesses to “influence city services, decision-making, the operational environment and their own residential area” will also be promoted through multi-channel and inclusive means of interaction.

On the topic of “**Intelligent traffic solutions that underpin smooth transport**”¹⁴¹, the City stresses that it will “continue to invest in the digitalisation of traffic information and management, as well as in the intelligent transport infrastructure that facilitates commercial transport services”. Traditionally, Helsinki has been investing in sustainable smart mobility solutions which make the City a leader in the field¹⁴². For instance, **the world’s first mobility-as-a-service (MaaS) solution was born in Helsinki in 2016**. Therefore, the renewed strategy will only continue a “long-standing tradition” on the Mobility domain.

Regarding **monitoring and evaluation**, the City will report on the strategy’s implementation to the City Council halfway through the council’s term of office. “The City Board and the City Executive Team also regularly monitor the City Strategy’s key successes, impacts and challenges.”¹⁴³

Governance

The City of Helsinki is the biggest service organisation in Finland, employing 38,000 people. Indeed, Finnish cities have 535 statutory tasks and in addition the City of Helsinki provides 200-300 voluntary tasks or services in a wide range of services- Social services & Healthcare, Education, Urban Environment, Economic development, and Law enforcement. The key division is *Social services and healthcare* which represents half of the city budget.

As mentioned before, the 2017-2021 City Strategy put a strong emphasis on digitalisation for service provision. An important part is, according to the City, about “fixing the digital plumbing”, *i.e.*, to **improve the digital foundations** such as telecommunications, support services, lifecycle services for data terminals, servers, and capacity services”¹⁴⁴ to ensure reliability in the City’s operations. For this reason, **a digitalisation unit has been created at the City Executive Office’s new Strategy Department to focus on the digital foundations of the City**. This unit, established in early 2021, has around 150 employees and it is

¹³⁹ [Helsinki’s priorities for the council term and coming decade | City of Helsinki](#)

¹⁴⁰ [Helsinki’s priorities for the council term and coming decade | City of Helsinki](#)

¹⁴¹ [Helsinki’s priorities for the council term and coming decade | City of Helsinki](#)

¹⁴² [Smart mobility in Helsinki | My Helsinki](#)

¹⁴³ [Strategy implementation – indicators and monitoring | City of Helsinki](#)

¹⁴⁴ [City of Helsinki reforms its digital foundation – major project scheduled over several years | City of Helsinki](#)

led by the **Chief Digital Officer (CDO)**, a new position created to give a strong mandate to the work of this unit. The 2021 budget is of €100 million, which represents an additional €10 million for 2021 to accelerate the work and help the city recover from COVID-19¹⁴⁵. This new unit is part of a bigger organisational change initiated in 2017 in the context of the 2017-2021 Strategy for “the Most Functional City”.

The Digitalisation unit in 2021 further merged the IT teams dispersed across the City administration.

In fact, in the document of the City Budget for 2021¹⁴⁶, it is possible to read that “the number of information management staff will have decreased when some of the staff have moved to the central office City-level ICT support for the Digital Foundation team in the context of organisational change. The rest of the industry ICT support staff will move to the Digital Foundation team by 2022. For externally funded projects the staff required for the project will be hired.”

The CDO is a member of the City Executive team that is led by the Mayor. In addition to that, the **CDO heads the Digital Management team** that has been formally set up by the City Manager of the highest-ranking seating official (not a politician) so there is a strong mandate for the CDO. Formally, the digital unit is not taking any decision; instead, it is finding compromises and promoting alignment on digital topics internally. The formal decisions follow the City governance rules, in which the CDO is one of the main decision-makers and can approve calls up to 0.5M which then proceed to the City management or City Council. To some extent, there is “heavy governance” in the approval phase.

An important organisation also well-connected to the City of Helsinki is Forum Virium Helsinki (FVH)¹⁴⁷. Indeed, Forum Virium is the city-owned “innovation company” which helps to “see the future” for prospective services which gives this organisation more flexibility to run experiments. It has a budget of € 8-10M annually also including internal funds of the City. The CDO is also a Chairman of the Board for the Forum Virium Helsinki, which ensures a more direct connection between the solutions and the learnings from the projects of Forum Virium and potential applications to the City. While FVH has been essential to provide smart solutions to the City, it has also played a major role in connecting the innovation ecosystem towards common projects. The role of FVH will be further explored in the sub-section 2.1.3.

While Forum Virium is key to promoting experimentation of solutions, the City itself also offers this possibility. In fact, the Economic development department has also a **testbed for innovation platforms** (‘testbed.helsinki’¹⁴⁸). Moreover, there is **an innovation agent in each division** to help companies test their approaches, *i.e.*, innovation is happening in many fronts of the City; it has become pervasive.

The CDO also wants to foster a mindset that focuses on the need/problem to tackle rather than jumping into technical solutions without fully understanding which problem to solve. Therefore, the emphasis has been to change the way services are designed to assess what is exactly the problem, because sometimes it may not require a new tool, it may just be about the way of operating.

Capacity to develop digital solutions

¹⁴⁵ [Mikko Rusama, Helsinki: Writing the rule book on personal data - Cities Today \(cities-today.com\)](#)

¹⁴⁶ [City Council approves Helsinki budget for 2021 | City of Helsinki](#)

¹⁴⁷ [City of Helsinki Innovation Company - Forum Virium Helsinki](#)

¹⁴⁸ [Testbed Helsinki - Testbed Helsinki](#)

In the City of Helsinki there are around 2,000 job titles across various professional backgrounds such as engineers, doctors, biologists, lawyers and planners¹⁴⁹. In that sense, there is a diverse internal capacity in the City to coordinate the key activities.

Training and professional development are provided by the City, also with the “help of professional and vocational training”¹⁵⁰. Furthermore, mentoring opportunities are available for a newcomer to benefit from an experienced employee in the City. Apprenticeships are also possible and are ensured by a workplace supervisor. Additionally, the development of skills is also encouraged by rotation of tasks and employees can also take a training leave for study programs.

At the level of salaries, the City distinguishes the level of the degree with monetary rewards. Accordingly, more and more employees have postgraduate degrees.

However, the City notes that data capabilities are lacking especially considering the high ambition to leverage on data to drive City operations and to anticipate needs¹⁵¹. Most employees proficient in statistical methods and tools are employed at the Urban Research and Statistics Uni. In the City's 3D team, there are professionals in charge of building simulation and visualisation models. The service register platform also includes experts that do technical reporting. Nevertheless, competences are scarce in the Municipality when it comes to data science, data mining and machine learning. Accordingly, there is also a need for data engineers with an understanding of the cloud and data lake environments. Moreover, it would be beneficial for business administration departments to have some data & analytics expertise in order to realise the benefits of data. As a result, the City will employ data strategists to explore use cases based on data which will be complemented by trainings for business departments to get more familiar with the opportunities from data and digital technologies such as AI.

To foster an internal culture of experimentation, the CDO of the City of Helsinki has also initiated an internal innovation program through which employees can apply for a maximum of €10,000 for pilots or proof-of-concepts to find out for example how AI can help in their day-to-day work.

3.2.1.2 Data Management

As mentioned before, the Digitalisation program of 2019 proposed the definition of a **Data Strategy for the City of Helsinki**¹⁵² that would develop the data, AI and robotization capabilities of the City to make better use of data and digital tools for proactive public service delivery and hence to anticipate needs of residents and visitors.

The Data Strategy was approved in 2020, introducing the following changes and benefits as listed in the City's Data Strategy:

1. **“Data is utilised to create a city that proactively responds to residents' service needs on their terms-** proactive targeting of services requires the widespread employment of analytical methods.
2. **Data-driven decision-making-** at present the City lacks the capacity to make full use of the potential offered by modern data lakes, data warehouses and analytical methods in its decision-making and

¹⁴⁹ [The City of Helsinki is Finland's largest employer | City of Helsinki](#)

¹⁵⁰ [Training and development | City of Helsinki](#)

¹⁵¹ [Chapter 7. Competences And Organisation - Digitaalinen Helsinki](#)

¹⁵² [The City of Helsinki Data Strategy - Digitaalinen Helsinki](#)

operative activities. For example, the creation of a digital twin model of the city would enable the City's operations to be examined and simulated from various perspectives.

3. **The City's operations and resources are optimised with the help of data-** access to up-to-date data coupled with advanced analytics, such as machine learning, dynamic optimisation, and predictive models.
4. **The sharing of data drives business and the utilization of external resources-** data managed by the City should be shared and made available to the partners in the external ecosystem, such as communities, universities, and businesses.”

Underpinning these ambitions is the vision that **“the data generated by Helsinki is the most usable and used city data in the world by 2025”**. The City believes some bottlenecks remain for sharing and re-using the data. Accordingly, the Data Strategy was justified because of insufficient sharing and data aggregation between the City's divisions, City-owned companies and group companies. In part, the City believes this is an operating cultural aspect, but also due to the “lack of shared guidelines for promoting cooperation within the City”. Finally, another challenge common to municipalities is the use of personal data, as it entails an expert assessment of the legal basis (e.g., GDPR). To this end, nine principles were defined alongside some initial measures. For instance, *All data is accessible via APIs and in machine-readable format, or Data and analytics capabilities are developed based on the needs of the City's divisions and concrete use cases*. Examples of measures are the establishment of cross-divisional working groups, which will monitor the implementation of the Data Strategy; or providing city residents with the services to transparently monitor and manage the processing of their personal data.

To improve transparency and trust on the use of AI by the City, the AI Register¹⁵³ was created. It presents information on the City's AI systems and enables the exchange of ideas around human-centred AI in the city. The examples show that AI is increasingly being used across different divisions of the City. The Parking Chatbot¹⁵⁴, under the responsibility of the Urban Environment Division, uses natural language processing for identifying the main interests and replies back on “trained rule-based discussion paths and the open data connected to it.” It also takes into consideration the consent to location information. Another example is the IMMS (Intelligent Material Management System)¹⁵⁵ to manage the City Library's collection that includes 1.8 million items. The AI solution enables real-time tracking and tracing of the items in case they are moved thanks to Radio-frequency identification (RFID) tags. As a result, it has improved the handling of reservations and the efficiency of processing which leads to more time left for the library staff to dedicate to other tasks.

The City of Helsinki has also signed the Declaration for the **Cities Coalition for Digital Rights¹⁵⁶**, initiated by the Cities of Amsterdam, Barcelona and New York in November 2018. This initiative wants to, quoting, “improve the lives of people and support communities in cities by providing trustworthy and secure digital services and infrastructure”. The Coalition works together to develop local use cases and to share

¹⁵³ [City of Helsinki AI Register – Tekoälyrekisteri on ikkuna Helsingin kaupungin käytössä oleviin tekoälyjärjestelmiin. Rekisterin kautta pääset tutustumaan kaupungin tekoälyjärjestelmien yleisiin kuvauksiin, tai tutkimaan oman mielenkiintosi mukaan niiden tarkempia tietoja. Voit myös antaa palautetta, ja osallistua siten rakentamaan Helsinkiin ihmiskeskeistä tekoälyä.](#)

¹⁵⁴ [Parking chatbot – City of Helsinki AI Register](#)

¹⁵⁵ [Intelligent material-management system – City of Helsinki AI Register](#)

¹⁵⁶ [Cities for Digital Rights |](#)

experiences on digital rights topics that could also have influence at the global level. Once concrete output from this initiative is the Digital Rights Governance Framework¹⁵⁷.

In 2021, Helsinki joined the international MyData Global network¹⁵⁸- “a principle for managing personal data, which states that people must have the opportunity to manage, utilise and disclose any personal data collected on them”. According to the CDO, in the context of the City’s Data Strategy, MyData principles will be implemented “by creating the capabilities for the transparent management and authorisation of data”. In 2020, the Ministry of Finance decided to support with around € 2M the MyData activities of Helsinki, Espoo, Turku and Oulu.

Open data efforts in Finland started around 2008 and the world’s first Open Knowledge Festival¹⁵⁹ (part of the Open Knowledge Foundation) was an important landmark as it attracted visitors from 100 different countries, which created a “momentum” for starting to discuss open data practices. The other **important milestone for open data was the launch in 2011 of the Helsinki Region Infoshare service** providing free access to public data.

The Helsinki Region Infoshare (HRI)¹⁶⁰ is an open data service for the Helsinki metropolitan area cities- Helsinki, Espoo, Vantaa, and Kauniainen. Considering that Finnish municipalities have over 500 statutory functions and can also have optional functions¹⁶¹, there is a large volume of public data being produced and that, if open, could benefit all stakeholders such as academia and businesses who may want to use that data for research and innovation purposes. Therefore, HRI was created in 2011 precisely with that ambition. In the beginning, HRI was partially funded by the Finnish Independence Jubilee Fund Sitra and the Ministry of Finance with collaboration from the municipalities which currently fund this service. **Forum Virium Helsinki has also been fundamental to the evolution of this service over the years**, and between 2010-2013 it was responsible for project planning and coordination of the service¹⁶². For priority-setting, alignment and coordination purposes, there is a steering group which for example decides every year what HRI should do for the next year, etc (yearly budget of € 60,000). The steering group consists of the financiers (cities), executors, City of Helsinki Executive Office, and Forum Virium Helsinki. The City of Helsinki 's Executive Office is responsible for the operational coordination of HRI.”

Currently, HRI has 2 people working full-time on the service and the activities are a lot about communication, to train employees of the Cities on how to open data, provide consultations, promote developers’ meetings and to establish collaboration with universities. In the case of training, while they are intended for employees of cities in the Helsinki metropolitan area (all staff can join, not just for ICT teams), the training material is also made freely open to everyone, following the mindset of openness of the HRI service. In the website¹⁶³ it is possible to find a **podcast on the basics of open data**, the **slides of the information sessions on open data and HRI’s operations**, **data opening trainings** (e.g., “What is an open interface?”, “Open data and spatial databases”), **use cases** (e.g., application of geography and maps), and **ICT procurement trainings** (e.g., open source in procurement). Trainings typically start by covering the concept of open data, and

¹⁵⁷ [The first draft of the Digital Rights Governance Framework is out and open for feedback | Cities for Digital Rights](#)

¹⁵⁸ [Helsinki joins the international MyData Global network | City of Helsinki](#)

¹⁵⁹ [Open Knowledge Festival, Helsinki, Finland, 17 - 22 September 2012 | Joinup \(europa.eu\)](#)

¹⁶⁰ [Helsinki Region Infoshare - Avoimen datan palvelu \(hri.fi\)](#)

¹⁶¹ [Functions of municipalities and joint municipal authorities | LocalFinland.fi](#)

¹⁶² [What HRI? - Open data service](#)

¹⁶³ [Training materials - Open data service \(hri.fi\)](#)

then examples are given (i.e., showcases with popular data so that participants get a feeling of what they could get as professionals or citizens). Trainings usually take 3 hours and can also have invited speakers. Regarding collaboration with universities, an example is the activity for **students to create mobile apps using open data** which has been taking place for 5 years. HRI also organizes meetings with the Developers' community 4 or 5 times a year around specific themes (e.g., in December 2021 the topic will be on population statistics; previously also on climate adaptation).

Nowadays (March 2022), HRI hosts about 560 datasets and 290 applications have been built making use of that data. The datasets are organized around the following themes - *Living, Administration and decision-making, Maps, Culture and Leisure, Transport and Tourism, Education and Training, Built Environment, Economy and Taxation, Health and Social Services, Employment and livelihoods, Population and Environment and Nature*. **A concrete example of data interoperability across the 4 cities is the Service Map** which depicts the Helsinki region and enables users to search for public and private services and opening times, the routes to services and accessibility information of the services. The success factors here were the fact that i) data was in the same formats/standards as elsewhere, and ii) if the same open APIs are used, errors are noticed faster and thus quality improves. Updates of the service map are made every 30 minutes. **Another Finnish city not in the Metropolitan Region, Turku, is already using the same source code for the service map which shows the scaling-up potential of open source and interoperable solutions such as this one.**

Indeed, 2021 marks the 10-year anniversary of the Helsinki Region Infoshare service. According to HRI representatives, the lessons learned are the following: i) by working together, you can accomplish more; ii) interoperable data makes utilization easier; iii) building a community does not happen overnight, it requires persistent work to generate discussions and organize meetings with the community of data practitioners. In terms of achievements, the City highlights that **i) plenty of data from Helsinki region is now open and accessible for all** (e.g., GIS/map data, statistics and APIs); **ii) best practices of HRI are used around Finland in different services;** **iii) the established cooperation model helps when faced with new challenges/tasks** such as EU open data directive and high-value datasets. Going forward, HRI will continue the path towards more interoperable data, will promote more automatic data opening (a lot of data is still manually updated), and will train more people and promote discussions on the opening of algorithms and source codes. HRI organized an open data in the metropolitan area 10-year anniversary webinar¹⁶⁴, and the **lessons learned mentioned before were also presented at the 2021 EU Open Data Days**¹⁶⁵.

Finally, in 2021 the City of Helsinki collaborated with the World Economic Forum to build on its human-centric mindset for proactive service delivery to experiment on "building the blueprint for a human-centric approach to data relationships". The key outcomes were the following, quoting directly from the publication¹⁶⁶:

- "The definition of the **Helsinki Process for Utilizing Personal Data**: a management tool created to enable efficient data utilization. It defines stakeholders, roles, goals, and tasks when utilizing data, from the introductory stages to setting up the data environment and sharing results.

¹⁶⁴ [10 years of open data in the Helsinki metropolitan area - The recording of the festival webinar has been published - Open data service \(hri.fi\)](#)

¹⁶⁵ [Programme - EU Open Data Days - Publications Office of the EU \(europa.eu\)](#)

¹⁶⁶ [Empowered Data Societies: A Human-Centric Approach to Data Relationships | World Economic Forum \(weforum.org\)](#)

- The **Helsinki Template for Data Request** was developed to help plan the data utilization process.
- The **Helsinki Personal Data Hybrid Cloud Architecture** is a new, technology-agnostic blueprint for a GDPR-compliant hybrid cloud.
- **Helsinki Anonymizer** is an open-source software toolbox, developed for anonymizing unstructured or weakly structured data.
- The **Helsinki data-based service staircase** is a modular tool for project management, aimed at developing public services.”

3.2.1.3 Societal Engagement

Citizen engagement

The City of Helsinki has been actively promoting a model of open participation and interaction since 2016¹⁶⁷, with equal opportunities for participation. In fact, this model is embedded across all City operations and divisions, and each has its “own committee-approved participation plan, the progress and activities of which are monitored and reported on regularly”. Many of these initiatives intend to build transparency (e.g., with open data for municipal activities), to open up the municipal facilities to increase physical access, and to use digital channels so as to promote citizen engagement. The participation and interaction model has already been assessed in 2019¹⁶⁸. For example, the Helsinki Region Infoshare service is mentioned as an opportunity for resident participation through events and networking. In 2017, the **United Nations named the Participation and Interaction Model of the City of Helsinki as a good practice linked to the SDG Action *Make cities and human settlements inclusive, safe, resilient and sustainable*¹⁶⁹.**

One of the key initiatives is participatory budgeting, which is an opportunity for citizens to voice their concerns and put forward new ideas. This service is called OmaStadi (MyCity)¹⁷⁰ and the proposals to be voted on are included in the digital platform omastadi.hel.fi. The service is built on the Decidim platform, which is being “developed through international cooperation led by the City of Barcelona. The OmaStadi service is maintained by the City of Helsinki¹⁷¹. The participatory budget corresponds to 0.1% of the city’s annual budget¹⁷². In 2021, nearly 400 proposals by citizens were voted on. 47,064 residents participated in the voting process which is a turnout of 8.1% in the entire City representing a good voting turnout at the international level¹⁷³.

Moreover, citizens can access the City venues by using the online booking tool varaamo¹⁷⁴, also for booking equipment. Other digital channels for interaction with the City include the **feedback function**

¹⁶⁷ [Participation and Interaction Model | City of Helsinki](#)

¹⁶⁸ [osallisuus-ja-vuorovaikutusmallin-valiarviointiraportti.pdf \(hel.fi\)](#)

¹⁶⁹ [City of Helsinki’s participation model, linked to “Make cities and human settlements inclusive, safe, resilient and sustainable” - United Nations Partnerships for SDGs platform](#)

¹⁷⁰ [OmaStadi \(hel.fi\)](#)

¹⁷¹ [About the service - OmaStadi \(hel.fi\)](#)

¹⁷² [City of Helsinki’s participation model, linked to “Make cities and human settlements inclusive, safe, resilient and sustainable” - United Nations Partnerships for SDGs platform](#)

¹⁷³ [OmaStadi voting popular among Helsinki residents | City of Helsinki](#)

¹⁷⁴ [Welcome - Varaamo \(hel.fi\)](#)

available on the City of Helsinki's website¹⁷⁵, the online service **Kerro kantasi**¹⁷⁶ for local residents to express their opinions on topics under preparation, the Helsinki Canal¹⁷⁷, among others.

Alternatively, citizens can use the portal **Kuntalaisaloite.fi** (Citizen initiative) provided by the Finnish Ministry of Justice to “take municipal initiatives for the municipalities involved in the service and support and follow initiatives taken by others”¹⁷⁸, including the City of Helsinki.

Regarding citizen-centric approaches for public service provision, as mentioned before, the City is increasingly moving from reactive to proactive public service delivery considering the needs of residents. A big part of this effort will increasingly be driven by data and the use of digital technologies such as AI for better predictive capabilities. So, the user is at the core of this transformation in public service provision, and the relevant groups of citizens (the elderly, families, youth, etc) are involved in the pilots of the new solutions before moving to implementation. This is for instance the case in the SMS-based tool for pre-school placement, or the Health Benefit Analysis for medical diagnosis, among many others. We present those and other examples in more detail in section 4.

The City of Helsinki was also a pilot city in the EU project “Healthy Boost- Urban Labs for Better Health for All in the Baltic Sea Region – boosting cross-sectoral cooperation for health and wellbeing in the cities”¹⁷⁹, funded by the European Regional Development Fund and concluded in the Fall of 2021. The pilot of Helsinki envisaged increasing the participation of “under-represented groups in social activities and decision-making”, and it was integrated in the implementation of the 2020-2021 round of participatory budgeting projects. As part of the pilot, a three-round panel for the elderly was organized on remote activities in order to identify IT support needs and input from senior citizens on the best way to develop the services they use.

Additionally, the City believes that boosting digital skills eases integration. To this end, the City provides digital support across “libraries, service centres for older people, youth and resident housing, adult education centres, customer service points, Helsinki City Information and International House Helsinki”¹⁸⁰.

Interaction with the innovation ecosystem

The City is building a culture of technology experimentation together with innovation stakeholders. Forum Virium Helsinki is the City's independent innovation company to develop new digital innovations while also mobilizing businesses, public organisations, universities and citizens in this effort. The slogan of FVH is ‘fail fast, learn fast’ so that solutions can be tested in a real-world environment with real users before deciding to scale the idea. Forum Virium was founded in 2005 by the City of Helsinki and several media and telecommunications companies, such as Elisa, Nokia, TeliaSonera, Tieto and YLE Finnish Broadcasting Company¹⁸¹. As mentioned before, Forum Virium Helsinki focuses “on the future” and hence looks for “radical and systemic innovations”¹⁸², and assumes a user-driven and risk-taking attitude towards innovation. FVH operates on a project-based approach. Part of the budget comes from the internal

¹⁷⁵ [Give feedback | City of Helsinki](#)

¹⁷⁶ <https://kerrokantasi.hel.fi/hearing/F52rrGvbH61IV0616vda7JxXLazvtN5y?lang=en>

¹⁷⁷ [Etusivu - Helsinki-kanava \(helsinkikanava.fi\)](#)

¹⁷⁸ [Etusivu - Kuntalaisaloitepalvelu](#)

¹⁷⁹ [Healthy Boost EU project - Helsinki osallisuus \(osallistu.helsinki\)](#)

¹⁸⁰ [Good digital skills promote integration | City of Helsinki](#)

¹⁸¹ [cl_forum_virium_12_12.pdf \(gsma.com\)](#)

¹⁸² [Introduction - Forum Virium Helsinki](#)

funds of the City of Helsinki but many of the agile pilots and experimentations are funded under different EU funding streams such as Horizon 2020 and Horizon Europe. Forum Virium's partner network is global, though there is a focus in Europe. Companies are invited to pilot their solutions in the context of FVH's smart city projects. Other partners are universities and research institutions to integrate project consortiums, as well as Cities and Networks. Forum Virium Helsinki's board includes representatives from the company IBM and the City of Helsinki divisions.

FVH coordinated the project “Smart Kalasatama” that ran between Autumn 2013 and June 2021 for agile smart city experimentation in a district of Helsinki¹⁸³. City officials, businesses, researchers¹⁸⁴ and citizens were involved in the “several innovation projects and 25 agile pilot implemented in Kalasatama”, under the topics of Smart living, Smart infrastructure, Green infrastructure, and Everyday well-being. Funding was provided as part of the 6Aika strategy during 2015–2017 and from the City of Helsinki Innovation Fund for 2017–2021. Residents have also been active in this initiative- over 800 of Kalasatama's 3,000 residents have already participated in developing new smart solutions¹⁸⁵.

The final report of this project¹⁸⁶ presents the key lessons learned and insights from this experience which has attracted international interest. One of the key takeaways is that the model of agile piloting developed in the smart district has been successful as a testing platform in a real-life context, and while some of the early ideas did not work, others have led to new and concrete business applications and opportunities. Indeed, the Agile Piloting Programme has developed dozens of pilots in Kalasatama and has proven successful in bringing together the key actors and implementers in the district. This model has also been introduced in Norway, but there is growing interest internationally on this method.

On carbon-neutrality, companies have gained better insights on which low-carbon solutions and services are viable, while residents have become more aware of “how service choices can contribute to reducing their carbon footprint”. In terms of tech-driven solutions, smart technology has been used in buildings to understand and regulate energy and water consumption. **“Digital twin Helsinki has also made digital twin models of the Kalasatama area that are more detailed** relative to those of those of the whole city. Currently Kalasatama is exploring dynamic modelling of the natural environment to create a digital twin of green infrastructure”. Additionally, the carbon footprint experiment Kotihilli collected data on electricity consumption of Helen energy company's Sävel Plus service and the Miils service on food choices which were then merged into carbon footprint data to support making climate-friendly choices. In the context of making everyday life easier, a robot delivered “groceries from the K-supermarket of the RED1 shopping centre with Kone smart elevators to the apartment doors”. These are just a few examples of a much wider range of pilots tested during this period.

Following the Smart Kalasatama experience, the new Smart City - Helsinki Innovation Districts project will scale-up the best practices to Pasila and the urban renewal areas of Mellunkylä, Malmi and Malminkartano-Kannelmäki. The project is funded by the City of Helsinki Innovation Fund until 2023. The solutions will be the following according to FVH¹⁸⁷:

¹⁸³ [Sharing experiences from Smart Kalasatama – a district as an experimentation platform - Forum Virium Helsinki](#)

¹⁸⁴ [Forum Virium Helsinki Partner Network - Forum Virium Helsinki](#)

¹⁸⁵ [Helsinki - a unique testbed | My Helsinki](#)

¹⁸⁶ [Loppuraportti Fiksu Kalasatama Valmis 0811021-en.pdf - Google Drive](#)

¹⁸⁷ [Sivua ei löytnyt - Forum Virium Helsinki](#)

- Malmi: Smart lighting, street space analytics and resident experience.
- Pasila: 5G technology and city information model, logistics during construction and guidance.
- Malminkartano-Kannelmäki: The sharing economy of facilities, lighting, food and green infrastructure.
- Mellunkylä: Wood construction, cost-effective carbon neutrality, smart housing solutions and cooperation with housing companies.

The numerous projects run by FVH can be found at the website¹⁸⁸, with a big focus on the Internet-of-Things (IoT), Smart City and Smart Mobility.

As mentioned earlier, the City of Helsinki ultimately wants to turn the city into a testbed for innovative solutions and opportunities for businesses. For this reason, it created at the end of 2020 a Testbed.Helsinki program¹⁸⁹ for smart mobility, EdTech, Built Environment, and Health&Wellbeing, counting also with the support of FVH. As part of this initiative, Hackathons are also promoted to e.g. look for digital innovations for circular economy and waste treatment¹⁹⁰; collaborations will be established to find solutions to immobility¹⁹¹; an “Helsinki Innovation Districts project is looking for new solutions for smart lighting and street space analytics with quick experiments; among many others”.¹⁹²

A good example is also the Jätkäsaari Mobility Lab¹⁹³ established in 2019, under the topic of smart mobility. This is a project of the City of Helsinki funded by the City’s Innovation Fund, led by the City’s Economic development division-Unit for Innovations and New Experiments and coordinated with FVH (primarily involved in the agile piloting course and the citizen engagement process), to test and prototype companies’ solutions while addressing citizens’ needs and enabling sustainable transportation in the city. The location – Jätkäsaari- is because the area has one of the busiest passenger ports located in Europe, similar to an island, with congestion and pollution (seven times a day there are significant peaks). The key activities developed in the context of the Mobility Lab are Smart infrastructure, Launchpad, Test users, Test areas, Agile pilots, Network. The community is also often involved in the open calls and in setting challenges. Relative to the test users, there are 300 people in the mailing list, and people in that area tend to be interested because it is a dynamic area in terms of construction, so it is relatively easier to engage with residents there when compared to some older areas. Occasionally, there are also some rewards as gift cards for participating in the testbed.

A flagship is the project on on-demand electric boats. In 2020, in the **participatory budget**, as part of the ideas for how citizens want their environment to be improved, citizens pointed out the need for better connections between islands. At the same time, the mobility lab was aware of a company interested in testing on-demand electric boats which could improve the accessibility of Maritime Helsinki. As a result, **the Mobility Lab merged the residents’ need with the solution provider in the network**, and in Summer 2020 the boats were tested- 7,000 round trips took place despite being a “COVID summer”. Hence the solution has

¹⁸⁸ [Projects - Forum Virium Helsinki](#)

¹⁸⁹ [Testbed Helsinki - Testbed Helsinki](#)

¹⁹⁰ [Hackathon seeks digital solutions for circular economy and waste treatment - Testbed Helsinki](#)

¹⁹¹ [Wellbeing technology helps Helsinki to the challenges of immobility - Testbed Helsinki](#)

¹⁹² [Smart light, wise street: the search for fast experiments is open - Testbed Helsinki](#)

¹⁹³ [Jätkäsaari Mobility Lab - Helsinki’s testbed for smart mobility](#)

been further developed and piloted in another location of Helsinki. In a nutshell, the need identified by citizens was addressed and the uptake of the solution was also high.

Another case of user participation is that of improving **Air Quality within Project ‘HOPE- Healthy Outdoor Premises for Everyone’¹⁹⁴**, under an Urban Innovative Action. The project installed several types of air quality sensors in Jätkäsaari and other locations in the city, and low-cost powered sensors were distributed to residents to put them on the balconies or their backpacks, so they provide data from their own environment. The partners involved were the City of Helsinki, Helsinki University, the private company Vaisala Plc, Helsinki Regional Environmental Services authority, Finnish Meteorological Institute, Useless Company Std and Forum Virium Helsinki.

Regarding traffic management, the Jätkäsaari Smart Junction Project¹⁹⁵ was developed by the City, Aalto University and the startup CONVEX to install traffic radars and cameras in the main junctions all the way from the harbour to the motorway with the aim of getting a better picture of the traffic situation. Then, researchers apply AI and simulation models to next year manage and optimize the traffic lights. Within the project, a lot of the data is open for developers as well so that data is used also for other kinds of services (e.g., mobile services to provide better services and offering rewards on residents’ conscious behaviour to avoid congestion). At the same time, the university helps with providing the context, the data, and the real-life needs of the traffic managers can be used as proper cases for the university student’s coursework.

The City of Helsinki is also a partner in the *Ethics of AI*¹⁹⁶ free online course created by the University of Helsinki. The course covers the ethical aspects of AI, so that people are more familiar with “what can and can’t be done to develop AI in an ethically sustainable way, and how to start thinking about AI from an ethical point of view.”

3.2.1.4 Procurement

Traditional and innovative procurement

According to the 2021 European Commission study “EU-wide benchmarking of innovation procurement investments and policy frameworks”¹⁹⁷, **Finland ranks 1st** out of the 30 European countries analysed, considering the **strong efforts of the government to put in place a policy mix supporting innovation procurement.**

The national public procurement system is harmonized and decentralized, and the main public procurement competences are allocated to the Ministry for Finance, that is mostly responsible for guiding central government procurement related activities, and the Ministry of Economic Affairs and Employment, which prepares national procurement legislation and amendments. According to the latter¹⁹⁸, **municipalities and joint municipal authorities account for two thirds of the value of public procurement in Finland**, and the central government for one third.

¹⁹⁴ [HOPE - Healthy Outdoor Premises for Everyone | UIA - Urban Innovative Actions \(uia-initiative.eu\)](https://uia-initiative.eu/)

¹⁹⁵ [Smart Junction | Aalto-yliopisto](https://aalto-yliopisto.fi/)

¹⁹⁶ [Ethics of AI \(mooc.fi\)](https://mooc.fi/)

¹⁹⁷ [Results of EU wide benchmarking of innovation procurement investments and policy frameworks across Europe | Shaping Europe’s digital future \(europa.eu\)](https://europa.eu/)

¹⁹⁸ [Innovative public procurement - Ministry of Economic Affairs and Employment \(tem.fi\)](https://tem.fi/)

More concretely, the **action plan in the Government Program for innovative public procurement**¹⁹⁹ sets out measures to “increase the use of innovative public procurement, developing services and promoting sustainable growth”. The goal is to increase the volume of innovative public procurement to 10% of all procurements. For this reason, the instrument is incentivized to be used horizontally to drive social, climate and sustainability goals. Moreover, the plan puts emphasis on the importance of capacity-building on the topic. Though the target for innovation procurement is only set at the national level, some municipalities also set their own targets.

Finland also has a **national Competence Center for Sustainable and Innovative public procurement** entitled KEINO²⁰⁰, founded by Motiva, the Association of Finnish Local and Regional Authorities, VTT Technical Research Centre of Finland Ltd, The Finnish Funding Agency for Innovation – Business Finland, the Finnish Environment Institute SYKE, Hansel Ltd, KL-Kuntahankinnat Ltd and the Finnish Innovation Fund Sitra. The ambition is to increase the uptake of innovative and sustainable procurement and to boost knowledge exchange on the topic. An important part considers capacity-building activities as KEINO recognizes that public procurement requires specific skills linked to “budget and pricing expertise, operational procurement, expertise in procurement law and communication skills”. For this reason, the Competence Center organizes events and courses on an annual basis for public purchasing authorities²⁰¹.

Specifically on the topic of digital technologies, **Business Finland**- the Finnish public operator that provides innovation funding and internationalisation services and promotes tourism and investment-²⁰², **put forward in 2018 a Framework for turning digital transformation to solutions for the grand challenges**²⁰³, and places procurement as one of the policies important to drive investments in digital technologies including Artificial Intelligence, IoT, 5G and cybersecurity.

Finland has a centralised eProcurement platform available, Hansel Ltd²⁰⁴, which is a “state-owned public procurement enterprise that acts as a central purchasing body”²⁰⁵ for central and local governments. At the same time, **OpenProcurement.fi**²⁰⁶ - launched in 2017 as part of the Digitalisation of Government Procurement Programme²⁰⁷ and managed by Hansel as mandated by the Ministry of Finance- **provides in a transparent manner all information on central government and municipal procurement**, based on data published in the avoindata.fi²⁰⁸- the service that consolidates all Finnish open data.

Considering the policy mix – strategies, targets, competence center, platforms- in place to support public procurement and innovative procurement in the country, it thus comes as no surprise that Helsinki is also a leading city in the use of procurement. Indeed, **Helsinki’s procurement strategy was updated in 2020**²⁰⁹ **alongside the preparatory phase of Finland’s National Public Procurement Strategy**²¹⁰. Helsinki is in fact Finland’s largest buyer, with € 4 bn every year out of an annual national total of €

¹⁹⁹ [TEM-asiakirjapohja eng](#)

²⁰⁰ [About KEINO | Hankintakeino.fi](#)

²⁰¹ [Developing procurement competence | Hankintakeino.fi](#)

²⁰² [Etusivu - Business Finland](#)

²⁰³ [digital-finland-framework.pdf \(businessfinland.fi\)](#)

²⁰⁴ [Hansel - Hansel in brief](#)

²⁰⁵ [DPA Factsheets 2021 Finland vFinal.pdf \(europa.eu\)](#)

²⁰⁶ [Explore public spending \(openprocurement.fi\)](#)

²⁰⁷ [Valtion hankintojen digitalisoinnin toteutusohjelma \(valtioneuvosto.fi\)](#)

²⁰⁸ [avoindata.fi](#)

²⁰⁹ [Helsingin kaupungin hankintastrategia 14.12.2020](#)

²¹⁰ [City of Helsinki’s procurement strategy updated | City of Helsinki](#)

35 bn in procurement volume which shows the potential of the City to create new markets and services. The three main areas considered in the update were “functional markets, promotion of innovations, impact, responsibility, procurement management and procurement skills”. Additionally, a greater concern is placed on the responsibility and impact of procurements. According to the City, the ambition is to build up procurement expertise and to promote a greater involvement of residents, companies, and other stakeholders in the preparation of procurements. The strategy also highlights the role of pre-commercial procurement and innovation partnerships to incentivise innovation. Importantly, this update is also fully aligned with the key policy documents of the City such as the 2021 Helsinki City Strategy mentioned earlier.

Besides, the 2020 updated strategy also puts a stronger emphasis on sustainability, building on the 2015 Helsinki city guide for sustainable procurement. In particular, the City uses carbon footprint criteria to promote sustainable public procurement. As a result, Helsinki’s efforts have already been recognized in the European context. For instance, Helsinki was the Runner-up at the **2021 Procura+ Awards**²¹¹ for *Procurement Initiative of the Year* as the City project “identified low-carbon procurement pilots and supported the contracting entity with the sustainability perspective”.

Currently, the City performs public procurement of innovative solutions (PPI) with its own resources, while joint procurement for digital services/goods happens only rarely, and the main reason for doing it concerns obtaining lower prices for produced services and goods. **Tenders typically include as key requirements a data sharing agreement** for the access and re-use of data, and **Free/Libre Open-Source Software (FLOSS)**.

The experience of the City in procurement is also beneficial in the context of the project **AI4Cities**²¹², an **EU-funded Pre-Commercial Procurement (PCP) to find innovative AI solutions in Energy and Mobility** to reduce CO2 emissions in Helsinki and five other European cities²¹³. The tenderers’ offers will be evaluated by the Buyers Group, composed of **Forum Virium Helsinki, representing the City of Helsinki (and the lead procurer in the project)**, the City of Amsterdam, the City of Copenhagen, the City of Stavanger, the City of Tallinn and Cap Digital (for the Paris Region).

Financing digital solutions

In Helsinki, Digital innovation is part of the budget for each service area. For example, in 2020 the total amount of investment in ICT in the City was € 187 M, across all departments. In 2021, the new Digitalisation Unit received a budget of € 100M, including an additional €10 M for 2021 to “accelerate the work and help the city recover from COVID-19”²¹⁴.

Local/autonomous funds and Horizon 2020/Horizon Europe are the most relevant sources for the digital innovation activities of the City. Structural and cohesion funds such as the ERDF, alongside InvestEU, national and regional funds are also highly relevant. The top service areas particularly active in competitive funding calls at both national and European level are Building & Spatial Planning, and Transport & Mobility.

²¹¹ [Procura+ | AWARDS \(procuraplus.org\)](https://procuraplus.org/)

²¹² [AI4Cities | Home](https://ai4cities.eu/)

²¹³ [AI4Cities | RfT - phase 1](https://ai4cities.eu/rft-phase-1/)

²¹⁴ [Mikko Rusama, Helsinki: Writing the rule book on personal data - Cities Today \(cities-today.com\)](https://cities-today.com/news/mikko-rusama-helsinki-writing-the-rule-book-on-personal-data/)

3.2.2 Change Management

Participation in global, European and national cities' networks

The City of Helsinki is a regular participant in international and European networks- **Open and Agile Smart Cities (OASC)**²¹⁵, **EUROCITIES**²¹⁶, **Cities for Digital Rights**²¹⁷, **Living-in.EU**²¹⁸, **MyData Global network**²¹⁹. These participations have been fundamental to share experiences throughout the digital transformation journey, notably in areas regarding data - sharing, re-use, interoperability/standards, privacy-, use of digital tools, and alignment and coordination of efforts. **Helsinki is having a strong influence in shaping some of these key policies worldwide** due to the progress achieved over the years with its vision and strategic priorities for Digitalisation.

For example, within OASC, Helsinki is a **Personal Data Champion**. OASC looks into Minimal Interoperability Mechanisms (MIMs)²²⁰ to introduce “practical capabilities based on open technical specifications that allow cities and communities to replicate and scale solutions globally”. The current MIMs are *Context Information Management* (MIM 1); *Common Data Models* (MIM 2); *Marketplace Enablers* (MIM 3); *Personal Data Management* (MIM 4); and *Fair Artificial Intelligence* (MIM 5). In fact, MIM 4 on Personal Data was a new specification created by the City of Helsinki, together with Vastuu Group, 1001 Lakes and Visions. In fact, this MIM connects well with the personal data management policy put forward by the City. The goal is, accordingly, “to help data sources scale their service to multiple cities through a two-pillared interoperability framework that minimizes the amount of integration work required”²²¹. Nowadays, **the City of Helsinki utilises Vastuu Group’s MyDataShare as the “operator platform to enable the transparent flow of personal information** between systems as it digitalises permissions needed for trust and convenience regarding personal data management”²²². This solution has won the European Identity & Cloud Award 2021. Additionally, this is also fully in line with the principles of the MyData Global network.

City representatives also report direct **discussions with the European Commission and the European Parliament on topics related to data governance and data intermediation**. The City also has a very **close collaboration with the City of Amsterdam** on procurement standards for AI solutions. Moreover, in 2019 the **City of Helsinki signed the ‘City to City Digital Declaration’**²²³ **to strengthen the collaboration with the City of London** on topics related to e.g., AI for smart city solutions, 3D city modelling, ethical use of data, etc.

At the national level, the 6AIKA (“6Cities”)²²⁴ **network is delivering public value for the six largest Finnish cities- Helsinki, Vantaa, Tampere, Oulu, Turku and Espoo-**. In 2014, there was a decision by these cities to join forces and to share the funds rather than doing things individually. Put simply, the idea was not to compete, but to pool resources together and get more impact. First, there was a need to **build**

²¹⁵ [Our Cities - Open & Agile Smart Cities \(oascities.org\)](https://oascities.org/)

²¹⁶ [Helsinki - Eurocities](https://eurocities.eu/)

²¹⁷ [Cities for Digital Rights |](https://citiesfordigitalrights.org/)

²¹⁸ [We signed | Living in EU \(living-in.eu\)](https://living-in.eu/)

²¹⁹ [MyData Global - MyData.org](https://mydata.org/)

²²⁰ [MIMs - Open & Agile Smart Cities \(oascities.org\)](https://oascities.org/)

²²¹ [OASC MIM4 specification \(mydatashare.com\)](https://mydatashare.com/)

²²² [OASC Personal Data Champion City of Helsinki and Partner Vastuu Group and win European Identity & Cloud Award 2021 - Open & Agile Smart Cities \(oascities.org\)](https://oascities.org/)

²²³ [London and Helsinki announce new digital co-operation | City of Helsinki](https://cityofhelsinki.fi/en/news/london-and-helsinki-announce-new-digital-co-operation)

²²⁴ [What is 6Aika? - 6Aika](https://6aika.fi/)

“the foundations,” i.e., **capacity and the knowledge base through *spearhead projects*- open data and interfaces²²⁵, open innovation platforms²²⁶, and open participation and customership²²⁷**. These constituted the basis for the first big projects that were launched. The next phase was to conduct **pilot projects** across different thematic areas (e.g., smart mobility, learning, health, well-being, circular economy and energy efficiency). Nowadays, it is in the phase of scaling the results because the 6AIKA project ends in Summer 2021. Therefore, current efforts are in place to make sure each city that has participated can use the data and the knowledge that has been gathered over the years. The Six City Strategy 2014–2020 is part of Finland’s structural fund programme for sustainable growth and jobs 2014–2020. “The strategy and its projects are funded by European Regional Development Fund (ERDF), European Social Fund (ESF), the Finnish Government, the participating cities and project partners. The budget amounts to 100 million euros, approximately”. The project established a **rule that at least 2 cities had to be involved in each project to incentivize collaboration**.

Regarding the governance, in the beginning it took some time to build trust, not to compete, but afterwards the shared strategy/shared leadership approach solved the issue. The **Ministry of Economic Affairs and Employment** was at the top-level (giving political buy-in). For economic development, the highest decision-making power is in the **Management Group** which consists of the top-level city representatives from the Economic departments of each city, while in close collaboration with the **Steering group** and the **6Aika Strategy Office**. The latter handles the basic operations such as the opening of calls, what kind of themes in each call phase, etc. There were also **6AIKA coordinators** in each city that acted like “the voice of the city” for coordinating the activities in each city and putting the city ideas forward to the group. Each city has its own steering group to make sure the decisions are according to city-specific strategies.

Moreover, people working on projects have been learning from each other. For example, if a company/startup wants to work with different cities, the idea would be to have similar processes and transform the idea of “difficult administrations” thus smoothening the process for companies. Another important conclusion from the 6AIKA experience is that an effort should be made to collect the data to show policymakers the impact of what was achieved.

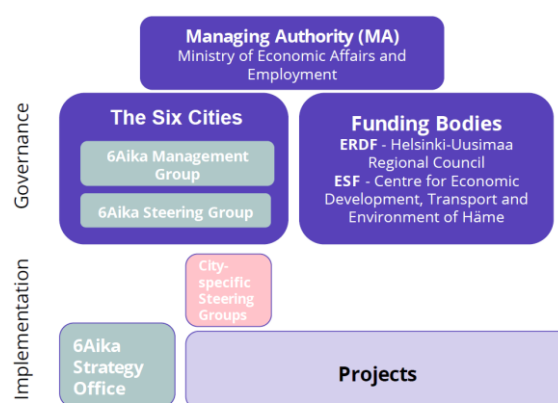


Figure 5 - Governance of 6AIKA

Source: 6AIKA

²²⁵ [Results: Open Data and Interfaces - 6Aika](#)

²²⁶ [Results: Open innovation platforms - 6Aika](#)

²²⁷ [Results: Open participation and customership - 6Aika](#)

In total, over 4,000 companies have participated in co-creation and piloting activities, 63 different organisations were involved and over 1010 specialists also took part in the initiative. Companies that worked with 6AIKA rated the project as 4,4 (in a scale of 1-5) thus very positively. As a result of “6AIKA:

- 708 companies were supported (with ESF),
- 842 products/services are on innovation platforms,
- 4 out of 5 companies would participate again,
- Over 5,600 people participated in improving their study or employment opportunities,
- It became easier to test at public premises.”

Almost 30% of the budget was allocated to the three Spearhead projects mentioned earlier, followed by Training and Employment, Circular Economy and Energy, and then by New Knowledge and Competences for SMEs, Smart City Solutions and Urban data, Mobility, Coordination, Learning, and finally Health and Wellbeing.

Before the end of the project, the team will prepare a final recommendation to the Ministry of Economic Affairs and Employment on good practices in urban development. A workshop will also be organized to ensure the continuity of joint and needs-based development work in the six cities after the end of the program.

The project will continue in 2021-2027 (aligned with the EU’s new regional and structural policy program) **but under a different configuration. The State has made an agreement with 16 urban areas in Finland** (mainly university and college areas), each with its specific themes. To some extent, it is “6AIKA at a larger scale”. The main objective is to build innovation ecosystems in different thematic areas. Helsinki is joining forces with Espoo and Vantaa (an ecosystem of more than a million people), including several universities and colleges and focusing on four different areas. The 6Cities knowledge will also be a good basis for the decision-making, idea creation and the establishment of collaborations. The Innovation Ecosystem Agreement for Helsinki, Espoo and Vantaa will cover content related to Smart and sustainable urban solutions, Wellbeing and health technology, New learning environments and digital solutions of skills development, and Emerging trends and general ecosystem development.

An example of a concrete project that took place under 6AIKA was project HIPPA²²⁸, to develop user-centred product and service design with enterprises to promote wellbeing in smart supported and service housing, by collaborating with companies in Helsinki, Tampere and Oulu. The added value from this project was on the tools that were developed and that remain available in the TUTTUnet testing and support network²²⁹. Indeed, this project “has developed operating models for the co-creation, testing, piloting, commercialization and marketing of user-driven products and services” and “to facilitate development work in the well-being and health sector”.

Participation in European projects and initiatives

²²⁸ [Results: HIPPA – Wellbeing and better service housing through digitalisation - 6Aika](#)

²²⁹ [Etusivu - TUTTU net](#)

The City of Helsinki is very active in European projects and initiatives. For example, the Horizon Dashboard²³⁰ shows that the EU contribution received by the City rose from € 142.44 M under FP7 to € 229.58 M under Horizon 2020. As mentioned earlier, Forum Virium Helsinki is also highly involved in many EU projects and figures from the Horizon Dashboard indicate a remarkable increase from an EU contribution of € 1.36 M under FP7 to € 12.08 M under Horizon 2020. Below we mention only two projects (**MySMARTLife and Synchronicity**) in what is a big landscape of projects in which the City and FVH take part.

mySMARTLife²³¹ is a project funded under Horizon 2020, with the following objectives, quoting:

- “Transforming current cities into more sustainable places where smart people and smart economy become reality.
- Making cities more environmentally friendly by reducing CO2 emissions and increasing the use of renewable energy sources.
- Making cities more inclusive and allowing a high quality of life.
- Involving citizens in the development of an integrated urban transformation strategy, which is easily transferable to other cities.
- Increasing the digitalisation of the cities thanks to the urban platforms.
- Implementing more than 150 actions in the three Lighthouse Cities of Nantes, Hamburg and Helsinki.
- Passing on experiences to the three Follower Cities as well as inviting other European cities to join the mySMARTLife Cities Network to share their experience.”

In this project, the City of Helsinki is a Lighthouse City, which means that the demonstrations are carried out in Helsinki and in the two other Lighthouse cities (Nantes and Hamburg). For example, the AI-enhanced Heat Demand Response of the City was piloted under the mySMARTLife project and has “saved 10-30% of building energy use in a building that was already very energy-efficient”. The project has led so far to the following interventions in areas of the City of Helsinki²³²:

- Merihaka and Vilhonvuori - Retrofitting Projects
- Kalasatama High-Performance Residential Buildings
- Viikki Environment House
- Energy Projects
- Smart Public Lighting
- Solar Power Plant
- E-Mobility
- Helsinki Urban Platform

For example, regarding the Helsinki Urban Data Platform, the Helsinki Urban Platform will (quoting) “be upgraded through the uptake of new open data generated in mySMARTLife as well as sourcing the heat

²³⁰ [Funding & tenders \(europa.eu\)](#)

²³¹ [Objectives - MySMARTLife](#)

²³² [Interventions - MySMARTLife](#)

leakage images of building facades to support the refurbishment activities. The 3D city model and IoT platforms are implemented and data available from the sectorial ICT systems will be utilised. Helsinki's Urban Platform will keep within the European open data and open API contexts, including the input from EIP SCC, FIWARE and OASC. The OGC open standards such as CityGML and SensorThings will be widely used".

SynchroniCity²³³ is a project funded under Horizon 2020, also co-funded by the Swiss Confederation and the South Korean Republic, **with the objective to develop large-scale IoT and AI-enabled services that impact citizens' lives** by involving **cities and businesses**. The City of Helsinki has been involved in different projects with other cities and business partners, such as the following projects:

- **Autonomous Air Quality Management (AAQM)**²³⁴ in public premises and buildings, together with Santander and Tampere: the project combined IoT, analytics and autonomous artificial intelligence. Besides, the solution presented features a user-friendly game style experience to test the usability. The key reported benefits for cities include for example increases in efficiency in public space maintenance services, improved "situational awareness in real-time", improved air quality, cost savings by optimising planning, resources, action and reaction time, etc;
- In the project **BLUEALPACA**²³⁵, Antwerp, Helsinki, Milan, Santander, are pilot cities to "assess the technical replicability and scalability of a conversational information service" involving around 2,000 citizens in total. The nine chatbot applications will be accessible by citizens and connected to real IoT data streams and mediated through the Synchronicity platform. Chatbots will run on cloud, integrated with the Synchronicity APIs to draw the data.

3.3 Digital Service Innovation Maturity

Digital infrastructure

According to the European Commission Digital Economy and Society Index 2021²³⁶, Finland ranks 5th in the EU regarding mobile broadband connectivity as measured by 4G coverage, 5G coverage, 5G readiness, and Mobile broadband take-up). The country ranks 4th in 5G readiness and 8th in 5G coverage.

As noted by the CDO, digitalisation is a major force that will change our lives- electrification and automation are rapidly happening in Finland which sets a completely new requirement for the digital infrastructure of the city requirements for sensors, fiber and other underpinning infrastructure.

Helsinki already offers fast and free city-wide Wi-Fi network for residents and visitors alike without password or registration needed. With 5G networks expanding, the City is also exploring these possibilities for new smart city experiments. For example, in 2020 the City of Helsinki in collaboration with partners has led **5G experiments related to augmented reality and edge computation**. Additionally, Pasila 5G, is a bigger project to test 5G and NB-IoT networks together with YIT, Telia and Mall of Tripla²³⁷.

Digital service innovation maturity across sectors

²³³ [Cities & Pilots | SynchroniCity \(synchronicity-iot.eu\)](https://synchronicity-iot.eu)

²³⁴ [Autonomous Air Quality Management \(AAQM\) | SynchroniCity \(synchronicity-iot.eu\)](https://synchronicity-iot.eu)

²³⁵ [BlueAlpaca | SynchroniCity \(synchronicity-iot.eu\)](https://synchronicity-iot.eu)

²³⁶ [DESI | Shaping Europe's digital future \(europa.eu\)](https://europa.eu)

²³⁷ [Built Environment - Testbed Helsinki](https://testbed.helsinki.fi)

Helsinki shows high digital service innovation maturity across various sectors such as Mobility, Health, Education, Environment, Urban planning, Welfare, Culture, Leisure, etc.

To begin with, Helsinki is a global pioneer in Smart mobility. The concept of Mobility-as-a-Service (MaaS) was borne in Helsinki region. This is an on-demand service integrating different modes of public and private transport in a single service. Whim by MaaS Global²³⁸ was the first ever MaaS solution and it was launched in Helsinki in 2016. According to the City²³⁹, “Helsinki’s vision is to be the first city in the world to offer a truly integrated personal mobility-as-a-service system”. Indeed, with this signalling political vision, the city’s mobility ecosystem has been expanding. An important enabler of the ecosystem is the Jätkäsaari Mobility Lab mentioned before, which allows companies to **test in a real environment their solutions**. Moreover, the City also has a **regulatory environment that is conducive to innovation** in smart mobility. Other key aspects behind this positive development are **open data**- transportation companies and operators in the Helsinki metropolitan area have opened their public data and it is available in the Helsinki Region Infoshare Service- and digital infrastructure that offers “fast and reliable connectivity” as described above. To this end, new smart mobility solutions have been piloted or implemented. For instance, Helsinki has been testing **robot buses** since 2016²⁴⁰ and in 2019 it was already possible to take a self-driving bus in Kalasatama to see how residents perceive them. Other examples include the experimentation of drone-based delivery services to the district of Jätkäsaari, Smart pedestrian warning system for the visually impaired, or an Autonomous Street sweeper²⁴¹.

The shift from reactive to proactive service provision based on data is already visible in the Health domain. For example, the **Health Benefit Analysis**²⁴² is a digital tool to analyse a patient’s data and applies a set of rules to predict the most adequate treatment. The tool optimises clinical diagnosis by linking medical guidance and top research. Some of the applications include a Risk calculator, a Care gap analysis, Clinical quality indicators, Population health reports, and a Health benefit calculator²⁴³. The idea is to apply preventive medicine so that medical professionals can identify and treat at-risk patients before any costly specialist care is needed. Additionally, the network of Helsinki’s health care centre offers a 24/7 online **chatbot**²⁴⁴ to clarify general health and illnesses at any time.

In **Education**, it is possible for parents of 6-year-olds to accept in seconds the kindergarten placement of their children²⁴⁵, also in a logic of proactive service delivery from the City. In **Environment**, the City has put forward in 2019 a platform entitled “**Helsinki climate watch**”²⁴⁶ for everyone to closely accompany the progress of climate action in Helsinki. For **visitors of the islands**, Helsinki has developed the **Ahti app**²⁴⁷ together with boating companies, boat clubs and others to make the app a “one-stop shop” with all information on the archipelago (e.g., sea routes, coffee shops, boat rental) to improve citizen participation in the decisions of the City. In **Energy**, the **Helsinki Energy and Climate Atlas**²⁴⁸ is a 3D city model with

²³⁸ [A Brief History of MaaS Global, the company behind the Whim app - Whim Helsinki](#)

²³⁹ [Smart mobility in Helsinki | My Helsinki](#)

²⁴⁰ [Helsinki - one of the world's most active test cities for robot buses](#)

²⁴¹ [Projects | Mobility Lab \(hel.fi\)](#)

²⁴² [Health Benefit Analysis improves medical diagnoses and encourages healthier lifestyles - Digitaalinen Helsinki](#)

²⁴³ [BA_CityTools.pdf \(bbhub.io\)f](#)

²⁴⁴ [Healthcare chatbot is available around the clock - Digitaalinen Helsinki](#)

²⁴⁵ [Preschool place with one text - Digital Helsinki](#)

²⁴⁶ [Helsinki Climate Watch](#)

²⁴⁷ [Ahti app puts the Helsinki archipelago at your fingertips - Digital Helsinki](#)

²⁴⁸ [Helsinki Energy and Climate Atlas](#)

information on buildings such as energy and repair data, consumption of water, district heating and electricity. Among other things, it is possible to calculate solar energy potential and to make heating demand predictions.

Below we zoom-in on a City service that illustrates how the City is executing in a simple and smart manner its vision for proactive service delivery- the **SMS-based tool for preschool placement**²⁴⁹.

Box 2 - Zoom-in: SMS based tool for preschool placement

○ Overview

In view of its vision to become the “most functional city in the world” to make everyday life as smooth as possible through proactive services, Helsinki now offers²⁵⁰ parents of children who are 6 years old and will be starting pre-primary education the possibility to accept via SMS a spot at the kindergarten. Hence, it is proactive service delivery in the sense that the City takes the initiative to reach out to parents to reduce the bureaucratic burden of filling in forms. The same benefit also applies to the day-care centres, which can save time by not having to process paper applications.

○ Relevance and uniqueness

The true innovation in this solution lies in the **personalized and situational-specific approach**- *i.e.*, the objective was to make it convenient for families that reside in Helsinki to easily get a confirmation for preschool placement.

The City of Helsinki is integrated with the National Depot Registry, so it gets up-to-date information. Age is one of the triggers for offering this placement that is available in the City data, while the second parameter is what is the preferred school based on address information.

This solution also required **legal innovation**, in the sense that the City had to make sure that it had the right to use this data. Privacy officers confirmed that sending the placement offer as an info message would solve this issue, and no express consent forms were needed. Indeed, the City stresses that “despite the automation, the proactive offering of a preschool place does not force the guardian to accept the place offered. If they do not want to accept the place being offered, then they can dismiss the offer with an SMS message and apply for another place by filling in an electronic application form in the City’s e-services portal”²⁵¹.

Moreover, this is a **simple and digitally inclusive solution** because not every parent may own a smartphone, so developing an app would not probably be the most inclusive approach. Thus, it is a smart and practical solution even if the level of technology embedment is minimal.

○ Challenges & Drivers

In a few (rare) cases, the address information was not properly up to date, *e.g.*, when a person had moved. Moreover, another challenge was the legal interpretation, which meant the City had to consider whether a consent form was needed from the parents. Finally, the City had to take into account how to offer an easy user experience using an “old legacy system”.

²⁴⁹ [Preschool place with one SMS message in Helsinki | City of Helsinki](#)

²⁵⁰ [Kindergarten place via SMS - Digitaalinen Helsinki](#)

²⁵¹ [Preschool place with one SMS message in Helsinki | City of Helsinki](#)

Key drivers include the strategic objective of the City to promote proactive services, and the fact that this project integrated the related Digitalisation program of Helsinki.

- **Implementation and Monitoring**

The **target group** for this solution were the parents with children turning 6 within the year.

The **pilot** was launched in January 2020 in two early childhood education areas of Helsinki. An SMS was sent to 1,058 families. The response rate was 88.66% and the acceptance rate registered was 84.6%. The pilot was then scaled-up to the entire city in January 2021. This time, the SMS was sent to 5,591 families and both the response rate and the acceptance rate surpassed that of the pilot- 93% (or 5,201) and 89% (or 4,645), respectively.

The **technical implementation is based on BookIT Finland Ltd's text message solution**. BookIT Finland Ltd sends out the preschool placements to parents through their text message application.

"The SMS-based preschool placement project is a key project of the digital citizen services section in the City of Helsinki Digitalisation Programme" supporting proactive public service delivery.

- **Impacts**

The **"proactive offering of a preschool place was tested in January 2020 in two early childhood education areas in different parts of Helsinki"** - Kulosaari, Herttoniemi and Laajasalo and Malminkartano, Kannelmäki, Hakuninmaa, Maununneva, Kuninkaantammi and Länsi-Pakila, Itä-Pakila and Maunula, Tuomarinkylä, Torpparinmäki and Oulunkylä. **The service expanded to the whole of Helsinki in 2021** following the high acceptance rates in the piloting phase.

As a result, the **confirmation of the kindergarten placement went from 2 months (with paper and online forms) to only 1 minute**.

Finally, the day-care centres also benefited from this solution, "as the processing of paper applications will mainly be eliminated".

In the future, the City expects²⁵² that this approach can be replicated to more statutory services, while making sure the right permissions to use the data are in place.

3.4 Conclusions and lessons learned

Helsinki is a global leading city in digital transformation. The City has well-established political and strategic priorities for digital development, underpinned by a strong culture of impact assessment and evaluation that contributes to greater transparency and to build on lessons learned to further improve policies, instruments and projects. Its participation and interaction model also leads to a trust-based relationship with citizens through initiatives such as Participatory Budgeting, Pilots with users in specific districts to collect their views on new solutions for the city, and other digital channels for residents to voice concerns.

The City is also a global pioneer in the provision of data-driven services, in line with its vision to move "from reactive to proactive service delivery". Its increasing effort to open public data, combined

²⁵² [Mikko Rusama, Helsinki: Writing the rule book on personal data - Cities Today \(cities-today.com\)](https://www.cities-today.com/2020/05/14/mikko-rusama-helsinki-writing-the-rule-book-on-personal-data/)

with an experimentation culture in real-life testbeds and high-quality digital infrastructure, has enabled new solutions to be created in fields such as Health, Education and Mobility. The City is also one of the most advanced countries in exploring solutions for the use of personal data according to human rights principles. Also, the City wants to ensure digital inclusion and accessibility across its services.

The City also benefits from a robust and dynamic innovation ecosystem, where the City’s “innovation company”- Forum Virium Helsinki- plays a key role to establish local, national and European partnerships and projects that are exploratory and based on agile piloting, with benefits to the entire ecosystem in Helsinki.

As a result, **Helsinki is increasingly an influential city in European city networks and digital policies.**

Below we explore in more detail some potential lessons learned from the experience of Helsinki in transforming its public service provision through digitalisation:

i) *Strong links between digitalisation efforts and megatrends such as climate change and demographic challenges enable “fit-for-purpose” policy responses - a paradigm shift from “reactive to proactive” service provision*

The City acknowledges in both the current and previous strategies, the importance of addressing environmental challenges such as climate change, and demographic challenges such as ageing. Both are already generating socioeconomic impacts including rising costs in the health care sector. As a result, the City is placing digitalisation as an enabler for more informed decisions on aspects such as transport, energy efficiency of buildings, or urban planning, as well as to anticipate needs and to act proactively, rather than reactively to problems faced by citizens.

For example, digital twins and a 3D model of the city are supporting urban planning decisions. Also, a digital tool is helping medical professionals to identify and treat at-risk patients early on before costly specialist care is required²⁵³.

ii) *Helsinki is bearing the fruits from its pioneering efforts to open public data.*

Helsinki was one of the first regions to open public data. The Helsinki Region Infoshare consolidates data from the whole metropolitan region and incentivizes its use by developers, universities (and students) and businesses. However, building a community that is interested in data sharing and re-use takes time, it is the result of a decade of persistence of the HRI that will continue in the future. An increasing number of new applications has been emerging from this effort to better inform policymaking. This data has been important to build 3D models and digital twins of specific areas of the city, an example being the Kalasatama Digital Twins Project²⁵⁴.

iii) *A city-owned “innovation company” with flexibility and a strong mandate for innovation collaboration with local, national, and cross-border collaborations has led to the emergence of smart city solutions*

²⁵³ [BA_CityTools.pdf \(bbhub.io\)](#)

²⁵⁴ [Loppuraportti \(hel.fi\)](#)

Forum Virium Helsinki has been a key actor to drive a culture of experimentation and of agile piloting for testing new solutions. It has developed extensive experience in involving the right partners to generate new solutions. This organisation is also an active coordinator and participant in EU projects and programs.

iv) Pooling resources together with other cities maximizes impact and the scaling-up of solutions. At the same time, this requires the right governance to be in place.

The 6AIKA is a good example of a group of cities pooling together funding (rather than competing for it), with a well-structured governance for taking decisions and a good design of the different phases, from setting the foundations (the spearhead projects), to developing pilots and moving to project implementation, which has to take place in at least two cities.

v) Building a culture of engagement with citizens through structured channels such as participatory budgeting but also through a user-centric mindset for developing new solutions has built trust in the city administration and generated more public value

The City of Helsinki has been actively promoting a model of open participation and interaction, with the OmaStadi participatory budgeting, Kerro kantasi for local residents to express their opinions on topics under preparation, or by participating in European projects that shed light on how to better include the needs of specific user groups in service creation.

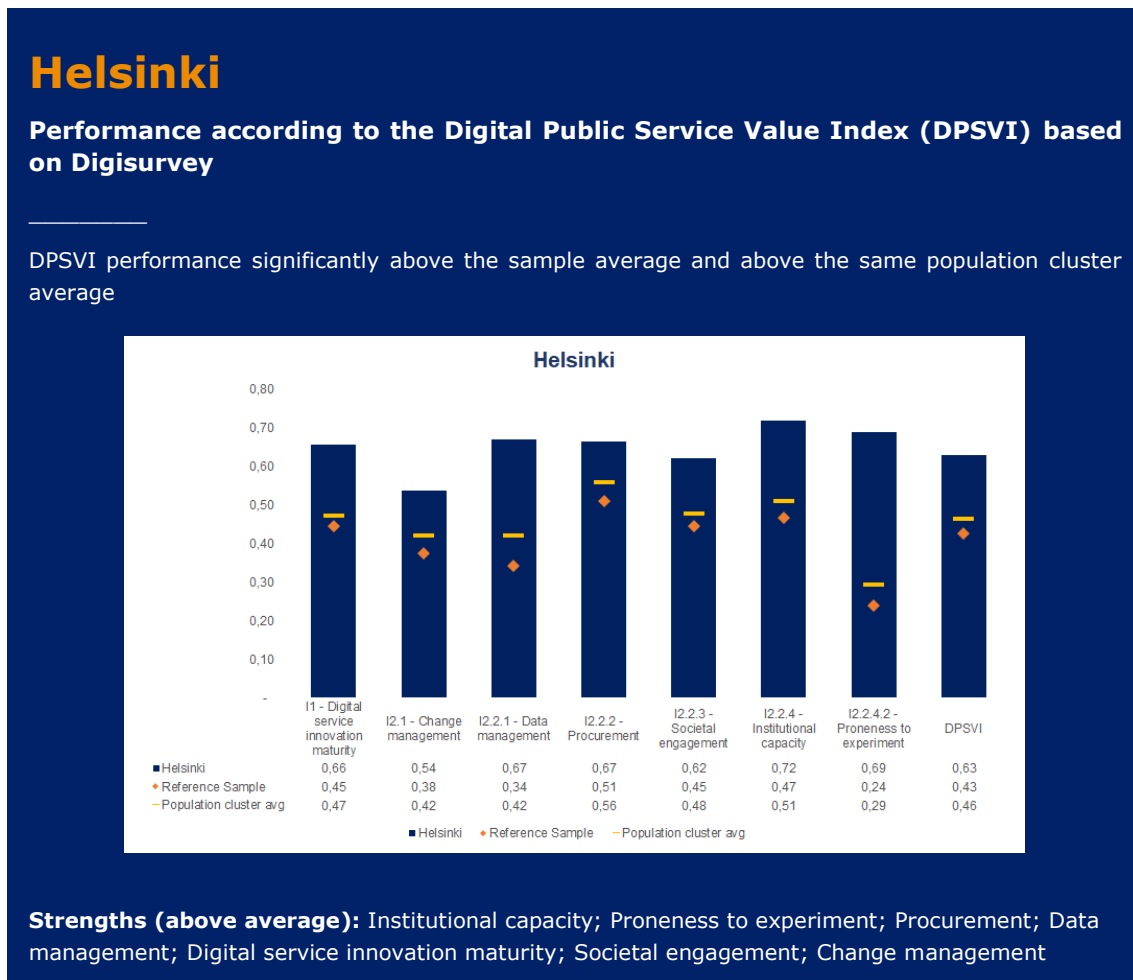


Figure 6 - Performance of the city of Helsinki in the DPSVI relative to the reference sample and the population cluster average

4 Case Study: Ljubljana (Slovenia)

4.1 Overview and approach to digital innovation

Ljubljana is the capital and largest city of Slovenia with 294.464 inhabitants²⁵⁵. Ljubljana also integrates the Ljubljana Urban Region which is the most developed region in the country. In terms of economic structure, the city has a mix of industry (e.g., pharmaceuticals, petrochemicals) and service activities (Health, IT, Tourism)²⁵⁶. The city is home to a vibrant academic environment due to the presence of the University of Ljubljana and other research institutes, as well as a dynamic innovation ecosystem with key intermediaries such as Technology Park Ljubljana and important innovation actors such as the Slovenia's Digital Innovation Hub, accelerators, and incubators²⁵⁷.

Tourism in Ljubljana has registered steady growth over the years²⁵⁸ reflecting the continuous efforts of the City to make Ljubljana an attractive, green and smart destination. Indeed, between 2018 and 2019 Ljubljana Tourism led an initiative called "Enhancing the digital promotion of Ljubljana and the Ljubljana region as one of the leading tourist destinations in Slovenia"²⁵⁹. In Ljubljana, "sightseeing and technology go hand-in-hand" so the City has promoted key initiatives for accessible and integrated public transportation for visitors and residents, revamped the *Visit Ljubljana* website and app, and is exploring new tools such as virtual reality to experience the city. These efforts have been recognized by the 2020 award "European Capital of Smart Tourism- digitalisation category"²⁶⁰.

Ljubljana wants to become one of the smartest and greenest cities in the world. The city received the title "European Green Capital 2016"²⁶¹ due to its efforts on sustainable mobility, green supply chains, sustainable land use, smart waste management, among others. As a result, **the development of public services in the City is anchored in a vision for a sustainable and digital Ljubljana.**

The City is currently designing its Digital Strategy in order to more effectively meet that vision. Despite that, there are already examples of relevant digitally innovative services across sectors, with different levels of technological maturity and complexity embedded. The organisational structure to govern the digital portfolio has only very recently been updated to address silos. There is significant collaboration with the innovation ecosystem to jointly lead projects and co-develop new solutions also due to the lack of internal capacity to lead the technological side of new initiatives. The City leverages on European networks, projects and competitions to share knowledge, develop pilots and get visibility for the digital transformation path it has been following over the years. Since early 2000s the Municipality has aimed to create a culture of direct communication with citizens.

²⁵⁵ SURS Republic of Slovenia Statistical Office: Population by MUNICIPALITIES 1.1.2021 [Population by MUNICIPALITIES, HALF-YEAR and AGE. PxWeb \(stat.si\)](#)

²⁵⁶ [Ljubljana | URBACT](#)

²⁵⁷ [JRC Publications Repository - Place-based Innovation Ecosystems: Ljubljana start-up ecosystem and the Technology Park Ljubljana \(Slovenia\) \(europa.eu\)](#)

²⁵⁸ [Tourist arrivals and overnight stays in previous years » Visit Ljubljana](#)

²⁵⁹ [Enhanced digital promotion of Ljubljana and the Ljubljana region » Visit Ljubljana](#)

²⁶⁰ [LJUBLJANA - Category winner: DIGITALISATION \(europa.eu\)](#)

²⁶¹ [Winning cities \(europa.eu\)](#)

4.2 Proneness to Change

It is expected that the City's innovation governance will gradually become more agile and efficient once the upcoming digital strategy for Ljubljana enters the implementation phase. As of January 2022, the internal structure has been updated to position Digitalisation at the same high level of other key departments, as some **silos emerged at times**. There have been considerable efforts to develop new data-driven applications and public services, often in partnership with public or private companies, intermediaries, and academia. This public-private approach has already proven successful in some of fields, especially considering that the City does not always have the capacity to develop the technological components of more sophisticated solutions. Traditional and innovative procurement remains challenging, and its potential is underutilised to stimulate innovation.

The new strategy will also revamp data sharing and integrated solutions across different verticals following interoperability standards, in an urban data platform. This will also open the door for developing the digital twin.

Establishing **structured channels for interaction between the Municipality and citizens** has been a priority for the City since the early 00's to build trust and transparency. These are both physical and digitally enabled initiatives.

4.2.1 Innovation governance

4.2.1.1 Institutional Capacity

Digital strategic priorities

The City of Ljubljana is currently developing its digital/smart city strategy. The decision on the development of the Strategy was taken at the Strategic Council for Informatics of the City of Ljubljana and the activities have been coordinated by the Working Group for Digital development at the City administration. NGOs and external experts were hired for organisational and professional support. The design process is set bottom-up, inclusive and open. In the next six months, the City plans workshops with City administration departments and services, key institutions and public companies. The purpose of these workshops is to assess digital maturity, competencies and identify key personnel in individual areas of management, as well as gaps, barriers, and pain points in the implementation phase.

At the same time, the City will organize focus groups with stakeholders from the ecosystem of the city- non-governmental organisations (NGOs), representatives from various business associations, universities and research institutes, and professional associations (Strategic Research and Innovation Partnership, Digital Innovation Hubs, etc). **Communication with citizens** is planned through an online survey and small meetings, primarily through gate-keepers. Special consideration will also be provided for vulnerable groups (blind, visually impaired, people with disabilities, digitally illiterate, socially disadvantaged, etc.). The development of the concept of the document and the content will be regularly checked with other municipalities, the Ministry of Public Administration, and the Government Office for the Digital Society, as well as professional associations.

Moreover, the City also strives to implement the openness of the process through participation in other public events, including round-table discussions on the topic of digital transition in Ljubljana and beyond. The development of the strategy will be regularly presented to the management of the City administration, where key open issues will be communicated. Before submitting the final Strategic document to

the City Council for approval, an open public debate will be held again for further discussion. The Strategy is planned for and aligned with the financial window 2021-2027, with individual action plans and other milestones for evaluation and amendments.

Governance

The design of the Digital Strategy has brought some organisational changes to solve existing silos.

In particular, the **department responsible for Digital development has been upgraded in the organisational structure** to the same level as other key departments in City administration (e.g., finances, legal department, ...). That enables that responsible person for digitalisation to be always present in key decision-making in city administration. Another effective measure is, through a data discovery process, to bring data from everyday business processes to shared data and open them to entitled entities mostly inside the City administration, but also as open data and data for feeding services for end users. This way, connecting processes and exchanging data between different entities inside city administration becomes open by default. The digital development unit will have four key pillars- Governance, Processes (e.g., connecting payment and transportation), Data (governed by a single data management system); and Infrastructure (Wi-Fi, IoT, cloud).

The Digital development advisor is and will continue to be daily involved in the work of the department responsible for digital development. He leads the working group for digital development which is the key operational body for the design of projects and proposals and for communication with external parties in this field. He is regularly (weekly) present in the formal *City board for general matters and city development*, and he is also in direct communication with other City departments chiefs and Heads of city companies and other organisations and in direct contact with the mayor and his close associates. But the overarching coordination is made at the Working Group for Digital development. Cooperation with external experts from the University of Ljubljana and the Chamber of Commerce and Industry of Slovenia has also increased significantly.

General alignment with the Digital Slovenia national strategies for 2020 and 2030²⁶² will also be checked, as the national strategy will be useful for setting priorities for executing projects that are prioritized at the national level. The City of Ljubljana is a supporter of the **Slovenian Digital Coalition²⁶³** but is not directly involved. However, the City is represented through Digital Coalition stakeholders. The Municipality promotes regular exchanges of information through local communities' associations and with Digital Coalition stakeholders following guidelines proposed by Digital Coalition.

The City of Ljubljana is also regularly in touch with other public authorities at local and national level. The City is particularly active in the communication with the **Association of Urban Municipalities of Slovenia²⁶⁴** that represents the 12 urban municipalities, the biggest cities in their respective regions with a special status. At the moment, the municipalities are working intensively on the topics of *Digital strategies* and *Financial programming for municipalities (2021-2027)*, where digital projects are also taken into account. This Association ends up having a leading role in harmonizing digitalisation processes, due to the fact the country does not have functional regions (*i.e.*, there are Eastern and Western Cohesion Regions, but they do not function as regions in the structural way). In the past, Cohesion policy programs and the various

²⁶² [Digitalisation of society | GOV.SI](#)

²⁶³ [Digital coalition - Digitalna En](#)

²⁶⁴ [English – Združenje mestnih občin Slovenije \(zmos.si\)](#)

urban municipalities were in a way forced to work together because of the Integrated Territorial Mechanism, so the Association was a sort of intermediary in the first phase of selection of projects. That process resulted in more collaboration between urban municipalities than ever before. Five years ago, urban municipalities started to exchange some practice on some projects (e.g., on urban development strategies) which “forced” them to collaborate further. That is the story of why the Association became a force nowadays, and in the digital field.

However, it is perceived that Slovenia in general has been lacking real dynamics in digital development as a country. In practice, the 212 municipalities that exist in Slovenia, a country with roughly 2 million people, did not have a coherent integrated development of digital functions until some time ago. Digital development was dispersed across “212 centers of digital development”. Thanks to the efforts of the Association, these initiatives are becoming more integrated, and projects and practices are more regularly exchanged and coordinated (e.g. joint procurement process for a city card, IT system for payments, getting information about air quality, etc).

The OECD Digital Government Review of Slovenia²⁶⁵ stresses that “although the sub-national administration benefits from considerable autonomy, the central government based in the capital Ljubljana is responsible for a wide policy portfolio (...) and **several stakeholders highlighted that new governments tend to discontinue projects and initiatives underway**, with clear negative consequences on the sustainability of policy action and results”. Another example of negative impact from a certain level of uncertainty from the central government relates to the cancellation of a national tender for municipalities to apply for digital infrastructure in 2021.

Capacity-building

The City’s view is that public entities often struggle to attract highly competent professional developers for the public sector due to limited budgets to offer highly competitive salaries. However, this need can be solved by involving private partners in certain activities linked to technology and digitalisation, as long as their reliability and respect for data privacy is ensured. Hence, Ljubljana believes that public-private partnerships (PPPs) can provide good results by merging the specific and technical competencies of the private sector with the strategic priorities of the City, as to deliver more value from public service provision.

The City provides **optional ICT training** to its employees, and sometimes also training activities with external experts for specific needs.

4.2.1.2 Data Management

Nowadays, Data is collected but not governed by a specific strategy, i.e., the public authority has a data collection system but does not standardise or publish data on a regular basis. However, **Open data, data use and re-use, data discovery and data management will be important pillars of the upcoming Digital strategy** mentioned above.

The City has a centralised data platform with limited real-time and static data available in a range of formats, static data refreshed at suitable intervals, limited quality control, etc. Most data collected comes

²⁶⁵ [Digital Government Review of Slovenia: Leading the Digital Transformation of the Public Sector | en | OECD](#)

from the City administration, national public administration, utility companies, and citizens. Currently, data is used consistently mostly in the fields of Building & Spatial Planning, Culture&Leisure, Transport&Mobility, and Social&Welfare services. An example is spatial data - it is ordered in numerous layers that can be used for different purposes (streets, buildings, trees, ongoing constructions, parks, traffic info, etc).

The data platform is not yet connected with a data modelling function to produce large virtual environments to achieve a real-world experience such as Local Digital Twins or similar. However, the **integration is planned**. The City is following digital twin solutions and using those experiences as input for its designs. The City perceives the quality of the digital twin as mostly dependent upon two factors: the 'resolution' of the digital twin that is based on quantity, quality and depth of data used, and on BI and AI tools that are used for analytics, visualisations, and predictions.

Also in preparation is the development of an Interoperability Framework or Strategy. Nevertheless, **the City is already making use of interoperable digital solutions or services** such as the Connecting Europe Facility (CEF), the OASC Minimal Interoperability Mechanisms (MIMs), and the FIWARE standards.

Data are made available on the Web under an open license and a non-proprietary open format (e.g., CSV instead of Excel). The license used to publish data openly on the City data platform is CC 0 - Public Domain / PDDL, which means that it relinquishes all copyright rights and allows for any kind of reuse (Commercial and non-commercial) without limitations.

The formal launch of the urban smart city platform is in the process of a public tender. The next step is to formally present the key elements, especially the data management system that will gather city data from all departments and organisations in a single repository. With this smart city platform, there will be an open API layer, services can be connected to any verticals (e.g., bike sharing, tourism). For the set-up of the platform, technical challenges were not detected as crucial because the City believes technology will not be the problem in setting up the platform. On the other hand, capacity challenges will probably be more challenging, as there is a lack of personnel with the proper knowledge to ensure the implementation of the solution with sufficient capacity. There are also some legal obstacles (data geolocation) and response time difficulties that will have to be addressed.

The City of Ljubljana maintains its own digital infrastructure (servers, communications, working stations, etc) regularly. Mostly, the City uses its own infrastructure, but also some outsourced infrastructure that is connected with service-based solutions. For future platform development, the City is planning to use urban city platform as a service integrated with solutions, basic systems and infrastructure.

4.2.1.3 Societal Engagement

Citizen engagement

The City has recognized since 2003 the importance of consulting and involving citizens in the decision-making process including in the creation of more adequate solutions that serve the needs of the residents of Ljubljana. Indeed, an Office entitled **Citizens' Initiatives Service** was founded in 2003 to precisely provide direct communication channels for citizens to interact with the Municipality. The main structured initiatives in place are the "Open Days with the Mayor", the Web Portal for Citizens' initiatives, and the

Info 65+²⁶⁶. Additionally, the 17 City quarters host a total of 53 offices, where citizens can communicate directly with the administration, get information, etc. The Municipality believes these complementary physical channels of interaction are important because of the digital divide, thus providing a more inclusive interaction between the City and the residents.

Since 2006, the City has promoted the initiative “Mayor’s Open Days”, which takes place at least twice a month at the City Hall. Citizens can make an appointment by phone, fax, e-mail, regular mail or in person. Just in the first decade of implementation (2006-2017), 25,500 citizens were able to send to the dedicated services of the City their suggestions ahead of the meeting with the Mayor, so that the Mayor would be already informed about the details of the issues at stake thus leading to richer discussions. Afterwards, the Mayor sends his views back to the Office which processes the final reply to the citizen. The topics covered typically relate to infrastructure, environment, transport, among other issues.

The online Portal Service for Citizens' Initiatives²⁶⁷ was created in 2008 and has registered 46,694 submissions of new proposals, comments and problems detected as of December 2021. The categories are diverse – Informatics, Culture, Waste, Water Supply, and many others. Citizens can create an online entry of the initiative without registration; they only need to include basic information (name and surname) and the City ensures that anonymity is preserved. Alternatively, citizens can also use the Facebook page to submit their views. Upon submission, the Office responsible for the Citizens’ Initiative makes sure that the right department of the Municipality addresses that request. The average time to reply is 3 days, and the maximum is 8 days. For transparency reasons, all initiatives are publicly available with the respective status-cast, pending and resolved. The answer from the City is also published in the portal²⁶⁸.

Furthermore, the Information Office 65+²⁶⁹ opened in 2016 within the Central Information Office of the City, for people over 65 years old and/or with disabilities to enable physical access to the City premises for basic information on public services and key activities available to them.

The internal budget of the Municipality funds both the operation of the web portal and INFO65 +. The City of Ljubljana believes that these initiatives show that it is possible to create a culture of regular communication with citizens to deliver public value even on a small budget.

The Office responsible for the Citizens’ Initiative Service monitors on a regular basis the outputs from these initiatives, notably the number of entries in the web portal, number of meetings with the Mayor, and the number of visitors at the Information Office 65+. Most suggestions and questions are also discussed and reviewed in a triple helix Commission (i.e., it is composed by the administration, council representatives and citizens) for Citizens’ Initiative of the City Council. Their regular meetings and final positions are publicly available on the website of the Municipality of Ljubljana²⁷⁰.

As a result of the remarks transmitted by citizens using physical and digital channels of communication with the City, “slow traffic zones have been introduced, parking barriers set up and a part of Slovenska Street

²⁶⁶ [Here for our citizens » City of Ljubljana](#)

²⁶⁷ [Pobude meščanov \(ljubljanasi\)](#)

²⁶⁸ [OIDP](#)

²⁶⁹ [Information Point 65+ » City of Ljubljana](#)

²⁷⁰ [Meetings of the Citizens' Initiative Commission » Municipality of Ljubljana](#)

was converted into a shared space”²⁷¹. Another example is the introduction of electric vehicles that facilitate running errands for the elderly and mobility impaired.

The efforts of the City to increasingly build bridges between the public administration and citizens have been recognized in the context of the URBACT call for Good practice in 2017²⁷². URBACT is an European Territorial Cooperation programme with the ambition to foster sustainable integrated urban development in European cities. It creates a platform for discussion on key integrated solutions to urban challenges via knowledge exchange and sharing good practices that work on the ground for urban development.

Besides these structured initiatives that have been established since the early 2000s, there are others that also stand out as important for the sense of belonging to the City. An example is **Project Outside**²⁷³, which started in 2019 as a collaborative project between the NGO KD Prostoroz²⁷⁴, the Institute for Spatial Policies (IPoP)²⁷⁵ and the City with the goal of collecting views from residents to regulate public space and support small local actions. The Municipality of Ljubljana finances the material costs up to €800 for each action.

Relative to citizen-centric approaches to design and develop digital services, there are already a few impactful examples in the City though more could be done to embed the involvement of citizens in digital public service provision. **URBANA**²⁷⁶, the Smart City Card of the Municipality of Ljubljana (see *section 1.3*), tested 1,000 cards with citizens at the piloting stage and since the launch of the pilot up until today, the City embeds as part of the process a close monitoring of remarks, complaints, and suggestions so that the system is periodically updated. Moreover, the City of Ljubljana was a co-applicant together with 5 other cities and regions in Europe to the Horizon 2020 **ClairCity project**²⁷⁷ (2016-2020), which explored the topic of citizen-led air pollution reduction in cities. In total, during this project and across all cities and regions, 818,736 citizens were involved, 82 policy makers consulted, 132 stakeholders involved, 65 elderlies filmed, 447 school children engaged, over 1,000 citizens were involved in public events, and 4,887 citizens were involved in Delphi process. The results were tailor-made to the specific local context of each city. The Clair-City Action Plan defined for Ljubljana²⁷⁸ “for citizen-inclusive air quality and carbon policies” included a set of citizen-led policies that resulted from the project’s involvement of citizens in the Delphi survey process. One of the proposed actions that is more ICT-driven is to “Show live air quality conditions in the city in order to increase awareness of citizens of the health benefits of clean air”, following the experiences of cities such as Sosnowiec and Amsterdam.

Interaction with the innovation ecosystem

Technology Park (TP) Ljubljana is the city’s innovation hub for knowledge and technology transfer²⁷⁹. **This intermediary institution is 89 % owned by City of Ljubljana** since 2003, so it is part of what City representatives call the “Big family of the City of Ljubljana”²⁸⁰. Indeed, the top and middle management of Technology Park Ljubljana is involved in City administration work whenever relevant and new ideas and

²⁷¹ [Bringing citizens closer to their mayor and city services | URBACT](#)

²⁷² [Ljubljana received two URBACT Good Practice titles » City of Ljubljana](#)

²⁷³ [We are collecting initiatives for new project actions Outside » Municipality of Ljubljana](#)

²⁷⁴ [Prostoroz \(prostoroz.org\)](#)

²⁷⁵ [Institute for Spatial Policies - \(ipop.si\)](#)

²⁷⁶ [Ljubljana public transport » City of Ljubljana](#)

²⁷⁷ [ClairCity – Citizen-led air pollution reduction in cities](#)

²⁷⁸ [ClairCity Ljubljana Policy Action Plan | Zenodo](#)

²⁷⁹ [TP Ljubljana in 2020 | Technology park Ljubljana \(tp-lj.si\)](#)

²⁸⁰ [One big city family » City of Ljubljana](#)

projects developed in Technology Park Ljubljana are on occasion presented to city administration as proposals for wider use. The main axes of action of the TP are i) *Development Collaboration & Global Commercialization*; ii) *Collaborative innovation ecosystems*; iii) *Innovation infrastructure*; iv) *Digital innovation in healthcare*, and v) *Lean innovation and startup acceleration*²⁸¹.

Currently, TP is an important ally of the City of Ljubljana in digital development. First, TP supports new ideas to connect startups focused on ICT solutions with Ljubljana Public companies that work for the City. For example, once a year there is a conference with startups where the City agrees to connect providers to concrete digital-led solutions for the city. Second, TP is involved in the Science Center²⁸² activities, and in the discussions taking place for the new digital strategy for the City (as mentioned in section 2.1.1). Third, TP has also supported the City in the preparation of its Digital tourism strategy.

Moreover, Technology Park Ljubljana has been working closely with the Municipality on key projects linked to open data to create new potential applications for citizens, visitors and entrepreneurs. Both TP and the Municipality of Ljubljana are involved in the project *DEAS: Data Economy Alps Strategy to stimulate participation, competitiveness, and new business in Alpine Space*²⁸³, co-financed by the European Union via Interreg Alpine Space²⁸⁴ (with European Regional Development Funds), and running between 2019 and 2022. The project aims “to strengthen the cooperation between public and private actors working in the Data Economy (PPPs)” and to “improve the value of using open data for public service and business” leading to “the creation of new disruptive and customer-oriented services/products for citizens, tourists and entrepreneurs”²⁸⁵.

More generally, over the past three years, TP has worked on the visualization of open city data, the development of a pilot service/app for parking sites, as well as the development of an app for announcement on floods (natural disasters) using sensors and a system of alerts to the population via SMS. Ljubljana is the “lab” for these solutions, and the implementation is then led by the Municipality. While the City’s focus on digitalisation before the pandemic was mostly on urgent infrastructure matters such as Wi-Fi networks, sensors for the smoke, etc, more recently the ambitions have been revamped because of the idea of becoming a true digital city in Slovenia.

The city of Ljubljana also hosts Slovenia’s Digital Innovation Hub (DIH)²⁸⁶, co-founded by the Technology Park. The DIH is co-financed by the Republic of Slovenia and the European Union, under the European Regional Development Fund (ERDF). The idea is to create a “central national point for providing, connecting and supporting business and technological knowledge, technologies, experimental and pilot environments”. DIH Slovenia’s key strategic partners come from various sectors- S4 Smart Factory Cluster, ICT Horizontal Network (SRIP PMiS), industry, academia (University of Ljubljana, University of Maribor), Associations (Association for Informatics and Telecommunications, Chamber of Commerce, and Industry of Slovenia), Technology Park Ljubljana, Smart Factory Cluster, Wood Cluster, IIBA Slovenia and others.

²⁸¹ [Our Journey | Technology park Ljubljana \(tp-lj.si\)](#)

²⁸² [Hiša eksperimentov \(hands-on science centre\) » Visit Ljubljana](#)

²⁸³ [DEAS: Data Economy Alps Strategy to stimulate participation, competitiveness and new business in Alpine Space | Technology park Ljubljana \(tp-lj.si\)](#)

²⁸⁴ [Alpine Space \(alpine-space.org\)](#)

²⁸⁵ [The Project – Alpine Space \(alpine-space.org\)](#)

²⁸⁶ [What is the Digital Innovation Hub of Slovenia \(DIH Slovenia\)? - Dih en](#)

Moreover, the City of Ljubljana is open to university proposals and very supportive of improving their working environment, but on the other hand universities have their own independent development agendas that the city is not interfering with directly. **Cooperation with academia on different projects and initiatives with City is “everyday practice”**. For instance, there is substantial collaboration with the Institute for Innovation and Development of the University of Ljubljana (IRI UL)²⁸⁷ that functions as a non-profit research institute focused on knowledge transfer between the university and the wider ecosystem hence including the City as well.

The collaboration with the Institute for Innovation and Development takes different shapes, namely as strategic partners in the context of European projects, advice to the City on people-centric approaches for digital strategic priorities and new services, invitations to City representatives to give guest lectures and mentor the assignments of students, among others. The IRI UL is composed by a multidisciplinary team of engineers, designers, architects, and social scientists including anthropologists, mostly involved in Horizon 2020 projects and Erasmus+ projects to implement people-centric and anthropologic processes to involve people in non-technological and technological processes and solutions. The Institute collaborated with the Energy manager of the City Hall on the project “Energy advance”²⁸⁸ regarding energy renovations of buildings under the ownership of the Municipality through energy audits and consultancy. Additionally, there was also close cooperation within a Horizon 2020 call Smart Cities and Communities – City Sense- to boost people’s engagement in developing smart and inclusive cities. This connects to a current H2020 project- RE-MODULEES²⁸⁹- for flexible building renovation shared solutions. The City of Ljubljana is not directly involved as a partner (but is a potential beneficiary from the outcomes of the project) and the university is foreseen as a partner (subcontracted). The digital part is that there is an overall lack of data in buildings’ performance, so the key outputs will be digitalised in a GIS-based, open-source virtual Renovation Hub.

Moreover, the project **UCITYLAB** (UniverCity Action Lab)²⁹⁰, funded under Erasmus+, links European universities with their urban stakeholders to jointly address societal challenges. The Institute reports great collaboration with the City Office for Development Projects and Investments, to create a new education program in the field of urban challenges, applied to 4 different cities as pilots, including Ljubljana. Representatives of the City were involved as mentors, engaged with student teams and delivered guest lectures on urban mobility and waste management providing the City’s perspective in topics such as bureaucracy. Most proposed ideas were connected to digital services in urban mobility and waste management. Staff of the Institute is also involved in the **DRIVEGREEN** project²⁹¹ with the goal of developing an intuitive and user-friendly mobile application to help reduce CO₂ emissions by monitoring driving habits and encouraging eco-driving. The project is co-funded by the Slovenian Research Agency and Ljubljana will be one of the 4 cities that will test this solution. Also, a representative of the Institute participates in the **City’s strategic group for digital transformation** in Ljubljana which includes 10-12 experts from different fields. Some of the points raised include the importance of ensuring humanity and solidarity in digital solutions; importance of connecting solutions that are public and private; assure smooth public transportation that is supported by digital

²⁸⁷ [IRI UL – Institute for Innovation and Development of University of Ljubljana - University of Ljubljana \(uni-lj.si\)](#)

²⁸⁸ [Energy advanced: energy renovations of buildings under the ownership of the City of Ljubljana » City of Ljubljana](#)

²⁸⁹ [re-MODULEES – IRI UL \(uni-lj.si\)](#)

²⁹⁰ [UCITYLAB – University-City Action Lab](#)

²⁹¹ [DriveGreen](#)

solutions; support peer-to-peer energy communities, digitally supported; support participatory solutions from digital democracy (easier voting, participatory budgeting that is digitally-inclusive); among others.

The City of Ljubljana also worked with the Center for Energy efficiency of the Jožef Stefan Institute and Siemens on the research project “Sustainable urban infrastructure Ljubljana - A look into the year 2050”²⁹². In terms of concrete measures proposed, some of them relate to organisational novelties- e.g introduction of the business position of energy manager- and others also to investment-e.g., hardware and software for implementing systematic energy management in buildings owned by the City of Ljubljana-.

Regarding the involvement of **NGOs**, an example is the Project Outside mentioned earlier, which involved the NGO KD Prostoroz and for the next phase will involve Pazipark Society.

A good example of a policy instrument to mobilise the City’s innovation ecosystem to find concrete solutions for challenges related to Mobility (live healthy; sustainable travelling), Environment (waste management), nutrition (digital experience in the bee world) and Floods (open data for information on natural and other disasters in the Municipality) is the virtual **Hackathon “Green Hack- With open data to the green future”²⁹³** organized in November 2021 around those key areas. The initiators of the hackathon are the Ministry of Public Administration, the City of Ljubljana, Technology Park Ljubljana, and the International Research Center for Artificial Intelligence within UNESCO - IRCAI. The overarching goals are to “optimize the existing data display in the direction of upgrading / approaching the mobile application, link existing data between different institutions and present them as a new information, development and use of digital technologies for the purpose of education about the bee world”. The initiative targets “ideamen”, programmers, graphic designers, entrepreneurs, and pitch presenters. The four winning teams (one per category) will be awarded a monetary prize²⁹⁴.

4.2.1.4 Procurement

Traditional and innovative public procurement

At the national level, public procurement has been regulated by the Public Procurement Act since April 2000. According to the 2021 European Commission study on the “EU-wide benchmarking of innovation procurement investments and policy frameworks”²⁹⁵, in Slovenia more than half of the procedures were awarded using the national procurement procedure for low-value contracts, followed using open procedures. Public procurement policies are managed by the Ministry of Public Administration through the Directorate for Public Procurement²⁹⁶, including the responsibility for the IT services underpinning the national e-public procurement system²⁹⁷.

²⁹² [Trajnostna urbana infrastruktura \(siemens.com\)](#)

²⁹³ [HOME - GreenHack \(squarespace.com\)](#)

²⁹⁴ [PUBLIC TENDER FOR SELECTION OF CONCEPT SOLUTION "GREENHACK - WITH OPEN DATA TO A GREEN FUTURE" | Technology park Ljubljana \(tp-lj.si\)](#)

²⁹⁵ [Results of EU wide benchmarking of innovation procurement investments and policy frameworks across Europe | Shaping Europe's digital future \(europa.eu\)](#)

²⁹⁶ [Procurement Directorate | GOV.SI](#)

²⁹⁷ [e-JN electronic public procurement \(gov.si\)](#)

Previous research²⁹⁸ investigated the areas perceived by Slovenian municipalities as those bringing the highest **administrative burden** to their core business and found that **public procurement regulations ranked at the top** of the list.

Specifically, regarding the development of national innovation procurement policy frameworks, Slovenia ranks 13th at the EU level. The European Commission study identifies room for improvement in the governance of innovation procurement, considering that there is no national action plan with established KPIs, structured capacity-building initiatives²⁹⁹, nor a monitoring tool. The results also show that Slovenia does not publish public procurement for innovation (PPI) widely, which means there is untapped potential for the use of the tool to attract innovative suppliers and to stimulate innovation.

According to Ljubljana City representatives, the current public procurement system remains time-consuming and often challenging when seeking innovative solutions that are not clearly predefined. Also, weak practices in pre-commercial procurement and Innovation Partnership Public Procurement were identified as an obstacle in the implementation of innovative projects. To carry out public procurement procedures in the City of Ljubljana, the City uses the internal application iNAR (for internal confirmation of proposals, legal and financial review), and publishes the Calls for tenders, exhibitions, and public announcements in the City Hall website³⁰⁰ as well as in two external portals, namely S-procurement³⁰¹ and the national electronic public platform mentioned before⁴. However, the advantages from having both internal and external portals to present PPI opportunities are not clear. Tenders for procuring innovative digital services/goods often include the following requirements: data sharing agreement (i.e., Access and Re-use of data), reference to Open Standards or Open APIs and specific technical specifications.

More generally on the public procurement uptake by the City of Ljubljana, in the period 2007–2017, 1,894 public procurements were carried out under the Public Procurement Act in the City³⁰². These had to be awarded in accordance with the national Green Public Procurement Regulation³⁰³. Looking ahead, the City intends to focus on greater rental of goods instead of purchase and sharing instead of ownership, in order to reduce the environmental footprint.

The City of Ljubljana rarely procures innovative digital services/goods together with one or more public authorities (i.e., Joint Procurement), and the main motivation tends to be the lower prices for procured services/goods. A concrete example of a recent joint public procurement procedure in the City of Ljubljana is that of the development of a multimodal mobility system for the city.

Financing digital solutions

The City of Ljubljana has a dedicated budget for digital innovation. For example, in 2020 the City invested €800,000 in ICT. The key funding sources are structural and cohesion funds, with InvestEU, national, regional and local/autonomous funds also having a significant role. According to the City, the top 3 service areas active in competitive funding calls for funding are Culture & Leisure, Social & Welfare Services, and Transport & Mobility.

²⁹⁸ [Better Regulation and Public Procurement in Slovenian Municipalities | KLUN | Transylvanian Review of Administrative Sciences \(rtsa.ro\)](#)

²⁹⁹ However, some initiatives have been taking place though on an ad-hoc basis: [Trainings and workshops \(gov.si\)](#)

³⁰⁰ [Razpisi, razpmitve in javne objave » Mestna občina Ljubljana](#)

³⁰¹ [S-PROCUREMENT](#)

³⁰² [Budget of the Municipality of Ljubljana » Municipality of Ljubljana](#)

³⁰³ [Green public procurement | GOV.SI](#)

Indeed, the City of Ljubljana sees EU funding and financing instruments as important channels to develop projects and solutions of strategic interest for the City. Data publicly available in the City Hall's website shows that in the financial framework 2007–2013, the City of Ljubljana drew 121.2 million euros in European funds, while in the financial framework 2014–2020, 105.3 million euros were approved by 31 December 2020³⁰⁴.

Moreover, the Municipality of Ljubljana often applies for calls from centralised (e.g., Horizon 2020, Urban Innovative Actions, URBACT, Interreg) and decentralized national calls through its Public Enterprises (JP), Public Institutions (JZ), Public Housing Fund MOL (JSS MOL), Regional Development Agency of the Ljubljana Urban Region (RRA LUR) and Technology Park Ljubljana (89% owned by the City)³⁰⁵.

4.2.2 Change Management

The City of Ljubljana is a regular participant in European networks, programs and projects in order to exchange good practice, give visibility to its efforts in digitalisation, and to receive financing to develop actions and pilots in strategic areas. Hence, Ljubljana is a signatory of the Living-in.EU initiative³⁰⁶, a member of EUROCITIES³⁰⁷, URBACT³⁰⁸, Urban Innovative Actions³⁰⁹, Interreg Europe³¹⁰, European Green Capital Award³¹¹, European Capital of Smart Tourism³¹², 100 Intelligent Cities Challenge³¹³, FP7 and Horizon 2020 research projects, among others.

To begin with, the City of Ljubljana was the **coordinating city and leading partner in the European project CIVITAS ELAN** which ran between 2008 and 2012 **under FP7**. The goal was to "mobilise citizens by developing with their support clean mobility solutions for vital cities, ensuring health and access for all"³¹⁴. The other four cities engaged in this project were Ghent, Porto, Brno and Zagreb. These were cities facing common challenges related to fast motorisation, capacity problems in public transport, infrastructure renewal and rapidly changing cityscapes". One of the key lessons learned was that obstacles to implementation are not always at the technical level; in fact, they are often linked to organisational, behavioural, or institutional issues. In the case of Ljubljana, the City has implemented 17 local and 4 joint measures and other activities contributing to sustainable mobility³¹⁵. Measures were related to addressing congestion problems in the city and reducing car trips. Moreover, the City replaced old buses with less polluting options (e.g., methane powered vehicles). Also, satellite navigation helped to make the travel time in public transportation more accurate. The creation of the URBANA Smart Card (which will be discussed in section 1.3) also enabled a more integrated payment modality for urban and suburban transport modes. **This project was co-financed by EU funds but had also city budget and private money pooled into its development. In practice,**

³⁰⁴ [Presenting new European projects » City of Ljubljana](#)

³⁰⁵ [With European funds to even faster development » Municipality of Ljubljana](#)

³⁰⁶ [Join us in building the European way of Digital Transformation for 300 million Europeans | Living in EU \(living-in.eu\)](#)

³⁰⁷ [Ljubljana - Eurocities](#)

³⁰⁸ [Ljubljana | URBACT](#)

³⁰⁹ e.g., [The City of Ljubljana project successful at the European UIA competition » City of Ljubljana](#)

³¹⁰ [TRIBUTE - Integrated and Innovative actions for sustainable Urban mobility upgrade » City of Ljubljana](#)

³¹¹ [Ljubljana - European Green Capital 2016 | Interreg Europe - Sharing solutions for better policy](#)

³¹² [Competition winners 2020 \(europa.eu\)](#)

³¹³ [Ljubljana | Intelligent Cities Challenge](#)

³¹⁴ [ELAN | CIVITAS](#)

³¹⁵ [ELAN | CIVITAS](#)

there were many City stakeholders involved, with different, well-defined, tasks for the execution³¹⁶. For example, the LPP (urban public transport operator) had the role of implementing advanced technology in buses, a dial-a-ride system for disabled people, planning bus with train journeys using Google transit web application, etc. The National Urban Planning Institute was responsible for the elaboration of the City's modern urban sustainability plan, and the Jožef Stefan Institute had the task of evaluating all measures.

Within Eurocities, Ljubljana was awarded in 2013 in the category “Smart Living” for “Providing safe & equal opportunities in traffic for children & people with disabilities”³¹⁷. For instance, the City developed a “web portal mapping transport options to different schools and identifying danger hotspots to help plan journeys”. Additionally, the City has developed personalized services to help people with disabilities travel by public transport.

The prioritisation of a green and sustainable Ljubljana has led to a set of initiatives that led to the recognition of the city as the **winner of the European Green Capital Award 2016**. Moreover, this vision is interlinked with the efforts of the City to boost sustainable and smart tourism. As a result, **in 2020 the City received the European Capitals of Smart Tourism Award under the category ‘Digitalisation’**³¹⁸, due to for example its measures towards accessible public transportation, and the digital infrastructure in place (free Wi-Fi network with 400 access points)³¹⁹. These awards have given visibility to the City at the European level as a frontrunner in the green transition and in smart solutions for tourism which brings more visitors and generates economic gains.

Within project SiMOS (2020-2022) of the ‘100 Intelligent cities challenge initiative of EC’, Ljubljana and other municipalities of Slovenia will work together to develop a common platform for the exchange of knowledge, solutions and opportunities. In the next phase, activities will be transferred to the operations level of the city administration and provided to various groups of users. Additionally, key performance indicators (KPI) will be defined as well as a plan for impact assessment of implemented solutions to strengthen the arguments for further investments in digital transition under the common motto “innovative, digital and intelligent solutions for green, sustainable and vital cities”. Resources will be assured by the city budgets as well as a national public tender for investments in digital infrastructure, which is planned in 2020 by the Ministry of Public Administration.

The City of Ljubljana is also active in Interreg's ‘Integrated and Innovative actions for sustainable Urban mobility upgrade’. In particular, the **TRIBUTE project (2021-2023)**³²⁰ will test “integrated innovative tools and actions in the Adriatic-Ionian cities, by means of the creation and the implementation of eight living labs on sustainable urban mobility”. The main outputs will be eight action plans and pilot actions around “innovative public transport and on-demand responsive services using electric vehicles, integrated management systems of public transport and cars along highly congested corridors, etc.”

The City of Ljubljana has also signed the declaration Living-In.eu, as the City shares the same values as the initiative, namely regarding openness of data, harmonized standards, connectivity, digital competencies, digital rights, etc. With support of the initiative the City hopes to get the opportunity to explore practical

³¹⁶ [Indicator 1 Ljubljana 2016 \(europa.eu\)](#)

³¹⁷ [awards 2013 \(eurocities.eu\)](#)

³¹⁸ [Ljubljana wins the digitalisation award in the European Capital of Smart Tourism 2020 competition » City of Ljubljana](#)

³¹⁹ [LJUBLJANA - Category winner: DIGITALISATION \(europa.eu\)](#)

³²⁰ [Integrated and Innovative actions for sustainable Urban mobility upgrade – TRIBUTE \(adriinterreg.eu\)](#)

successful examples from other cities, indirect guidelines, as well as share its know-how with other municipalities in the local and international environment, including other organisations such as NGOs, public companies and local stakeholders, including SMEs and businesses.

4.3 Digital Service Innovation Maturity

Over time, the City has made considerable efforts to digitalise its services as a way to become a greener and smarter city. In fact, Ljubljana was one of the first cities to have a pilot digitalising its public services on electronic paper back in 2015. Digital paper technology is used to display passenger information in bus stops in the city centre, with technology that consumes much less energy and integrates solar cells to charge the battery. “The e-paper screens show bus schedules, arrival information and route changes”³²¹; in other words, it was an automated timetable scheduling. This technology used the company’s Visionect hardware and software³²² and benefits from the collaboration with the Ljubljana passenger transport public operator³²³, part of Ljubljana’s “big city family”³²⁴. Importantly, this solution can be personalized hence making it more inclusive e.g., “the partially sighted could, for example, increase the font size on screen or read the screen content with the help of their smartphones, with many similar adjustments possible for the disabled and the elderly”. Some upgrades for external usage still need to be tested.

The City also partners often with private companies to develop technological solutions. Besides the example of Visionect mentioned above, another example includes the partnership with the company Avant-car in the field of **sustainable mobility- electric car sharing**³²⁵. “Full system services (reservation, unlocking the vehicle, starting the engine, final payment) are provided via the Avant2Go mobile app”. This initiative aims to reduce CO₂ emissions by incentivizing renting instead of car ownership. In the international competition by the Carshare City Award, Ljubljana ranked second in the category up to 750,000 inhabitants. The competition is organized by Carsharing Association and Movmi to evaluate “the introduction, maintenance, support and recognition of the significance of car sharing”³²⁶.

Furthermore, the City is aiming for simple and impactful digital solutions that can be also inclusive so that “no one is left behind” in the access to services. Some examples include i) the **Tap Water Ljubljana** app³²⁷ which informs about the location of public water fountains with drinkable water; ii) **Ljubljana by Wheelchair** app³²⁸ to help find wheelchair-accessible locations for tourists; iii) **Nexto Ljubljana**³²⁹ app (designed by Slovenian developers) is an audio guide combined with additional features such as puzzles, riddles and item collection by scanning objects with a smartphone; iv) **URBANA single city card**³³⁰ to simplify and integrate payments applied to different areas of the city such as transportation modes, parking and library services.

³²¹ [Ljubljana leads the way in a smart city success story - Visionect](#)

³²² [Smart cities on electronic paper: digitalized public transport information in Slovene capital - Visionect](#)

³²³ [Javni holding Ljubljana | Ljubljanski potniški promet \(lpp.si\)](#)

³²⁴ [One big city family » City of Ljubljana](#)

³²⁵ [Innovative city » City of Ljubljana](#)

³²⁶ [Ljubljana – second most car sharing friendly city » City of Ljubljana](#)

³²⁷ [Tap Water Ljubljana on the App Store \(apple.com\)](#)

³²⁸ [Ljubljana by Wheelchair - wheelchair accessible locations in Ljubljana, Slovenia.](#)

³²⁹ [Nexto Ljubljana – Apps no Google Play](#)

³³⁰ [Single city card – URBANA | Ljubljanski potniški promet \(lpp.si\)](#)

Indeed, digital is seen as an enabler for new services and activities across sectors. For example, the City has created an app to recognize **invasive plants**. In the field of **Spatial planning**, the goal is to have 3D scans of everything in the City (e.g., traffic signs, water pipes, drinking water) constantly monitored and upgraded. In Energy supply, there is a distant metering system and AI-based analytic systems. In the field of **Tourism**, virtual reality is being used to “travel in time” to Ljubljana in the Roman times. City maps have also been digitalised. In addition, regarding Sports&Recreation, there are QR codes in the parks information available on the most interesting aspects of that micro-area, the natural surroundings, etc.

In terms of **open data integration from the City to inform citizens and tourists** on important aspects related to mobility, environment and public events, the City of Ljubljana has created a **dashboard-style web application entitled “A Moment in Ljubljana”**³³¹ to provide real-time information on road conditions, available parking spaces, available bicycles and stations in the BicikeLJ system, Citizens’ initiatives received and replied, water quality, Cultural, sports and social events, Air quality data, Weather forecast and Funerals.

As mentioned before, the communication with citizens is a central element of the Municipality’s *modus operandi*. To this end, in 2018 the City created a **chatbot entitled “Ljubo”**³³² as a new solution for more effective communication with citizens. This chatbot is available through Facebook messenger, where people can get more information on various aspects linked to the city such as scheduling of buses, BicikeLJ free stations, free public parking spaces and the schedule for waste disposal. The chatbot is also updated based on the interest shown by citizens in specific domains of the city.

While COVID-19 was a digital booster- the number of digital certificates activated grew rapidly during the pandemic-, there were not any new services created as such, but the uptake of the services that were already in place increased massively.

Below we zoom-in on the City service that represents the highest level of technological and service design maturity in the City of Ljubljana- the URBANA Smart Card.

Box 3 - Zoom-in: URBANA Smart Card

○ Overview

The Urbana single card³³³ is a **no-contact smart card and mobile app allowing cash-free payments when accessing different services of the city**. Nowadays, the card can be used for rides on Ljubljana city urban and suburban modes of transportation, for the funicular to Ljubljana Castle and to buy tickets to all Ljubljana Castle events, as well as for paying parking fees at public parking spaces and P+R facilities, Ljubljana City Library services, and renting bicycles in the BicikeLJ bike-sharing system.

The solution was launched in 2009 as a smart card – beside this, users could also pay with the Moneta technology for rides in buses. Since 2014, users with smartphones can use the mobile application Urbana as well. The number of services integrated in Urbana has also been increasing over time.

○ Relevance and uniqueness

³³¹ [Single city card – URBANA | Ljubljanski potniški promet \(ljubljanasi.si\)](#)

³³² [Chatbot Ljubo from Ljubljana » City of Ljubljana](#)

³³³ [Mobile Urbana » City of Ljubljana](#)

The main purpose of URBANA was to **get rid of cash payments and tokens, and in a way that new services could be increasingly added to this cashless payment system.**

At the time of its launch, discussions in European cities around City Cards were not so common so this was an innovative and pioneering initiative to design and implement a multimodal service in the city. Hence Ljubljana “is one of the first cities in Europe to have introduced uniform payments for city services”³³⁴.

Urbana is today very well accepted by citizens, i.e., it is “very normal” to use URBANA if you are a visitor or a resident in the city.

○ **Challenges and drivers**

One of the challenges for the uptake of the URBANA solution by citizens was to convince them and, in particular the elderly, to go from using cash in buses to the physical contactless card and to downloading the mobile app. Information on the transition from cash to cashless bus payments was provided through all the information channels at the disposal of the City, namely press conferences, Mayor’s Public Addresses, and press releases.

Also, **the transition did not happen overnight**, so there was a period when it was possible to pay in cash or to use the cash-free method of the Urbana card. The City did not go for an incentives model based on discounts, but the passengers, who validated their trips with the Urbana card, were able to drive for 90 minutes with only a single payment from the time the first ride is paid for, which was not feasible in the cash payment.

Additionally, regarding the Urbana mobile app, the City used all the information channels listed by adding notifications on the City Hall’s website and sending them also by email. **The mobile application was developed by Telekom Slovenija, the City of Ljubljana, and the passenger traffic operator** Ljubljanski potniški promet. The fact that the app was created with the involvement of the telecommunications company Telekom Slovenija, which also had the goal to maximize profit and increase the usage of mobile phones, meant that the company also put some effort into informing its users about the added value of Urbana.

The **data generated by Urbana is open upon request but not publicly available**, because in the past there were new services generated on these data, but whose quality could not be guaranteed by the City nor it was often clear for citizens if the provider was the City Hall, the bus company, a group of students, or others. For this reason, it is possible to request access to the data, but it is not fully open. At the same time, this shows that indeed opening city data attracts a lot of interest from the ecosystem to develop new solutions and even commercial applications.

○ **Implementation and Monitoring**

The fact that URBANA had **from the start strong political support from the Mayor** was important to the success of this initiative both in terms of governance and internal commitment to work together to develop the best solution for the city. A **cross-department working group** has been established involving all key departments that could potentially link their services to URBANA. This working group involves

³³⁴ [Single city card – URBANA | Javni holding Ljubljana \(jh.si\)](#)

the interested departments in having services linked to the solution, as well as those already using it, and those that could use it but may need some encouragement to join in.

The key **requirements of the procurement** order for this solution were that the smart card should be interoperable to allow for new services to be integrated, and in a contactless manner. “Suppliers were called upon to come up with their own solutions meeting these minimal criteria (some technical specifications, e.g., range of contact-free reading devices, and service response parameters were defined in more detail according to the specific intended uses of the smart card, also the size of the smart card was defined). The specifications and all other questions were further clarified in the procurement process before the bids were submitted by providing a period for answering questions posted by the potential bidders”³³⁵.

For the initial development phase, 1,000 smart cards were tested before proceeding to the implementation phase. In addition, user journeys were also created to describe each situation of the user experience along the way. After taking into account the users’ remarks and complaints, the City proceeded to it’s the full production and implementation phase. The Urbana Smart Card can be purchased and topped up at tourist information centres, newsstands, and ticket offices as well as at most bus stops³³⁶.

In fact, since the launch of the pilot up until today, the City has implemented as part of the process a close monitoring of remarks, complaints and suggestions so that the system is periodically updated. In particular, the transition to mobile app (available on smartphones since 2014) was also closely monitored. **Urbana has a user support system and an interactive engagement system monitored through a ticketing system-** any remark has to be resolved through the responsible body.

URBANA is also totally integrated in the back-office system- all the clearings, payment between different services, entities and city companies have been completely automated since the launch of this solution in 2009 as Urbana has the ambition to become the payment integrator for services in Ljubljana.

Initially, the City only had estimates for the number of trips being realized, but shortly after initiated a data collection effort that shows that there are 39 million trips per year with the Urbana card.

The City nowadays monitors not only the number of trips, but also a set of other indicators such as the number of transactions with the card, number of validations, number of payments, number of city services using the card, number of top-ups of the card, number of downloads of the app, constantly monitored throughout the years.

The new, upgraded Urbana will be running as a pay-as-you-go system. The owner of terminal equipment is the City of Ljubljana, (through the Public transport company, LPP of which the City is the majority owner) paid from the internal budget. However, in the future LPP plans to switch to a complete service-provider model, i.e., the service provider of Urbana will manage the whole system and its components, but LPP will lease it through contracted responsibilities to ensure the stability of the service. Importantly, the provider of the solution has also been involved in the execution of services the whole time. In other words, **Urbana shows the success of developing a close public-private partnership to develop impactful city services.**

³³⁵ [Microsoft Word - Public Procurement for Innovation in Small European Countries. final11210 \(manchester.ac.uk\)](#)

³³⁶ [Ljubljana Card » Visit Ljubljana](#)

○ Impacts

Since the implementation of the Urbana card, in 2009 until today, a significant number of users - 560,000-yearly uses the public transport in Ljubljana. The mobile application Urbana was launched on 19th of May 2014 and until today 190,168 users were registered with steady growth over time. Both numbers are regarded by the City as very encouraging, taking into account the size of City of Ljubljana and its surroundings. **The City Hall has been sharing its successful experience with the URBANA card with other Slovenian cities.** For example, a similar system is used in the cities of Koper and Piran in Slovenia. Similar technology is also used by the carriers Marprom, Slovenian Railways, Nomago and Arriva, but the idea and the technology behind it are also used by the Ministry of Infrastructure in the 'Single ticket for public transportation' project.

Urbana has also received the following awards:

Ljubljana Tourist card rated third-best tourist card in Europe

- In a comparison test of European city cards conducted by the Euro Test website in 2012, which is managed by the German Automobile Association (ADAC), the Ljubljana Tourist Card received third place.
- The comparison was made between 16 tourist cards from 14 European cities.

Ljubljana City card Urbana and Rent-a-bike service BicikeLJ won the prize for the best IT solution

- Ljubljana city card Urbana and self-service bicycle renting system BicikeLJ won the award for best solution in the IT field.
- The prize "IT strawberry of 2012" was handed over within the International Conference at the Jozef Stefan Institute in Ljubljana.
- The number of BicikeLJ users is close to 15% of the population of Ljubljana and the number of rentals exceeded one million (note: today it is already over 8 million).

Mobile application Urbana won the MasterCard Transport Ticketing Award for the most successful mobile ticketing program

- The Urbana solution was awarded the first prize on 27 January 2014 in London at the MasterCard Transport Ticketing Awards in the Most Successful Mobile Ticketing Program category. The event, sponsored by the MasterCard Company, is the biggest event in this particular field in the world.

4.4 Conclusions and lessons learned

Public service provision in Ljubljana has been aligned with the City's vision for a green and smart city and destination, which has already led to distinctions at the European level with Green and Smart Tourism Awards and related awarded good practices. The City is designing its digital strategy in order to more efficiently govern its digital transformation journey, break silos, improve the collection and re-use of data for new applications, connect verticals, among others, to turn Ljubljana into a truly smart and integrated city.

Many of the City's efforts have also been anchored in its "Big City Family", which includes City administration services, public companies and public intermediaries that work jointly with the City to improve and implement solutions and services that deliver more public value. There are several examples across different sectors – mobility, energy supply, education, environment, tourism, etc. that show that this model of collaboration has been working, often also with the technical support from private companies and the wider ecosystem.

Below we explore in more detail some potential lessons learned from the experience of Ljubljana in transforming its public service provision through digitalisation:

i) The City has been promoting a culture of regular communication with citizens, through physical and digital channels so that there is generalized access to the population irrespective of the level of digital literacy.

The key physical channels for interaction with the City are the Mayor's Open Days and the office Info 65+, while the main digital channels are the web portal for Citizens initiative where citizens can insert new initiatives, and the Chatbot Ljubo.

Despite the simplicity (and even absence) of technology, these methods have proven effective in involving citizens over time which shows that the design of initiatives does not have to be always technology-driven. Besides these structured channels, the City has been participating in European projects that explore human-centric approaches to design and develop digital services, often also in collaboration with experts on the topic from e.g. academia.

However, most of the new public services are driven by the own initiative of the Municipality that prioritizes the areas of the City where there is more room for improvement and involves the ecosystem to design and implement solutions. At the same time, there are often feedback moments with citizens or users to test solutions (e.g., URBANA card) and mechanisms to provide regular comments and complaints in view of upgrading the solution.

ii) Over time, there has been an increased concern for making sure the services offered are personalized and inclusive according to the particular needs of groups of citizens.

The Information Office 65+ guarantees that the elderly and people with disabilities have physical and direct access to the City administration. In addition, the City has developed personalized services to help people with disabilities travel by public transport. For example, the e-paper technology used for timetable can be personalized hence making it more inclusive e.g., "the partially sighted could, for example, increase the font size on screen or read the screen content with the help of their smartphones, with many similar adjustments possible for the disabled and the elderly".

Within the design of the new Digital Strategy for the City, the communication with citizens is planned through an online survey and small meetings, primarily through gate-keepers for vulnerable groups (blind, visually impaired, people with disabilities, digitally illiterate, socially disadvantaged, etc.).

iii) There is strong collaboration between City and the "Big City Family" of Ljubljana. Public-private partnerships for the development of services are also often used to guarantee that the right technical expertise is mobilised.

Many of the solutions created (transport, parking, energy) counted with the support of the public companies that integrate the "family" of Ljubljana.

Technology Park Ljubljana has a key role as the intermediary between policy design and translating some of the strategic priorities into actual solutions. Hence TP is not only closely involved in the City’s discussions, but also in leading or participating in key projects at the European level that will bring added value for the city. It also engages with entrepreneurs and innovators to e.g., develop new data-driven solutions.

Public-private approaches guarantee that whenever there aren’t specific capabilities within the local administration, the private partner can work together with the City and bring in the technical knowledge and infrastructure. The URBANA mobile application was developed by Telekom Slovenija, the City of Ljubljana, and the passenger traffic operator Ljubljanski potniški promet.

iv) The City leverages on European networks, projects and competitions to share knowledge, develop pilots and get visibility for the digital transformation path it has been following over the years.

The City of Ljubljana is a regular participant in European networks, programs and projects in order to exchange good practice, give visibility to its efforts in digitalisation, and to receive financing to develop actions and pilots in strategic areas. Hence, Ljubljana is a member of EUROCITIES, URBACT, Urban Innovative Actions, Interreg Europe, European Green Capital Award, European Capital of Smart Tourism, 100 Intelligent Cities Challenge, FP7 and Horizon 2020 research projects, among others.

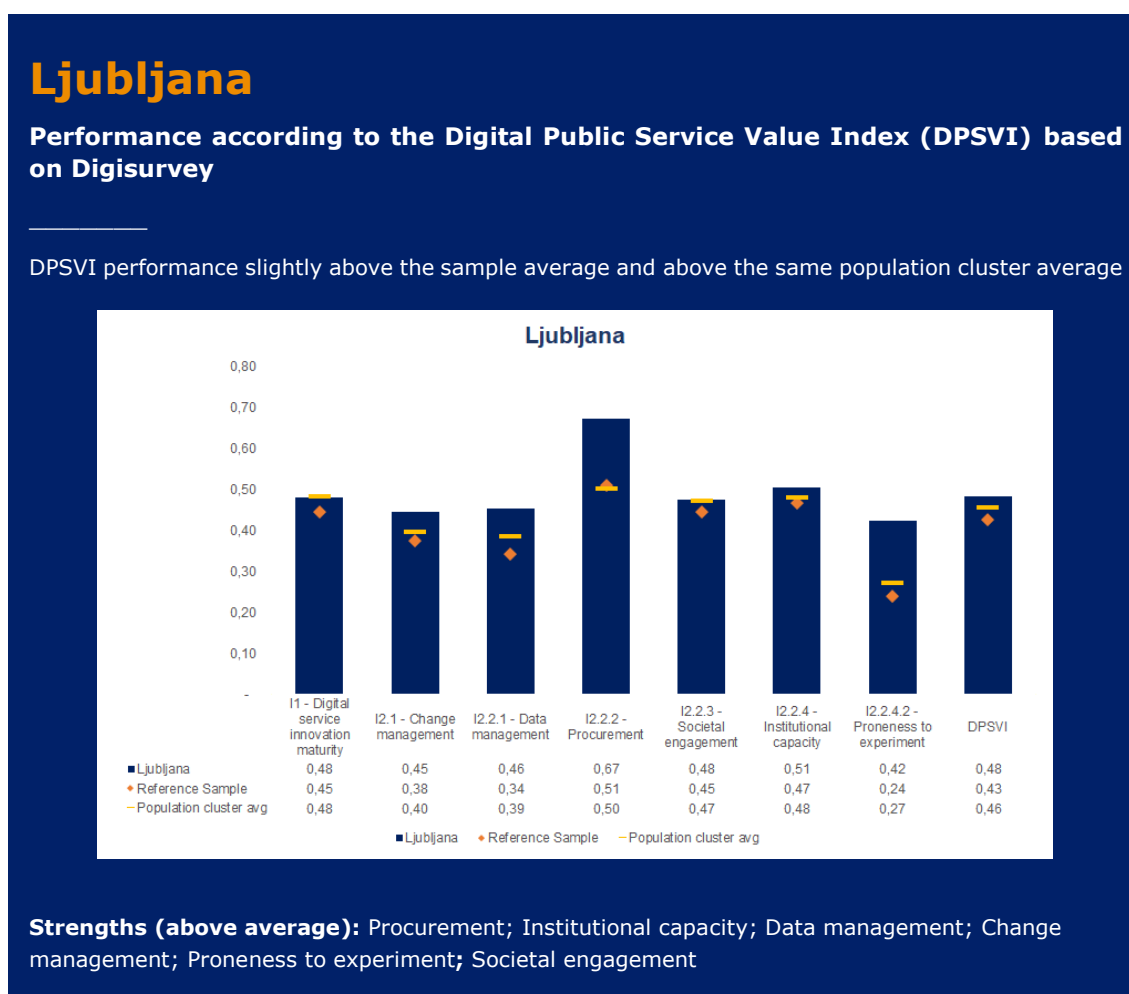


Figure 7 - Performance of the city of Ljubljana in the DPSVI relative to the reference sample and the population cluster average

5 Case Study: Luxembourg City (Luxembourg)

5.1 Overview and approach to digital innovation

The City of Luxembourg (“Ville de Luxembourg” or “VDL”) is the capital city of the Grand-Duchy of Luxembourg. The city has a population of 124,528 inhabitants (31/12/2020)³³⁷ of which the majority (70%) are foreigners. The city is run by mayor Lydie Polfer.

Within the City administration, the **Department of Information and Communications Technologies (“Service TIC”)** is responsible for the provision and management of ICT tools for the city’s 55 municipal departments as well as for the management of the city’s public ICT infrastructure and the management of applications for city personnel and residents.

Due to its size and relative economic importance for the Grand-Duchy, but also in terms of population and daily commuters, the **city of Luxembourg should not be investigated without analysing relevant developments in the field of innovation and digitalisation at the national level.** This is because the city of Luxembourg plays an important role for the entire Grand-Duchy of Luxembourg from an economic, social and cultural perspective: Approximately 20% of the country’s population which currently (01/2021) stands at 634’730³³⁸ live in the city. During the day, the city’s population doubles due to incoming commuters from surrounding communes and the three neighbouring countries (France, Belgium, and Germany). In terms of employment, 40%³³⁹ of the country’s jobs are in the city of Luxembourg of which many in the financial sector. Therefore, the national perspective and initiatives by the Luxembourg government and its ministries must be considered as well, as they have a direct impact on the capital city. An example which will be further discussed throughout this case study is Luxembourg’s multi-modal mobility strategy which focuses on transport flows within the city of Luxembourg (through the introduction of a tram line and the reorganisation of busses and bike lanes) as well as transport flows in and out of the city of Luxembourg (mainly commuters).

The City of Luxembourg’s administration possesses a **well-developed basic IT infrastructure allowing it to provide several digital services to its citizens** and to **automate certain internal processes.** To ensure a more goal-oriented and coordinated approach, the city is currently **developing a smart city strategy** as the current setup is too much based on an isolated “silo approach” between municipal departments when it comes to the development of digital services. Furthermore, the strategy should also address the **varying levels of digital maturity between municipal departments.**

On top of an overall, **favourable national context supporting digital innovation and eGovernment solutions,** the city also has a lot of **potential to collaborate with the actors in its innovation ecosystem** which consists of researchers and incubation hubs for innovative start-ups.

³³⁷ [Facts and figures | Ville de Luxembourg \(vdl.lu\)](#)

³³⁸ [La croissance de la population freinée par la COVID-19 - Statistiques // Luxembourg - Avril 2021 \(public.lu\)](#)

³³⁹ As mentioned by Mayor Lydie Polfer during her introductory speech for the city’s new mobility concept (available at: [Our Mobility Plan for Tomorrow | Ville de Luxembourg \(vdl.lu\)](#))

5.2 Proneness to Change

Luxembourg City is moving towards a data-driven approach and digitalisation of services both for its residents and for internal municipal departments and administrations: In recent years, the city of Luxembourg has developed several projects (e.g., real time data transmission for bus services, the Cityapp as well as the city's own fibre-optics network).

In this context, the City drives digitalisation projects to support the collaboration between its municipal departments as well as other relevant actors such as ministries (this includes the digitalisation of internal processes and workflows between departments and other administrations or ministries as well as other communes than the city of Luxembourg).

Towards its citizens, VDL works on offering digital communication channels as well as more and more services that can be performed digitally. These digital services are linked with the “myGuichet.lu³⁴⁰” frontend which is a digital service point for all residents of Luxembourg.

While these projects support the development of digital public services, the City of Luxembourg does not have a "smart city" strategy yet to guide and steer future developments in this field. The city council has, however, recognised the need for such a strategy and has launched the process to develop it. Through the strategy, the council aims for the city to set objectives in terms of smart and innovative digital services and processes within the city's administration and towards its inhabitants.

5.2.1 Innovation governance

The topic of innovation governance is addressed by looking at (1) the city of Luxembourg's maturity to provide digitalised, innovative administrative services to its citizens and (2) by looking at the key actors in the innovation ecosystem and the collaboration with the city.

The actors within the innovation ecosystem of the city of Luxembourg can be grouped in the following main categories:

- National level (ministries and administrations): *Ministry for Digitalisation* and Centre for ICT (CTIE)
- **City of Luxembourg, TIC Department & other municipal departments**
- Innovation ecosystem:
 - **Research institutes:** Luxembourg Institute of Science and Technology (*LIST*), the University of Luxembourg's Interdisciplinary Centre for Security, Reliability and Trust (*SnT*) and the Luxembourg Institute for socio-economic Research (*LISER*)
 - **Start-up incubation:** under the umbrella of the *House of Start-ups* several incubators are hosted such as the Luxembourg City incubator (LCI), The LHoFT and Le Village

Figure 8 presents the main actors within Luxembourg City's innovation ecosystem.

³⁴⁰ [MyGuichet.lu — Guichet.lu - Administrative Guide - Luxembourg \(public.lu\)](https://myguichet.lu)

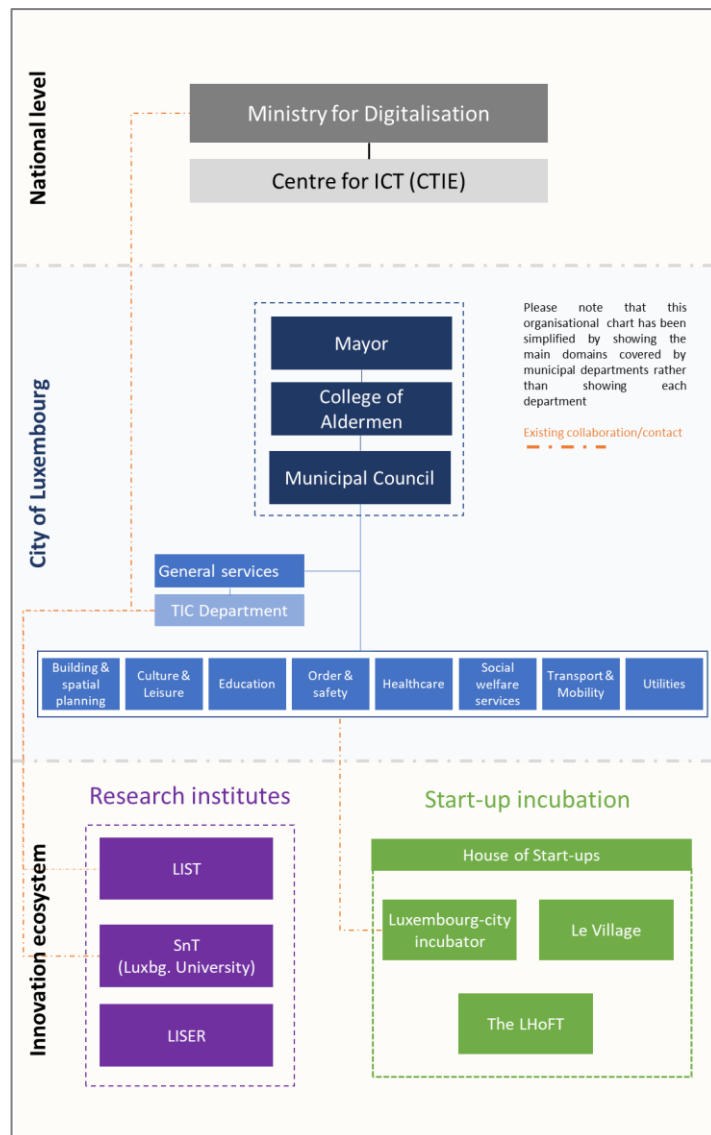


Figure 8 - Main actors within Luxembourg's innovation ecosystem

Source: Authors' own representation

5.2.1.1 Institutional Capacity

The **City of Luxembourg's central administration** consists of 55 municipal departments³⁴¹ covering all aspects from architecture and maintenance to mobility and water management. Among these, the department of **Information and Communications Technologies ("Service TIC")** is responsible for the provision and management of ICT tools for all municipal departments as well as for the provision and management of the city's public IT infrastructure including internet and intranet systems and the management of applications for city personnel and residents. The department oversees networks and systems and handles servers, all maintenance procedures, IT security and data storage. The department consist of approximately 62 people

³⁴¹ [Les services à votre écoute | Ville de Luxembourg \(vdl.lu\)](https://www.vdl.lu/fr/les-services-a-votre-ecoute)

across 5 ICT sub-departments: systems and operation, networks and communications, applications and development, information security and administration and budget.

The TIC department provides its services to all the city's municipal departments. The department helps other departments exploit existing data (which is hosted centrally in most cases and in a decentralised manner for a few municipal department) through the development of applications and projects.

Examples of digital applications developed by the department cover the domains of smart infrastructure (e.g., fibre optics network and free city-wide Wi-Fi network), smart governance (e.g., possibility for citizens to partake in yearly discussions on the municipal budget or electronic forms that support digitalised services) and smart mobility (e.g., provision of real-time data on public transport). More details about the digital services provided by the TIC department can be found in section 3 *Digital Service Innovation Maturity*.

The TIC department considers its **strength to lie in the provision of a high-capacity IT infrastructure** which consists of a fibre-optics network connecting all the city's municipal departments and relevant administrative buildings. The department, however, admits that a clear **weakness** currently lies in the **low level of automation of processes between municipal departments as well as services towards citizens**. Another weakness that is mentioned refers to the **coordination of projects aimed at developing new applications or automated services which is often onerous** due to the lack of a central coordinating entity and the different levels of technical know-how and maturity within municipal departments.

The development of a **digital smart city strategy** has the aim to address these weaknesses. Thus far, the city has performed a first "stocktaking exercise" of all ongoing or planned projects (within all municipal departments). Currently 70 projects have been identified. As a next step the city council will develop a roadmap that ensures current and future needs of citizens, workers and visitors of the City of Luxembourg are targeted. Examples of such projects include digital lighting, a commercial register and interactive citizen participation (e.g., digital certifications for personal data)³⁴².

Challenges faced by the City with regards to institutional capacity:

1. **Lack of a digital strategy:** While the above examples show that the city of Luxembourg already offers several services in a digital form to its citizens, the city is aware that it is lacking a clear (smart) strategy to further develop the use of digital tools both to provide more services in a digital form to its citizens but also to automate and digitalise many internal processes and procedures between its many departments. Once created, the smart city strategy will need to be implemented and steered, however, to this end no decision has been taken by the city council yet whether a dedicated, transversal entity will be created or whether the council will remain in charge of the implementation of smart city projects³⁴³.
2. **Varied level of digital maturity across the city's municipal departments:** While the city has put in place a strong IT infrastructure, the level of digital maturity across its municipal departments is very uneven: There are examples of departments such as construction, sewage, water, and mobility/transport with a high-level of digital maturity whereas other departments e.g., in the social and cultural domains are significantly less developed. Consequently, this means that many administrative procedures between

³⁴² [Ville de Luxembourg: smart city? | Paperjam News](#)

³⁴³ [Ville de Luxembourg: smart city? | Paperjam News](#)

departments are not digitalised which also negatively impacts the possibility to offer digitalised services to citizens.

While challenges at the institutional level exist, the **overall national context for developing innovative, citizen-centred digital services is favourable and supportive**: The Ministry for Digitalisation and its responsible centre for ICT (CTIE) are pushing for the advancement of eGovernment services and administrative simplification through digital solutions. The Ministry has put the topic of **digital government at the top of the political agenda** by identifying four strategic axes for Luxembourg government institutions³⁴⁴:

- 1) **Developing eGovernment**: the objective of this axis is to ensure citizens and companies have access to digital governmental services. An example is the *myguichet.lu*³⁴⁵ information and transaction portal which allows citizens and companies to interact with government administrations and to carry out administrative procedures and access their personal data that is held by the State. The portal is continuously evolving, and new services are added on a regular basis such as *e-tracking* or mobile applications such as *GouvCheck*³⁴⁶.
- 2) **Advancing administrative reform**: this objective involves the development of a simple and predictable framework for citizens and companies when interacting with government institutions and administrations. To this end, the Ministry aims to raise awareness about the link between digitalisation and administrative simplification through a participatory and collaborative approach involving citizens to take part in the discussion about the digitalisation of public services. The Ministry proposes to use collaborative workshops and co-creation platforms.
- 3) **Promoting digital inclusion**: this objective is related to ensuring that digital services are accessible to all and to avoid a “digital divide” where certain population groups (e.g., elderly people, people with disabilities or people with limited financial means) cannot make use of digital public services.
- 4) **Integrating new technologies**: this axis revolves around the promotion of the adoption of new technologies such as IoT, blockchain or big data analysis to government institutions and administrations and assessing their suitability to solve problems. Examples of this are specific calls for projects or through research projects in cooperation with research centres in Luxembourg (e.g., “Self-sovereign identity³⁴⁷” which involves LIST and the University of Luxembourg). Other activities under this axis include the adaptation of the regulatory framework as well as providing training to public sector employees via training courses offered by the National Institute of Public Administration (“INAP”).

Initial successes of the strategy are already becoming visible as recent figures for 2021 (until end of November) confirm that the flagship solution for digital administrative services “myGuichet.lu” has recorded a **new record of 3.1 million consultations linked to the transmission of administrative queries by citizens**. Surely the possibility to make a booking for a Covid-19 vaccination, the consultation of Covid-19 tests results and online forms for enterprises to apply for state aid in view of the pandemic have driven the increased utilisation of the platform. To further strengthen the development of eGovernment services a **new participative platform to drive administrative simplification will be launched in 2022**. While details about this

³⁴⁴ [Strategic axes - Ministry for Digitalisation // The Luxembourg Government \(gouvernement.lu\)](#)

³⁴⁵ [MyGuichet.lu — Guichet.lu - Administrative Guide - Luxembourg \(public.lu\)](#)

³⁴⁶ [GouvCheck – Check the authenticity of an official document - government.lu \(gouvernement.lu\)](#)

³⁴⁷ [Luxembourg joins European Blockchain Services Infrastructure | Luxembourg Institute of Science and Technology \(list.lu\)](#)

platform have not been published yet, it is to be assumed, given the Ministry's focus on collaboration with citizens and enterprises, that it will offer the opportunity to citizens and companies to work together with public sector administrations to develop efficient digital public services. Luxembourg's efforts to develop eGovernment have been recognised by a recent report by the European Commission which ranks the country 5th out of 36 countries³⁴⁸ (EU27 + third countries).

5.2.1.2 Data Management

As explained, **the City's TIC department is in charge of data storage and management for all municipal departments.** In this context, there is a shift to the cloud for more and more solutions and data management has been done via open data solutions for several years. Currently data is most often stored centrally and managed in a decentralised manner where each service has access to their respective municipal department's data and the City's Data Protection Officer (DPO) has access to the central data register for GDPR purposes. The TIC department only has access to data that is used by applications that are run by the department and therefore **a central overview of all existing data via a central platform is currently missing. However, first initiatives towards exploiting data through a more holistic approach, such as the use of data lakes, are currently being explored.**³⁴⁹

In anticipation of a central data platform, the TIC department has started analysing data via "**data lakes**". The city has worked on a proof of concept to test the technology and analyse correlations between different datasets to model/forecast the utilisation of certain services and to support a data-driven decision-making process. As an example, real-time data on the number of available parking spaces and data on the number of users of the municipal bike rental service and data on the local weather forecasts was combined to simulate the utilisation of the city's bike rental service. This proof of concept was done in collaboration with the city of Esch-sur-Alzette.

In terms of data management, a **clear challenge is still connected to the different levels of digital maturity between the municipal services and the lack of a centralised data platform as well as the lack of information on available data in each municipal department.** The city's upcoming smart city strategy is also meant to address this crucial point as explained by the city council.

At the national level, the country has adopted the **National Interoperability Framework (NIF)**³⁵⁰ on 1 March 2019, an initiative spearheaded by the Luxembourg Ministry for Digitalisation. The framework guides public sector institutions towards achieving a higher level of interoperability and digitalisation³⁵¹. The framework has the objective of improving practical governance of interoperability, extend collaboration between different concerned actors, develop a complete mapping of interoperable services and to promote the systematic use of user centred approaches which are based on interoperability principles. The NIF was designed in

³⁴⁸ E-government Benchmark 2021 – Entering a New Digital Government Era, European Commission, [eGovernment-Benchmark-2021-Insight-Report.pdf \(capgemini.com\)](https://ec.europa.eu/e-governance/e-governance-2021/insight-report.pdf)

³⁴⁹ [Ville de Luxembourg: smart city? | Paperjam News](https://www.paperjam.com/en/2019/07/11/ville-de-luxembourg-smart-city/)

³⁵⁰ [National Interoperability Framework - Ministry for Digitalisation // The Luxembourg Government \(gouvernement.lu\)](https://www.gouvernement.lu/fr/le_gouvernement/le_ministere_digitalisation/nif/)

³⁵¹ The Ministry for Digitalisation defines interoperability under NIF as follows: "*Interoperability in the context of the NIF represents the ability of different heterogeneous organisations to interact towards mutually beneficial goals, involving the sharing of information and knowledge between these organisations, through the business processes they support, by means of the exchange of data between their ICT systems. An element of this interoperability is a service's ability to communicate and exchange information in an efficient, effective, quick and simple manner with other services across organisations, in order to achieve a mutual goal in the common interest of the involved organisations and users. Interoperability covers the following levels: legislation, organisation, semantics and technique.*"

conformity with the **European Interoperability Framework³⁵² (EIF)** while also taking specific national needs into account. While the adoption of the NIF marks an important milestone, the framework as such will not ensure that high levels of data interoperability across government institutions will be achieved, as pointed out by the Ministry. The Ministry now calls for the creation of a governance schemes to ensure implementation. **The city of Luxembourg collaborates with the Ministry on these and other topics in the context of working groups at the national and communal level.** The TIC department is currently developing an interoperability framework strategy.

On the **research side**, there are several notable projects related to data management capabilities that have been realised by actors of the innovation ecosystem, albeit in many cases not only on the city level but also on the national level:

On a national level, **Luxembourg is already member of a partnership (“EuroHPC³⁵³) together with France, Italy, Portugal, Bulgaria, Poland, and Spain in the field of high-performance computing** (Luxembourg has its own high-performance computer “Meluxina³⁵⁴) and has a well-developed and established digital infrastructure particularly in areas such as mobility, construction, energy, and water management.

Due to Luxembourg’s fast-growing population and the related impact on the environment brought about by such rapid growth, the Luxembourg government has made “Smart City” one of its priority areas³⁵⁵. In this context, data and particularly big data play a pivotal part which is why the **Luxembourg Institute of Science and Technology (LIST) has invested a significant number of resources into digital technologies and the storage and exploitation of data related to the management of cities.** Several projects in the field of **mobility data management, digital twins and energy data management** are either ongoing or have been carried out:

Digital Twin

The **Digital Twin** project, run by the Luxembourg Institute of Science and Technology (LIST) together with Luxembourg’s Interdisciplinary centre for Security, Reliability and Trust (SnT) and the Luxembourg Institute of Socio-Economic Research (LISER), has the objective of creating a **digital twin for the entire country of Luxembourg and becoming the first-ever nationwide platform of this kind³⁵⁶.** The country has been chosen as it is well suited for the project due to its geographical, political, and economic importance within Europe. Its relatively small population of just over 600’000 inhabitants with the substantial daily influx of about 200’000 commuters has the capacity to be very fast and agile as explained by Dr. Kallstenius, CEO of LIST³⁵⁷³⁵⁸.

The project consists of three pillars (1) the technical testbed, (2) a living lab and (3) a policy toolkit.

Applications for the digital twin range from energy management, urban planning, the development of industrial zones to resource management or mobility. In this regard, the twin already integrates

³⁵² [The New European Interoperability Framework | ISA² \(europa.eu\)](#)

³⁵³ [Home | European High Performance Computer Joint Undertaking \(europa.eu\)](#)

³⁵⁴ [Meluxina: Luxembourg's new supercomputer - Luxembourg \(public.lu\)](#)

³⁵⁵ <https://www.infogreen.lu/the-smart-city-of-the-future.html>

³⁵⁶ [Digital Twin | Luxembourg Institute of Science and Technology \(list.lu\)](#)

³⁵⁷ In this context it is also important to note that the specific case of Luxembourg requires that the city level and national level be considered jointly as the challenges are different compared to the ones of more densely populated urban areas. Therefore, in the case of Luxembourg, it is important to create connections between urban and rural areas.

³⁵⁸ [A nation-wide digital twin \(tradeandinvest.lu\)](#)

outputs from closed projects carried out by LIST in specific domains such as mobility data management and energy data management. Two examples of such projects are provided further below.

In the case of the city of Luxembourg, and generally for smart city applications of the Digital Twin, it is important to identify relevant use cases that present an added value for the citizens of a city and for which interoperable data are available and for which data privacy aspects are resolved³⁵⁹ as mentioned by LIST. **For the city of Luxembourg, discussions about integrating the city into the digital twin are ongoing.** However, currently there is no clear view on what these concrete uses cases and applications (e.g., in mobility) could be as discussions with the city are still in their early stages and have been slowed down due to the shift in priority for the Twin during the COVID-19 pandemic.

Because the digital twin has the aim to cover the entire country, it proved to be a particularly valuable tool during the COVID-19 outbreak: it was used to **visualise the impact of policy decisions such as the closing of schools, reopening of restaurants, the maintaining of open borders on the expected numbers of infections and hospitalisations as well as the supply chain for specific medical equipment to be delivered to Luxembourgish hospitals.**

In terms of data management, LIST is aiming to develop a solution that can interact with other cities, countries, and regions. Therefore, **the institute adheres to the interoperability architecture supported by the Open & Agile Smart Cities network (OASC)**, and it uses the network provided by OASC and other initiatives such as “*Living in EU*” or “*Gaia-X*³⁶⁰” to establish contacts and collaborate with frontrunners in other regions of the EU on this topic. In this regard, alliances and consortia are formed to develop regional use cases for the twin.

Below, we provide two examples of past projects carried out by or with a participation of LIST whose results have been integrated into the Digital Twin:

Mobility data management:

The **CONNECTING** project was aimed at helping urban policy makers **assess transport systems and determine relevant mobility options in terms of sustainability through the development of an operational tool for the Life-Cycle Assessment (LCA) of mobility scenarios**. This project was important for Luxembourg to be able to reach its national CO2 reduction objectives. Additionally, the influx of approximately 150,000-200,000 daily cross-border commuters, had to be considered for issues related to the recharge and use of electric vehicles. Luxembourg’s multimodal dimension, based on a combined use of personal electric vehicles combined with public transport, had an impact on the project’s analysis, scope and complexity in terms of policy actions: For the project, the **focus was put on refining and evaluating mobility policies for the specific case of cross-border commuting from France**³⁶¹.

Energy data management:

The **SECuRe**³⁶² (**Smart Energy Cities and Regions**) project by LIST had the objective **to visualise the energy potential of an entire city at a glance. The project developed a tool** (hosted on a dedicated web platform) to compute and explore the renewable energy potential in a city. The developed model calculates

³⁵⁹ Data privacy is typically more of an issue in the field of smart city developments compared to projects concerning the development of industrial areas.

³⁶⁰ [What is Gaia-X | Gaia-X Website](#)

³⁶¹ <https://www.list.lu/en/research/project/connecting/>

³⁶² [SECURE | Luxembourg Institute of Science and Technology \(list.lu\)](#)

solar Photovoltaic potential, includes a biomass plant planning tool and an energy consumption and savings tool. Apart from municipalities, actors such as energy service providers, software companies, investors and citizens are potential users.

A **test-case was developed for Luxembourg's second largest city, Esch-sur-Alzette**. For this test-case, an existing 2D algorithm³⁶³ was further developed into a 3D model. The augmented 3D model allowed to integrate facades into the calculation of photovoltaic potential. Furthermore, the impact of renovations on energy efficiency was integrated into the test-case.

Added to this, the changing position of the sun over the course of the year is included in the model. To achieve this, for the city of Esch-sur-Alzette, between 12,000-13,000 maps had to be added together into a single map. Therefore, the model is based on vast amounts of data that are being processed to visualise the energy potential of a city; in the case of Esch-sur-Alzette, 3 billion operations were necessary.

The **SECuRE model can be used as a planning tool to select the ideal location of photovoltaic panels within a city and explore options for renewable energy**³⁶⁴. The project has not gone unnoticed as it has already attracted interest from various cities such as Rotterdam, Aberdeen, Zurich, Charleston (USA)³⁶⁵. For Luxembourg, the aim is to develop a **GIS-based interoperable Smart Energy Cities and Regions decision-support platform**.

5.2.1.3 Societal Engagement

The societal engagement of the city with its citizens, companies and innovation ecosystem can be analysed by focussing on three perspectives:

- 1) General interaction and communication channels between the city administration and citizens: To ensure that citizens can get in touch with the administration, three process flows have been put in place:
 - o The "Report-it function" which can be accessed via the Cityapp and the city's website *vdl.lu*, allows citizens to provide feedback on services, report problems and share suggestions. Information is received by the municipal department "Secretariat General" and then dispatched to the relevant departments.
 - o The *Communication team* within the CRP (Communication et Relations Publiques) department processes feedback received via social media.
 - o For the city app, a helpdesk (with a dedicated telephone number and email address operated by an external agency) which checks and corrects bugs.
- 2) Involvement of citizens in projects and service design:

In general, the use of co-creation approaches and citizen involvement that is applied by the city of Luxembourg depend on specific projects and whether there is an added value from involving citizens. This is typically the case when projects have an impact on open/urban areas and are linked to services that

³⁶³ The 2D algorithm stems from an earlier project ("MUSIC" 2010-2015), which introduced a 2D algorithm to establish the surfaces available for photovoltaic energy production.

³⁶⁴ [Luxembourg joins European Blockchain Services Infrastructure | Luxembourg Institute of Science and Technology \(infogreen.lu\)](#)

³⁶⁵ [Visualising the energy potential of a city | Luxembourg Institute of Science and Technology \(list.lu\)](#)

are relevant for citizens but to a lesser extent in the case of projects that are of a more technical nature. To illustrate this, two examples of citizen involvement are presented below:

- **Annual Budget discussions:** Citizens have the possibility to take part in the annual year end discussions concerning the city's budget via a moderated forum.
- **Mobility concept:** The City of Luxembourg has launched the **development of a new mobility concept**^{366,367}. The concept highlights the clear interlinkage between the city of Luxembourg and the country as the population of the city of Luxembourg which currently stands at 125'000, doubles during a workday due to incoming commuters³⁶⁸ (the city of Luxembourg hosts 40% of all jobs in the Grand Duchy of Luxembourg). To develop the new concept, the city puts a significant focus on citizen participation (geared towards both citizens of Luxembourg city and citizens of the entire country). The interactive participation process was launched in October 2021 via a public conference. The participation furthermore involves a survey on tomorrow's mobility concept for the city of Luxembourg as well as ongoing communication and interaction with citizens.

The city is currently evaluating the introduction of a collaboration platform to give citizens and businesses the opportunity to propose and discuss ideas for innovative projects³⁶⁹.

Finally, with regards to specific services, end user data is collected for services offered in the areas of building and spatial planning as well as transport and mobility to continuously improve these services for citizens.

3) Interaction with ecosystem and start-ups/ initiatives:

The innovation ecosystem involves actors that specialise either on research and development i.e., **Research institutes** or on fostering the ecosystem of innovative start-ups that may support smart city developments i.e., **Actors in the Innovation Start-up Ecosystem**. In the following these actors and their interaction with the City of Luxembourg are presented:

Research institutes

In terms of research institutes, there are three main actors that are involved in research in the field of smart cities and digital innovation in urban areas:

- The **Luxembourg Institute of Science and Technology (LIST)**³⁷⁰ is a mission-driven Research and Technology Organisation (RTO) performing research in the fields of information and communication technologies, environmental technologies, and advanced materials. The institute develops competitive and market-oriented product/service prototypes for both public and private stakeholders. As an autonomous enterprise with a public utility mission, LIST aims to be a trusted partner for Luxembourg businesses, universities, and public institutions to develop local projects with a potential for a European wide or even global application through partnerships. **The institute has a well-established contact with the City of Luxembourg and involves them in projects that are relevant for the city** such as the development of a Digital Twin (more information on this is provided in section 2.1.2 "Data Management").

³⁶⁶ [Our Mobility Plan for Tomorrow | Ville de Luxembourg \(vdl.lu\)](#)

³⁶⁷ [Mobiliteitsplang_depliant_A5_HD_version_bat.pdf \(vdl.lu\)](#)

³⁶⁸ During non-pandemic periods

³⁶⁹ [Smart Governance | Ville de Luxembourg \(vdl.lu\)](#)

³⁷⁰ [Institute | Luxembourg Institute of Science and Technology \(list.lu\)](#)

- The **Interdisciplinary Centre for Security, Reliability and Trust (SnT)**³⁷¹ which is part of the University of Luxembourg conducts research in the field of information and communication technology. The centre collaborates with the industry and the public sector on projects with a focus on creating a socio-economic impact. SnT's strategic research priorities include for instance: autonomous vehicles, cybersecurity, fintech and the Internet of Things. The centre focuses on the development of prototypes that are then implemented and put in production by partner institutions and companies. **Contact with the City of Luxembourg exists**, however, to collaborate with SnT and to ensure that prototypes can be successfully implemented and put in production, the digital maturity of the partner institution (need to have a competent team capable of working with big data and skills in UI/UX design) is crucial. However, in many cases, this is not yet the approach of public institutions and administrations in Luxembourg which impedes collaboration.
- The **Luxembourg Institute for Socio-economic Research (LISER)**³⁷² is a public research institute focussing on socio-economic research under the Luxembourg Ministry of Higher Education and Research. The institute consists of three research departments "Living Conditions", "Labour market" and "Urban Development and Mobility"³⁷³. The latter performs research in the fields of urban life and the functioning of urban areas. The main topics that are being researched include spatial development, cross-border metropolitan integration, local and cross-border mobilities and smart cities. The institute is involved in smart city projects and initiatives such as the Digital Twin for Luxembourg.

Actors in the Innovation start-up ecosystem

The **House of start-ups (HOST)**³⁷⁴ is a shared workspace launched by the Luxembourg Chamber of Commerce that offers 6000 square meters of space in the centre of the city of Luxembourg to innovation hubs, incubators, and business accelerators. The facility offers IT infrastructure, conference rooms and meeting spaces to entrepreneurs. It currently hosts several hubs:

- The **Luxembourg City Incubator (LCI)** was created in October 2018 on an initiative of the Luxembourg Chamber of Commerce and with the support of the City of Luxembourg³⁷⁵. The incubator focuses on six economic sectors: commerce, logistics, tourism, "*urbantech*", environment, construction, and accommodation. LCI supports start-ups in a tailor-made manner by providing support to establish contact and foster networking with partners and potential clients, identifying opportunities to raise funds (at national and international level (i.e., Greater Region: bordering regions of Germany, Belgium, and France)).

LCI supports the development of Luxembourg City as a Smart City through entrepreneurial development notably in the field of technological and economic innovation in the sector of "*urbantech*": Its aim is to provide structured support and to create advantageous conditions for start-ups that are important to smart city developments. **The City of Luxembourg plays an active role in the selection of such projects that may support its innovation journey:** The City attends selection committee meetings and provides its opinion on the utility of the start-up's innovative idea to the city³⁷⁶.

³⁷¹ [SnT \(uni.lu\)](http://SnT.uni.lu)

³⁷² [The institute in brief | LISER](#)

³⁷³ [Urban development and mobility | LISER](#)

³⁷⁴ [host.lu: House of Startups](http://host.lu)

³⁷⁵ [UN VIVIER D'INNOVATION AU SERVICE DES ENTREPRISES, DE LA VILLE, DU LUXEMBOURG – smartcitiesmag.lu](#)

³⁷⁶ Please note that the selection of startups is solely done by LCI, the opinion provided by the city of Luxembourg has no impact on LCI's final decision

A success story of this interaction is the start-up “Urban Time Travel¹” which is hosted by LCI and has started a collaboration with the City of Luxembourg to offer an AR/VR augmented experience to citizens and visitors of the city (more information on this is provided under the services offered in the area of “*Smart Living*” by the city in section 3 *Digital Service Innovation Maturity*). LCI is also in touch with actors from the research side such as LIST to identify potential collaborations in the field of “*urbantech*”

Going forward, the LCI team would like to set up regular and structured exchanges with the City of Luxembourg (i.e., relevant municipal departments) to present specific start-ups that have the needed maturity and that may be of interest to support smart city developments. The city’s upcoming smart city strategy should support this by providing more guidance on strategic directions also with regards to the interactions with LCI.

- The **Luxembourg House of Financial Technology (LHoFT)³⁷⁷** is a public-private sector initiative that aims to drive innovation in technology for Luxembourg’s important financial sector and financial services industry. LHoFT supports fintech start-ups by providing offices in their co-working facility and helps them connect with larger corporates from the financial services and technology industries to help them meet their innovation goals and to get access to resources. The LHoFT closely collaborates with the team of LCI to align on specific approaches and marketing in the context of the wider innovation ecosystem. **LHoFT has not collaborated with the City of Luxembourg yet but would be interested to support in the context of the implementation of the upcoming smart city strategy** in case support was needed (e.g., in the field of payments).
- Another actor hosted by the House of Start-ups is **Le Village³⁷⁸**, an incubator supported by the Credit Agricole Group which is connected to an international network (Milan, London, New York, Shanghai and Tokyo). There is currently no collaboration with the City of Luxembourg.

Challenges faced by the city with regards to collaborating with the innovation ecosystem

1. **Need for more structured coordination and collaboration with the innovation ecosystem:** While collaboration between the city and actors in the innovation ecosystem such as LCI exists, it appears that a more structured and goal-oriented approach is needed to ensure that the benefits of incubation and support schemes can be exploited. In this regard, the city expects that the smart city strategy will help them in structuring this exchange and collaboration in the future.
2. **Need more digital maturity to support development of digital solutions and collaboration:** This challenge relates to the need of the city to achieve a necessary level of digital maturity that will enable a more efficient and clearly structured exchange and collaboration with actors in the ecosystem that work on the development of new technologies and prototypes.

5.2.1.4 Procurement

In the national benchmarking study on the *Strategic use of public procurement for innovation in the digital economy*³⁷⁹ commissioned by the European Commission, **Luxembourg falls within the group of low**

³⁷⁷ [About Us – The LHoFT – Luxembourg House of Financial Technology](#)

³⁷⁸ [Home | Le Village by CA](#)

³⁷⁹ [The strategic use of public procurement for innovation in the digital economy - Publications Office of the EU \(europa.eu\)](#)

performing countries in terms of its advancement in rolling out an innovation procurement policy framework. The report highlights that Luxembourg possesses a basic legal framework as well as support from horizontal enabling policies to start building up a policy framework for innovation procurement. Furthermore, national guidelines promote an approach to Intellectual Property Rights allocation which strengthens innovation in public procurement. However, Luxembourg neither has a dedicated innovation procurement policy nor does it have a structured set of measures to support the adoption of such a strategy (e.g., there is no competence centre, action plan, spending target, incentives, or capacity building).

The City of Luxembourg's procurement approach typically involves the publication of a call for tender document via the national Portal for Public Procurement Contracts (*"portail des marches publics"*³⁸⁰). The portal is used by most public sector entities in Luxembourg such as government, individual municipalities, public institutions, and the city of Luxembourg³⁸¹. In terms of procurement the city is bound by the rules of the public procurement legislation which foresees different procedures depending on the size (i.e., budget) of the project. There is some flexibility when it comes to Proof-of-Concept procedures where collaboration with innovative companies and start-ups is possible. In this context, the collaboration with the Luxembourg-city incubator allows the city to get in touch with such actors.

In terms of funding of digitalisation projects that are developed by the TIC department, the city usually makes use of the City budget. Most projects funded through the city budget are in the domains of transport and mobility, utilities, and education. External funding such as funding via EU programmes is not used as projects are typically below a budget of 1 million Euro³⁸².

On the research side, it has been announced in January 2020 that an **academic Chair in Digital Procurement** will be created at the University of Luxembourg under the institution's Centre for Logistics and Supply Chain Management (LCL) which is part of the Faculty of Law, Economics and Finance.³⁸³³⁸⁴. As of 2021, a master's degree will be available to students wishing to be trained in the use of new technologies and computer science in procurement.

The programme covers the study of new technologies and research for digital procurement in a forward-thinking and academic manner. The course is supported by Luxembourg's Chief Procurement Officer Club³⁸⁵ (CPO) and will directly respond to market needs to develop a Procurement Excellence Platform in Luxembourg.

5.3 Change management

At the level of the State, the Ministry for Digitalisation has developed a strategy to promote technological innovation³⁸⁶. This is supported through initiatives and events involving citizens and companies such as hackathons on technological innovation. Through this approach, government administrations such as the

³⁸⁰ [Portail des marchés publics - Luxembourg](#)

³⁸¹ [Public procurement and tender documents | Ville de Luxembourg \(vdl.lu\)](#)

³⁸² [Ville de Luxembourg: smart city? | Paperjam News](#)

³⁸³ [University of Luxembourg and ministry of the Economy establish Chair in Digital Procurement - gouvernement.lu \(gouvernement.lu\)](#)

³⁸⁴ [Digital Procurement \(uni.lu\)](#)

³⁸⁵ The CPO (Chief Procurement Officer) Club is an organisation composed of CPOs from 7 leading companies (Amazon, ArcelorMittal, Delphi, Ferrero, Leaseplan, SES and Vodaphone) who have based their regional or procurement hubs in Luxembourg.

³⁸⁶ [Strategic axes - Ministry for Digitalisation // The Luxembourg Government \(gouvernement.lu\)](#)

CTIE (“*Centre des Technologies de l’Information de l’Etat*” i.e., the ICT centre of the public sector in Luxembourg) can easily collaborate with external actors to develop eGovernment solutions. **In this regard, the city of Luxembourg is actively involved in working groups organised by the Ministry at both the national and communal level.**

To develop and implement new applications, the City of Luxembourg applies a change management process based on a **participatory approach involving all relevant stakeholders and concerned municipal departments**. The challenge in this regard lies in the different levels of digital maturity across the municipal departments as well as the organisational challenge of having to unite often diverging expectations between the many departments of the city.

In terms of interaction with cities and actors outside of the country, **the City of Luxembourg has thus far not been an active participant in European networks or programmes in the field of digitalisation of public services**. While the city has joined the *Open & Agile Smart Cities network (OASC)*, main interactions with other cities are typically organised on a bilateral level and are in most cases limited to cities located in the proximity (i.e., greater Region) such as Metz or Trier. Specifically with regards to the area of transport and mobility, the relevant municipal department is involved in exchanges at the national level.

The City acknowledges the need to address the above-mentioned challenges such as low levels of digital maturity and organisational aspects through its upcoming smart city strategy. Managing change and capacity building to ensure a common level of digital maturity are important elements to be addressed. Furthermore, the city aims to strengthen its exchange with other actors (government level, private sector, research institutes and innovative hubs such as the LCI with its numerous start-ups) to engage in a structured and goal-oriented collaboration to implement its upcoming smart city strategy³⁸⁷.

5.4 Digital service innovation maturity

Digital services are increasingly provided by the City of Luxembourg through developments led by the TIC department. The department confirmed that the Covid-19 pandemic has accelerated this process of developing digital alternatives as more services are now available in a digital form such as the possibility to register an address/unregister from an address without having to visit the administration. In terms of innovative and digital services, the TIC department has developed several projects and services in recent years:

- **Smart infrastructure**³⁸⁸: The city of Luxembourg has put in place several important elements such as a **free Wi-Fi network covering the entire area of the city** allowing everybody in the city to use the service. The city has furthermore designed and put in place a **dedicated fibre-optics network**³⁸⁹ **(150km) that connects the city’s infrastructure and public buildings**. Finally, the city is currently analysing plans to install **sensors aimed to collect environmental, mobility and other data** that could be analysed via IoT technology to feed specific analysis or models and inform citizens.

³⁸⁷ [Ville de Luxembourg: smart city? | Paperjam News](#)

³⁸⁸ [Smart Infrastructure | Ville de Luxembourg \(vdl.lu\)](#)

³⁸⁹ [City Juillet/Août 2016 by Maison Moderne - Issuu](#)

- **Smart mobility**³⁹⁰: The City provides **real-time data concerning transportation** such as bus departures, alerts on network disruptions, parking space availability and availability of municipal bikes (called “*véloh*”). Another example includes the *Call2Park*³⁹¹ service allowing citizens to buy parking tickets in the city-centre via their phone.
- **Smart Governance**³⁹²: This includes a possibility for citizens to **partake in the yearly budget discussions through a moderated forum**, an **open data portal**³⁹³ allowing citizens to consult public data, the **tracking of administrative procedures** such as building permits, services related to getting in touch with the administration (“Report-IT platform”) as well as **electronic forms allowing an electronic signature for certain administrative procedures**.
- **Smart Living**³⁹⁴: The City, in collaboration with the Luxembourg City Incubator has supported the development of an **augmented virtual reality tour** by the start-up company “*Urban Timetravel*”³⁹⁵ allowing visitors to discover a district of the city (“Pfaffenthal”) through the lens of a citizen living in the district during the 19th century. The virtual bus tour is aimed at tourists, visitors, and citizens of the city. The city is currently exploring an extension of the virtual tour to other districts. On top of touristic applications of AR/VR, the city of Luxembourg has launched an **outdoor augmented reality project that allows users of the Cityapp to scan icons at bus stops to obtain additional real-time information superimposed on the camera image** such as bus departures, an interactive map, or changes to bus routes. The service is currently only available at certain bus stops, but it is planned to be gradually rolled out across the city. A further feature allows users of the app who view buildings located at tourist sites or buildings of historical importance through their phone’s camera to obtain additional information such as old pictures, historical videos and 3D models linked to the location, superimposed over the camera image.
- **Internet and ICT training**³⁹⁶: The city offers basic internet and ICT trainings (“*Internet Führerschäin*” i.e., “*internet driving licence*”) aimed at its citizens covering - ICT (types of digital hard- and software tools), **finding information** (e.g., browsing the web), **communicating** (using emails, electronic signatures etc.) and **creating** (creating and editing documents etc.). Trainings for instance in IT security are also offered to municipal workers.

Cityapp VDL³⁹⁷: The City of Luxembourg has developed a dedicated application called “Cityapp” for its citizens to obtain real-time information and to use certain services. More information about the app is provided in Box 4 below:

³⁹⁰ [Smart Mobility | Ville de Luxembourg \(vdl.lu\)](#)

³⁹¹ [Call2Park | Ville de Luxembourg \(vdl.lu\)](#)

³⁹² [Smart Governance | Ville de Luxembourg \(vdl.lu\)](#)

³⁹³ [Home - Portail Open Data \(public.lu\)](#)

³⁹⁴ [Smart Living | Ville de Luxembourg \(vdl.lu\)](#)

³⁹⁵ [Microsoft Word - Press-Release_Urban-Timetravel-October2020_EN.docx \(urbantimetravel.com\)](#)

³⁹⁶ [Internet and ICT training | Ville de Luxembourg \(vdl.lu\)](#)

³⁹⁷ [cityapp – VDL | Ville de Luxembourg](#)

Box 4 - Zoom-in: Cityapp VDL

○ Overview

The Luxembourg **Cityapp**³⁹⁸ has already existed for several years (a first version was launched in 2008 and a second version in 2015). The current version was deployed in 2020. The Cityapp offers a wide range of services to citizens through an integrated application build on real-time data. The Cityapp has the objective of becoming the number one reference for both citizens and visitors of Luxembourg City by providing tailored information and guidance to citizens and visitors of the city. This is achieved using geolocalisation and notification services as well as the possibility to personalise the application so frequent users can easily access relevant information.

The app offers real-time information about transport and mobility services, information about services related to waste collection, water quality, possibilities to get in touch with the city through the “*report-it*” function as well as information around local events and cultural venues.

The app targets inhabitants of Luxembourg City, commuters (which represent a significant daily influx of users) and visitors that make use of leisure activities in the city. In this context, two main types of users are: frequent users (who make use of the personalisation functionality of the app) and sporadic users.

○ Relevance and uniqueness

While the Cityapp as such is not a very innovative solution, the innovative element lies in fact that the app provides central access to a wide range of real-time city data in the form of specific “widgets” that can be further customised by the user to create a personalised dashboard. The City has started a major promotional campaign around the app, and they have already registered an increase in the number of downloads. Initial analysis of user data shows that the dashboard and widgets are indeed used a lot which confirms that the combination of accessing real-time city data through personalised dashboards is well accepted, particularly by frequent users.

- **The service design:** The design of the cityapp (2020 version) was done following a co-creation approach to determine the functional scope of the Cityapp. This process involved all municipal departments to gather information on which services and functionalities could be included given available data. In a second step, the TIC department ran a city-wide consultation of users in the form of qualitative interviews and a survey in French, English and German to understand how users rate the old application and what services and improvements should be developed as part of the new application.
- **Stakeholder engagement:** The CRP department collaborated with the TIC department and all municipal departments, citizens, and a private service provider to develop the new application.
- **Accessibility, technical capabilities, and data integration:** In the short-term, the city aims to integrate more functionalities concerning data on mobility such as data on connections between different means of transport as well as data on water quality. In the long run, the digital evolution of municipal departments and available data will be reflected in the app through new

³⁹⁸ [cityapp – VDL | Ville de Luxembourg](#)

functionalities. An example would be the integration of administrative procedures that can be accessed through the app which, however, would require user identification.

In terms of data integration, the city does not possess an integrated data platform yet. However, efforts are currently being undertaken to see how data from different sources can be exploited in the form of data lakes.

- **Environmental and tourism perspective:** On the environmental side, the cityapp feeds into Luxembourg's multi-modal mobility strategy by providing real-time data on different means of transport, connections, and itineraries. In terms of the tourism perspective, while not specifically targeting tourists, the geolocalisation functionality allows the user to quickly discover places of interest in the city such as cultural facilities and events, restaurants, leisure facilities and more.

○ **Challenges and drivers**

A **particular challenge** faced by the city during the development process of the new Cityapp relates to the **coordination effort between the City's municipal departments**. This was especially challenging because the level of digital maturity between the different departments of the city is a clear differentiator meaning that depending on the service a stronger effort was needed (for instance the mobility department is very experienced with data whereas other departments are not). In practice this meant that, depending on the service it was necessary to involve a technical expert to ensure that the discussion between the TIC department and the municipal department yielded the right results (e.g., to ensure that agreed standards for data are applied).

Another challenge relates to the **language coverage** of the Cityapp which is available in French, English and German. Most data that are fed into the app is only available in French and therefore there is a constant need to translate data whenever changes are made to the app.

Luxembourg city's upcoming Smart city strategy will be a driver for the future development of the cityapp (and other services). While today, the city still works very much in a bottom-up manner to identify available data and develop services or applications, it is expected that the strategy will ensure a more transparent and fluid collaboration between the different departments. The TIC department expects that the strategy will provide guidance for the exchange of data between departments. In this regard, particular focus should be on gaining a better understanding of what data exists and what data standards are used by the different departments.

○ **Implementation and Monitoring**

For the implementation of the new Cityapp, the service provider who developed the app was selected via a standard public procurement procedure (PMP: Portail des marchés publics³⁹⁹). The development of the app was financed via the City's budget. The development of the app was done via sprints to test technical functionalities with internal departments. The UX/UI design was performed by the selected service provider in collaboration with the relevant municipal department at the source of the data used (e.g., mobility department for transport data). Then user tests were performed (with 8-10 external users).

³⁹⁹ [Portail des marchés publics - Luxembourg](#)

In terms of monitoring, it is important to point out that, whenever a new need is detected from a citizen, the TIC department will consult with the relevant municipal department to make the needed data available. The CRP department points out in this regard, that citizens are typically very vocal and provide ample feedback through one of the three dedicated channels (see section 2.1.3 on Societal Engagement).

In terms of **usage monitoring, the CRP department checks utilisation statistics as well as the amount of feedback received after new releases.** Compared to the previous version of the app, a higher satisfaction rate has been noticed as less negative feedback has been received. Over the past 13 months (August 2020-September 2021), the app has gained 10'000 new IOS users and 5'000 new Android users. The overall usage of the app has, however, not increased but this may be due to the new personalisation feature allowing users a more efficient use of the app by setting up their own dashboard which leads to less interaction with the app as relevant data is immediately displayed without having to search for it.

- **Impacts**

The city confirms that the new cityapp has been well received by its users with an increase in downloads (see above). The largest impact is in the age group of 26-45 years which is the age range that most users fall into. In the short-term (coming 1-2 years), the current services and functionalities of the app will continue to evolve as more data will become available (particularly in the domains of water quality and mobility). In the longer-term (5 years+) and as the digital maturity of the different municipal departments increases, it is foreseen to include administrative procedures that rely on user authentication.

5.5 Conclusions and lessons learned

The analysis has shown that the City of Luxembourg's administration already provides several digital services to its citizens not least thanks to its well-developed basic IT infrastructure. The City is, however, lacking a smart city strategy and approach supported by a horizontal governance structure to steer and guide the implementation of the strategy. The current setup is too much based on an isolated "silo approach" when it comes to the development of digital services. This is apparent from the decentralised management of data, the different levels of digital know-how and skills within municipal departments and the overall weakness in coordinating such digital transition projects.

This situation also impedes the interaction with the city's innovation ecosystem to an extent. However, the knowledge of actors from the research side and the private sector offers a promising basis that could be further developed and exploited by the city.

The remainder of this section discusses these conclusions and lessons learned in more detail:

i) A well developed, basic IT infrastructure and a favourable national context support the development of digital services for citizens in the city of Luxembourg

The city of Luxembourg's investment into its smart IT infrastructure i.e., fibre-optics network and city-wide free Wi-Fi have allowed the municipality to develop digital services and to bring them closer to its citizens. Within the administration this has allowed the City to develop applications for municipal departments which have a necessary level of digital maturity and to automate certain processes for relevant departments and

administrations. For citizens this has meant that the City has been able to develop first digital services including the cityapp allowing citizens to access real-time data for specific topics such as transport and mobility or to get in touch with the city administration. Furthermore, the favourable national context supported by the Ministry for Digitalisation acts as an additional driver to further develop interoperable, citizen-focused eGovernment solutions.

ii) The relatively low level of digital maturity across the city's municipal departments impedes the development of more innovative digital services

The development of further innovative digital services is currently being slowed by the low level of digital maturity of the many municipal departments of the City. While there are some exceptions, such as in the domains of the general administration, transport and mobility, and utilities, relevant departments of other domains are significantly less developed when it comes to digitalisation and the use of data. The origin of this problem is at least to an extent the decentralised organisation of municipal departments when it comes to data management. The administration is currently lacking a central data platform that would allow it to exploit data for the purpose of developing new applications and digital services. The City has recognised this shortcoming and first attempts are being made to analysis large data sets combining various sources in the form of data lakes. The City has also recognised the need to increase the digital skillset of its municipal agents who can take part in training opportunities offered via the **INAP** (National Institute for Public Administration) and other private training institutes.

While a higher level of digital maturity is necessary for the city to develop digital services, this is also important to strengthen the City's collaboration and engagement with the innovation ecosystem whose members can act as supporting drivers by developing new solutions. However, necessary digital skills and setup at the level of the City administration are necessary to be able to implement such solutions.

iii) The absence of a digital strategy with clearly defined objectives and an implementation roadmap supported by a dedicated governance structure limits the city's ability to drive the digital transition and to fully exploit the potential of the existing innovation ecosystem

While the above-described lack of digital maturity and of a central data platform limits the range of possibilities in terms of developing innovative digital services, the absence of an agreed smart city strategy setting out objectives and an implementation roadmap for the development of new applications and digital services that is supported by a clear governance structure breaking the current "organisational silo approach" also slows the digital transition of the City of Luxembourg. To overcome this, the City has launched the process of developing such a strategy. While the strategy has not been published yet, the analysis shows that apart from identifying key objectives and implementing steps, there is also a need for a dedicated governance that breaks the current silo-approach.

iv) The innovation ecosystem has potential to act as a strong and capable supporting driver with its various actors from the research side and the private sector

The innovation ecosystem of the city of Luxembourg is well positioned to support the development of digital services for the City of Luxembourg. On the research side several institutions are delivering relevant research and developing prototypes that could be applicable for the city of Luxembourg such as the Digital Twin. The start-up incubation layer consists of several actors with the Luxembourg-city incubator acting as a dedicated hub to foster the development of "urbantech" companies. In this context the augmented virtual reality tour developed by the company "Urban Timetravel" is another example that shows how the ecosystem has already supported the development of smart city services and solutions in Luxembourg.

Going forward, the interaction and collaboration with the City of Luxembourg would benefit from becoming more flexible and goal oriented. This is because the implementation of the upcoming smart city strategy will also depend on the City’s ability to quickly roll out prototypes and use cases that have been developed by researchers and start-ups.

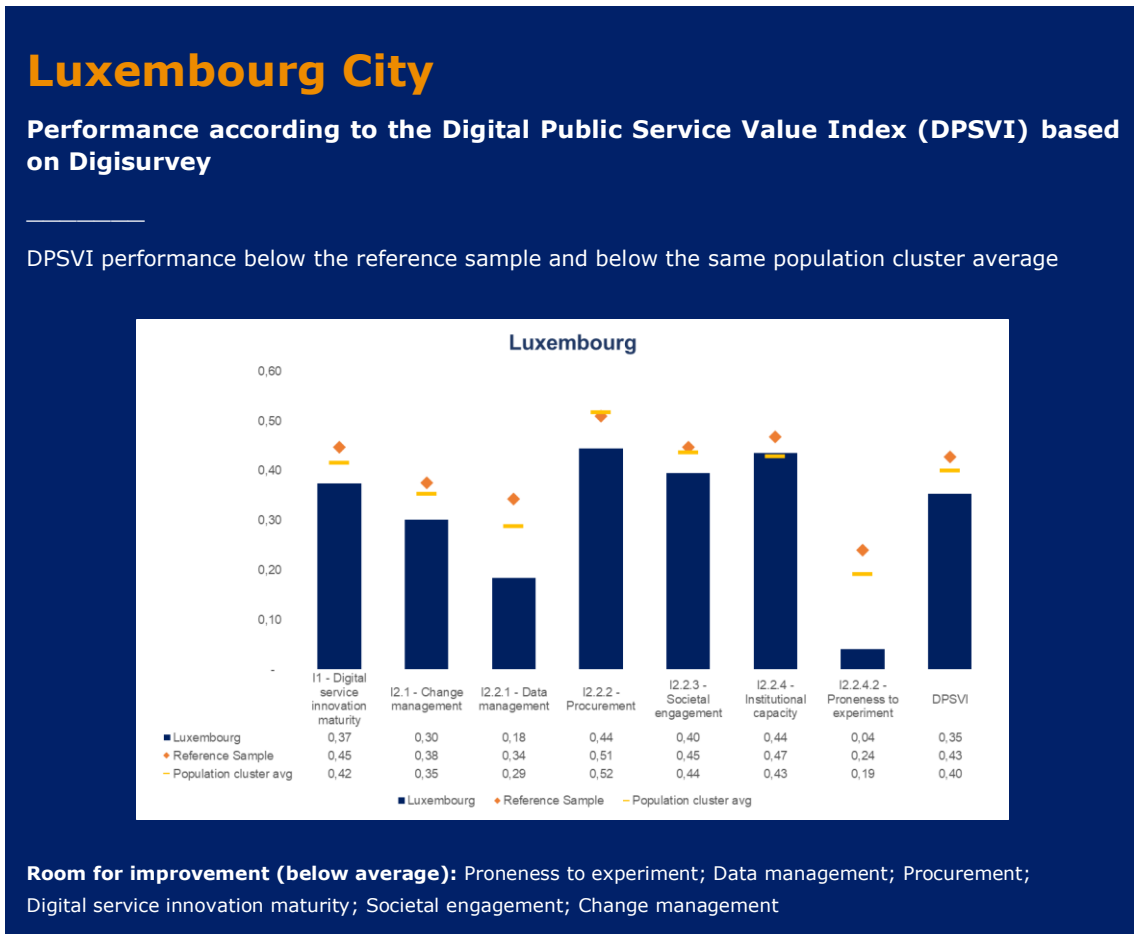


Figure 9 - Performance of the city of Luxembourg in the DPSVI relative to the reference sample and the population cluster average

6 Case Study: Magdeburg (Germany)

6.1 Overview and approach to digital innovation

Magdeburg is the capital city of the Eastern German state of Saxony-Anhalt, with 230,000 inhabitants and a significant student population of over 18,000 students every year⁴⁰⁰ which contributes to counteract population ageing. Magdeburg is also characterised by its vast and sparsely populated rural area in its surroundings. In terms of economic structure, “the main industries are mechanical and plant engineering, recycling and environmental technology, healthcare, medical engineering, and logistics”⁴⁰¹. The service sector of the economy has also been expanding⁴⁰².

The City is gradually increasing its efforts to digitally-transform public service provision. While there are already multiple examples of online services, the lack of an ICT strategy and vision until very recently has limited the embedment of technology in new services and products. Going forward, a data strategy would also contribute to aligning data collection, standardisation and sharing efforts across the municipality. A more structured involvement of the innovation ecosystem could also be beneficial to generate more advanced and targeted solutions to the needs of citizens. Seeking for inspiration in city networks of use cases that address important problems in the city will also reduce the design and time-to-market phases of new solutions. Finally, innovative public procurement is underexploited to stimulate demand-side innovation with local providers of solutions.

6.2 Proneness to Change

Overall, legislative acts such as the Online Access Act (OZG) have placed digitalisation more upfront within the City’s administration. COVID-19 also showed internally the importance of digitalised public services to continue to provide citizen services during confinements and quarantine periods.

The recently centralised Department for Statistics, Election and Digitalisation intends to better coordinate and integrate the digital efforts of the City mostly focusing on ensuring IT security, cloud storage solutions, modernised IT communication, or making use of algorithms for better decision-making.

The City is eager to become more agile and prone to experimentation despite existing constraints in terms of internal capacity, lack of a data strategy, limited collaboration with innovation actors, and only a few participations in city networks for exchanging approaches. The City’s intention to improve over time on all those fronts.

6.2.1 Innovation governance

6.2.1.1 Institutional Capacity

Currently, Magdeburg is at the start of its digitalisation path, but the City intends to boost its efforts in the upcoming years to modernise and digitalise its operations and services provided to citizens. **COVID-19 was to some extent a digital accelerator as it underlined the need for and importance of digitalisation in public administrations** in general to continue to provide services to citizens. The adjustment to the

⁴⁰⁰ [City \(magdeburg.de\)](https://www.magdeburg.de)

⁴⁰¹ [Magdeburg | URBACT](#)

⁴⁰² [Magdeburg | Germany | Britannica](#)

pandemic also led to more flexibility as hybrid and remote ways of working became “normal”. Procurement has also been made easier, for instance to buy infrastructure relevant to remote working.

Because there was no centralisation of the topic until 2020, digitalisation was not the task/focus of any employee or team, hence it ended up as something “to do on the side” rather than prioritised, as noted by the City representatives. However, as of **2021, the digital transformation efforts have become centralised at the Department for Statistics, Election and Digitalisation.**

The City’s current ICT strategy integrates both internal and external projects. According to City representatives, although internal projects are not necessarily visible for the broad public, citizens will benefit from faster response times and more flexible and efficient internal workflows. The main processes include:

- Procedures in the field of citizen services and submitting requests (reporting, administrative offences, motor vehicles, reporting portal, call system, alarm system, lost and found office).
- Finance, human resources, procurement.
- Intranet, employee portal, meeting management.
- Juvenile and social procedures.
- DSAP, Geographic Information System (GIS) and Computer-aided design (CAD) procedures.
- Secure communication via the Open Source Community Infrastructure (OSCI), and Special Electronic authority mailbox (“BebPo”).

In addition to COVID-19, other factors such as technological change, labour market changes, German Online Access Act (OZG), and the increase of the demand for online services by citizens led to a moment for **rethinking the City’s ICT orientation towards more digitalised and integrated city-wide processes, while ensuring ICT security.**

In particular, the Act to Improve Online Access to Administrative Services, or Online Access Act (OZG)⁴⁰³ is a Federal law from the Federal Ministry of the Interior, Building and Community (BMI) launched in 2017 to “make public administration easier to reach” through more user-friendly digital forms and documents to find and apply for government services and benefits. The implementation phase includes two key objectives, quoting: “firstly, **all services and benefits offered at federal, state and local level are to be accessible online** via their own portals; and secondly, all these portals are to be linked within a portal network. With a digital account, users will be able to reach all federal, state and local services from this network in only three mouse clicks. To make this possible, uniform IT standards and interfaces will be necessary”.

To this end, the City’s digital focus in 2022 will be on:

- **IT security - secure and mobile work:** review and implementation of security standards and provision for possible threats, implementation and operation of mobile device management for mobile devices, implementation of solutions for the secure and legally compliant use of cloud offerings.

⁴⁰³ [BMI - Homepage of the Online Access Act \(onlinezugangsgesetz.de\)](#)

- **Digital files and cloud storage:** provision of a Document Management System (DMS)/Enterprise Content Management system for all employees in the City, connection of storage and intelligent processing of documents of all kinds, integration of cloud storage for data storage.
- **Modernisation of IT communication:** introduction of modern and dynamic media for agile communication among each other as well as with citizens and partners, review of the existing communication media, expansion, or migration.
- **OZG I - Secure digital communication with authorities:** introduction of a standardised, secure communication path with authorities at all administrative levels, companies, organisations and associations, replacement of individual solutions in the various areas, process optimisation.
- **OZG II - Implementation of the Online Access Act:** improvement and increase of the online offers of the administration, taking into account the user-friendliness, subsequent use of standardised online application procedures without media discontinuity or creation of own services, findability of the online offers via the portal network, process optimisation.
- **Knowledge management:** gathering and processing of information for new hires and long-term sick replacements, avoidance of loss of knowledge in administration, independent of people, time and location, quick provision of knowledge.
- **Collaborative working:** review and implementation of new digital tools and storage options for city-wide collaboration, independence of time and place, new division of labor.
- **Machine learning:** checking in which (specialist) areas machine learning-based algorithms/procedures can be used, collecting and processing relevant data for the preparation and conception of possible procedures, implementation, and further development of such with the aim of relieving the specialist areas in their work or communication to improve with the citizens.

A more comprehensive ICT strategy from 2023 onwards is in the making and will substantiate the efforts that will already initiate in 2022. One of the important aspects for the success of this strategy will be to have strong role models in terms of digitalisation- for example, the goal would be to make the Mayor a digital leader.

The City believes that the **main forces shaping the speed of innovation in the upcoming years** will be the budget to be allocated to digital innovation, the involvement of external consultants to push forward digitalisation efforts, the change to a more agile administration, and the level of digital competences and the mindset for experimentation of employees.

City representatives believe that there is room for improvement in terms of general acceptance of innovative processes, both internally at the administration regarding openness to more digitally enabled processes, and externally, regarding citizens' 'appetite' to adopt digitalised public services. This also relates strongly to OZG's purpose of boosting the citizens' interaction with public administrations in Germany.

Considering that the **centralised Department for Statistics, Election and Digitalisation** only started operating in 2021, human resources and financial capacity is still expanding. The internal ICT team supports different departments and service areas including on software development.

To **improve its internal capacity to develop solutions**, the City of Magdeburg focuses on the one hand on trainings through tutorials, and on the other hand on collaborations with academia, an example being the new cooperation with Harz University for possibilities to study e-Administration/Digital Administration.

Though improving internal capacity requires a continuous effort and investment, there are some projects already developed internally such as the Vaccination-Headquarter-App, the OZG-App, the Election-App, among others. In most projects, the Municipality makes use of IT service providers such as KID Magdeburg⁴⁰⁴, the municipal IT service provider in the region of Saxony-Anhalt. In a nutshell, KID Magdeburg originated from the administration and has municipal shareholders such as the City of Magdeburg. For that reason, the company offers software and services that support IT processes within local public administrations such as Magdeburg.

6.2.1.2 Data Management

At the moment, the City of Magdeburg has not yet a data management strategy. **Data is collected and open in some cases, but not governed by strategy.** However, the public authority has a data collection system and publishes data on a regular basis both on the Municipality's website⁴⁰⁵ and the general open data portal of the city⁴⁰⁶. The City believes there are important legal challenges to address in terms of ensuring data security and personal data protection.

The City makes available open administrative data⁴⁰⁷ from the public sector's own databases in the interest of the public for free and re-use by all parties, especially targeting IT professionals. Hence data are made available in a non-proprietary open format and following the data license Germany – Attribution – Version 2.0⁴⁰⁸ that allows for further use of the data – also commercially – as long as the name of the author is mentioned. The approach followed by the City Council was to progressively open the data, to gain experience in providing and managing open administrative data. Nowadays, the open administrative data includes the categories of: *Population & Demography; Education; Culture & Sport; Leisure & Tourism; Geography, Basic Geodata & Urban Planning, Health & Social affairs; Budget & Taxes; Infrastructure, Construction & Housing; Public administration; Politics & Elections; Transport & Traffic; Environment & Climate; Economy & Work.*

6.2.1.3 Societal Engagement

Citizen engagement

Magdeburg started the initiative of the Citizens' Panel⁴⁰⁹ in spring 2012 to involve citizens in the issue of an ageing population by replying to a survey twice a year on a voluntary basis. This is seen by the Municipality as an important channel of communication with citizens on pressing matters affecting the city. At times there are also short thematic dedicated questionnaires e.g., in the topic of energy or questions that more directly relate to specific target groups such as the elderly or students. Data is then aggregated (and anonymised) and consists of an important source of information to policymakers in the City to shape new policies that reflect the needs and perceptions of citizens.

Furthermore, since 2014 **citizens can also submit an e-petition** through the city's website regarding requests and complaints to the Municipality following Article 19 of the Constitution of the State of Saxony-Anhalt. Typically petitions include recommendations for future actions by the local government or complaints

⁴⁰⁴ [Kommunale Informationsdienste Magdeburg GmbH / Start \(kid-magdeburg.de\)](http://kommunale.informationsdienste.magdeburg.gmbh/start)

⁴⁰⁵ [Office for Statistics, Elections and Digitisation \(magdeburg.de\)](http://office-for-statistics.elections-and-digitisation.magdeburg.de)

⁴⁰⁶ <https://www.magdeburg.de/Start/B%C3%BCrger-Stadt/Verwaltung-Service/Offene-Verwaltungsdaten/>

⁴⁰⁷ [Offene Verwaltungsdaten \(magdeburg.de\)](http://offene.verwaltungsdaten.magdeburg.de)

⁴⁰⁸ See [by-2-0 - GovData](http://by-2-0.govdata.de)

⁴⁰⁹ [Citizens' Panel \(magdeburg.de\)](http://citizens-panel.magdeburg.de)

that may concern previous actions with outcomes disapproved by citizens and whereby a correction of the situation may be necessary.

Indeed, **digital participation methods** have been increasingly used as a means to involve citizens in key decisions concerning the development of the city. A concrete example is the survey in November 2021 conducted by the City department for Urban Planning on **e-mobility solutions**. The results will support the decision of the City about the preferable location to build new charging poles as well as to capture the overall perception of citizens in Magdeburg regarding e-mobility. For instance, 53 % of the participants believe the current charging infrastructure is not sufficient, while there seems to be “great openness to alternative means of transport”⁴¹⁰. As next steps, the City will work together with a private provider from to develop a concept for infrastructural planning of electromobility in Magdeburg, an effort mostly funded by the Federal Ministry of Transport and Digital Infrastructure.

Interaction with the innovation ecosystem

The interaction with the innovation ecosystem remains limited and more done on an ad-hoc basis, i.e., at the moment the City lacks a structure to plan and organise collaborations with external partners that could support its efforts to digitalise public service provision activities. However, there are already some examples of initiatives that could inspire and pave the way for a more consistent approach to exploring collaborations with academia and the private sector. INTEL’s decision to build a chips giga-factory in Magdeburg⁴¹¹ is a good indication of the attraction potential of the city. Additionally, considering that Magdeburg is surrounded by a large rural area, there are transportation and logistics challenges to take into account which shall be addressed in a new transport network by 2022. This network is expected to rely on intelligent and real-time updates across the entire network infrastructure and between vehicles⁴¹². To this end, the City will collaborate with researchers from the Otto-von-Guericke-University in Magdeburg in the fields of engineering, computer science, environmental psychology, social sciences, logistics and networks, to make the Greater Magdeburg area an example of connected and intelligent mobility for others to follow⁴¹³. The underpinning idea is to enable real-time testing of mobility solutions such as driverless shuttle buses or on-demand autonomous micromobility solutions. The project is funded by Saxony-Anhalt’s Ministry of Transport.

In this context, the Institute for Logistics and Material Flow Technology (ILM) at the Otto von Guericke University in Magdeburg has been running since 2020 the project **AS-UrbanÖPNV⁴¹⁴ (Automatised Shuttle Buses- Urban Public Transport)** to close an identified gap between the reach of public transport and the areas no longer connected to the network (what is called by the project as the “last mile”). The shuttle bus – “Elbi” – can be tested by users free of charge. The other **key partners involved in this solution are the City of Magdeburg, Magdeburger Verkehrsbetriebe GmbH & Co (Magdeburg Transport Company) KG, Nahverkehrsservice Sachsen-Anhalt GmbH (Local transport service in Saxony-Anhalt), Institute of Automation Technology (IFAT) at the Otto von Guericke University Magdeburg, and Magdeburger Regionalverkehrsverbund GmbH (Magdeburg Regional Transport Association)**. The project will include the development of a concept for planning vehicle circulation and charging, as well as a pilot control center for real-time remote control of Elbi, connection of Elbi to the public transport planning network, and

⁴¹⁰ [First survey results on electromobility Magdeburg](#)

⁴¹¹ [Intel builds chip factory in Magdeburg – start of construction in 2023 | MDR.DE](#)

⁴¹² [Research & Development: Magdeburg invests in intelligent mobility \(hannovermesse.de\)](#)

⁴¹³ [OVGU - University of Magdeburg receives millions in funding for the development of new solutions for passenger and goods transport](#)

⁴¹⁴ [UrbanShuttle - Welcome to the homepage of the project AS-UrbanÖPNV \(ovqu.de\)](#)

measurement of users' acceptance of this solution. The project also looks into the environmental impact of this type of solutions and discusses "the potential effects of automated shuttle buses on the CO₂ balance in urban areas both on a micro level and on a macro level"⁴¹⁵.

The City of Magdeburg is also the location of the **Conference "Change Media Transform Business"**, an event focused on digitalisation of companies, the media, the public sector and associations, organised by the continuing education programs Cross Media and Digital Business Management of the Magdeburg-Stendal University of Applied Sciences⁴¹⁶. The City of Magdeburg is a sponsor and supporter of *Schauwerk* ('Showpiece')⁴¹⁷- the place where the conference takes place, and a place where people get together and create new ideas about the (digital) future. It is organized by the Institute for Industrial Design of the Magdeburg-Stendal University of Applied Sciences.

6.2.1.4 Procurement

Traditional and innovative public procurement

According to the 2021 European Commission study "EU-wide benchmarking of innovation procurement investments and policy frameworks"⁴¹⁸, Germany ranks 11th out of the 30 countries considered in the analysis thus being among the group of "moderate performing countries in implementing a mix of policy measures that are conducive for mainstreaming innovation procurement".

The same study concludes that the German procurement system is highly decentralised as procurement is distributed among federal, regional and local levels. In fact, 58% of procurement is awarded at the local/municipal level. At the national level, the main institution driving public procurement policy and legislation is the Federal Ministry of Economy and Energy (BMWi). In what concerns innovative procurement, the **Competence Centre for Innovative Procurement (KOINNO)**⁴¹⁹ is the key player at the national level to promote awareness-raising, share knowledge on innovative procurement, promote international networking on the topic, among others.

The overview of the current tenders of the contracting authorities of the state capital Magdeburg and city-owned companies is available at the **e-procurement platform**⁴²⁰ of the Procurement Office of the Federal Ministry of the Interior (BMI)⁴²¹.

Overall, the City believes some bounding legal frameworks and procurement processes are not efficient and limit the use of innovative public procurement which undermine the outsourcing of projects, a need the City has to address considering the limited internal capacity to build their own digital services from scratch.

Financing digital solutions

⁴¹⁵ [UrbanShuttle - Motivation \(ovgu.de\)](https://urbanshuttle.ovgu.de)

⁴¹⁶ [Über - . \(h2.de\)](https://uber-h2.de)

⁴¹⁷ <https://schauwerk.design/>

⁴¹⁸ [Results of EU wide benchmarking of innovation procurement investments and policy frameworks across Europe | Shaping Europe's digital future \(europa.eu\)](https://europeancommission.europa.eu/publications/publication-detail/-/publication/11111111-1111-1111-1111-111111111111)

⁴¹⁹ [The Competence Center for Innovative Procurement : KOINNO \(koinno-bmwk.de\)](https://koinno-bmwk.de)

⁴²⁰ www.evergabe-online.de

⁴²¹ [BMI | Procurement Office | \]init\[](https://www.bmi.bund.de/DE/Navigation/Navigation.html)

Local/ autonomous public funds (municipal budget) are the key source of funding to digital innovation initiatives. In 2020, the total amount of investment in ICT in the City was € 8M. Since the implementation of the City's ICT strategy, the share of digitalisation in the budget has increased by 10%.

The City is currently preparing applications for national and European funding opportunities linked to digitalisation.

6.2.2 Change Management

In terms of alignment with other German cities/ international cities and networks, the City of Magdeburg is also incorporating national guidelines (e.g., OZG as mentioned before) and is in contact with other cities through for instance the Deutscher Städtetag (Association of German Cities), the AG OST (Association of Eastern German Cities), and the VITAKO (Federal Association of Communal IT Service Providers). Magdeburg is also a founding member of KO.R (Association for Communal Statistic and Data Analysis with R).

Moreover, the City aims to become more and more integrated into European networks and initiatives, as shown by its signataire status of **living-in.eu**⁴²² **declaration** aimed at joining forces to boost sustainable digital transformation in cities and communities in the EU.

Magdeburg has also been engaged in **URBACT**⁴²³ (European exchange and learning programme promoting sustainable urban development) projects in the past, notably through its past participation in the project REDIS- "a network of cities that was focused on how municipalities can re-shape districts into science quarters"⁴²⁴ between 2008 and 2011. Besides Magdeburg, the other European cities involved were Aarhus, Newcastle, Manresa, Piraeus, Bialystock, Vienna and Halle.

As a general rule, before implementing a new service the City aims for asking for references or look into use cases of other cities that could shed light on the development and implementation phases.

6.3 Digital Service Innovation Maturity

Over time, the City of Magdeburg has increased the level of citizen services available online, though the maturity and sophistication of digital services is still low and there is room for improvement in terms of the use and embedment of technologies including the use of data to create data-driven services.

The City is digitalising the communication with citizens through different administrative services⁴²⁵. In the field of Childcare, the **KITA-Portal (day-care portal)**⁴²⁶ helps parents to find a place in institutions of the state capital Magdeburg. There are also digital portals for ordering a new number plate (cars), book a date for renewal of the ID Card, order the letter vote material, order civil status certificates, access the e-Library services⁴²⁷ (e.g., citizens can borrow ebooks, stream music, films, read online newspaper), among others. The City also makes available job opportunities⁴²⁸.

⁴²² [We signed | Living in EU \(living-in.eu\)](#)

⁴²³ [URBACT |](#)

⁴²⁴ [REDIS | URBACT](#)

⁴²⁵ [Online Services \(magdeburg.de\)](#)

⁴²⁶ [Homepage of the Parent Portal of the State Capital Magdeburg](#)

⁴²⁷ <https://stadtbibliothek.magdeburg.de/Thema-Online>

⁴²⁸ [Job market \(magdeburg.de\)](#)

Additionally, City Council public sessions are livestreamed via the official YouTube channel of the Municipality⁴²⁹.

Citizens can also submit an online form to report defects such as broken streetlamps, overflowing bins or randomly dumped rubbish. Those become available in a city map and the portal⁴³⁰ where the status is updated upon action from “In progress” to “Closed”.

Moreover, the city has a **digital archive**⁴³¹ which makes looking for ancestors/family much easier. For example, the archive started the **project "search for traces Magdeburg"**⁴³². Indeed, Magdeburg lost its medieval-early modern archive following the Thirty Years' War, thus this project “wants to counteract this amnesia with the modern possibilities of the Digital Humanities in order to rediscover the multifaceted past of the city”.

Under project “Modern Magdeburg”, displays 1,200 photos about Magdeburg in an online gallery on which the Magdeburg City Archive publishes “digitized archive material from selected holdings online”⁴³³.

The City is also about to start a new project to promote digitalisation in schools, notably to introduce schools to open source applications and to discuss new pedagogically relevant software and tools⁴³⁴.

Box 1.1 presents in more detail the project of optimisation of school districts in terms of assignment of pupils to schools as an illustration of the City’s efforts to increase the use of data for taking better decisions that reflect the specific needs of citizens.

Box 5 - Zoom-in: Optimisation of school districts

○ Overview

In Germany, primary school pupils are assigned to their respective primary school by the administration. But as cities and districts evolve, so does the demography of families and with them the demand for places in primary schools. This leads to the problem that schools might be located in the wrong areas without possibility for a short-term fix as building new schools is costly and takes a lot of time. The problem was further amplified as the city of Magdeburg experienced a sudden increase in demand for primary school places and the release of a guideline to try to have about 22 pupils per class.

○ Relevance and uniqueness

Before using the algorithm, the City of Magdeburg had fixed handcrafted school districts that were drawn on a map. Problems arose as the demography in the different neighbourhoods changed, some primary schools had classes with only a few pupils while others had very large classrooms which did not allow for an ideal learning environment.

The **families directly benefit from the algorithm** because the City is able to assign the pupils so that the walking paths are short and classroom sizes are well distributed across the city. This reduces the

⁴²⁹ [City Council TV \(magdeburg.de\)](https://www.magdeburg.de/city-council-tv)

⁴³⁰ [CitizenService \(magdeburg.de\)](https://www.magdeburg.de/citizen-service)

⁴³¹ <https://www.ancestry.de/>

⁴³² [Magdeburg Tracks: Start \(magdeburger-spuren.de\)](https://www.magdeburger-spuren.de/)

⁴³³ <https://www.magdeburger-moderne.de/>

⁴³⁴ <https://ratsinfo.magdeburg.de/getfile.asp?id=635043&type=do>

walking distance to school (or school runs) and the number of pupils per class hence a better atmosphere in the classroom.

Therefore, the City of Magdeburg implemented a **mathematical optimisation algorithm** to help with the distribution of primary school pupils across the city. The algorithm minimizes the total walking distance of pupils to their primary schools and factors in for example classroom sizes as well as natural or structural barriers on their walking paths. The City uses **geo data** of the prospective primary school pupil and primary schools as well as a routing service to find the shortest walking paths.

Moreover, the City uses **open source software** like OpenStreetMap routing server or R statistical language for optimization. So theoretically one can use our source code and port that to a different city or use it for a different service, where such kind of matching between citizens and services on a distance-based metric is needed.

○ **Challenges and drivers**

As the optimization and planning takes place more than a year prior to enrolment, the addresses of pupils might change in-between time of computation and school enrolment. So the computation needs ensure its robustness against those changes, which is addressed by statistical simulation.

○ **Implementation and Monitoring**

The Geo Data of schools and pupils' addresses is the basis for the algorithm. We also account for the capacity of each school. In the next step we are creating a **distance matrix with the help of an open routing platform**.

The chosen matching algorithm is **well-established in the mathematical community** and the **implementation was also reviewed** by a member of the "Faculty of Mathematics" at the "Otto-von-Guericke University" in Magdeburg.

The optimal solution of this algorithm can then be used to assign the pupils or at least to guide decision-makers and can work as a basis for discussion.

The Head of Statistics, Election and Digitalisation is the head of the project but is working together with the Department for Schools. The implementation is also reviewed by members of the Otto-von-Guericke University.

This solution has been further discussed at the city council, and there have been continuous integrations of minor tweaks to improve the optimization algorithm and to use it to assign the new pupils for the fourth year. The optimization is run internally, and results are given to the Department of schools and the city council. Only the final school districts are being published.

○ **Impacts**

In the first year of usage the City compared the total walking distance of the solution with the handcrafted version and found a benefit of about **10% reduction in total walking distance** across all pupils. Additionally, the theoretical optimum registered about 2% increased potential relative to the original solution.

Finally, the City also managed to distribute the children so that almost all classrooms had a size of 22 or less pupils which is considered optimal by both the city council and school board.

6.4 Conclusions and lessons learned

Public service provision in the City of Magdeburg is only at the beginning of its digitalisation path though the new ICT strategy and the centralisation of digital matters in one unit are expected to lead to more coordinated and organised efforts to develop new initiatives empowered by digital innovation. The City's internal capacity is limited in terms of resources with specific digital skills to develop solutions internally hence outsourcing is often the preferable option. Moreover, there is untapped potential in the use of innovative procurement and in the relation with the innovation ecosystem to explore collaborations that can on the one hand meet the needs of the City and lead to business opportunities for research, local companies and startups. There is also the intention to increase the participations in national and European networks of cities as to get inspired by the experiences of other cities that could materialise into concrete use cases for the City to develop and implement. Exploring and applying for national and European funding opportunities for digital innovation is also regarded as a priority for the City.

Below we explore some potential lessons learned from the experience of Magdeburg in transforming its public service provision through digitalisation:

- v) ***The City has increased digital communication and participation efforts over time, but there is room to improve in terms of data-driven services that suit the specific needs of the population.***

While there have been attempts to boost the communication channels with citizens, when it comes to the creation of new services, data becomes underutilised despite the efforts to start opening administrative data. The lack of a data strategy with well-established pillars related to data collection, interoperability, standards and processing undermines the possibility of achieving new data-driven services.

- vi) ***The example of the intelligent mobility project in Magdeburg, involving researchers, companies and users illustrates the potential for interacting with the innovation ecosystem to optimise and modernise specific city domains, in this case of transport networks and future of mobility.***

Considering the internal capacity limitations and the difficulty to attract talent with specific skills, establishing collaborations with universities and the private sector can lead stimulate demand for innovation and lead to innovative services that improve public service provision in the city.

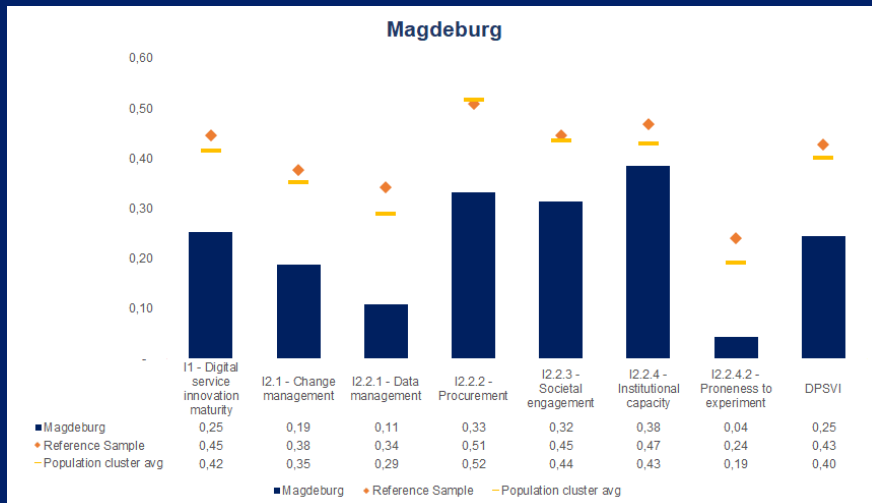
- vii) ***The City could further explore knowledge and practice exchange with other German and European cities that share similar challenges and priorities***

Considering that challenges towards digitally-innovative public service provision are common to many different cities, Magdeburg could better leverage the participation in national and European networks to share experiences, lessons learned, adopt new standards and mechanisms for sharing data, applying novel methods and techniques, among others.

Magdeburg

Performance according to the Digital Public Service Value Index (DPSVI) based on Digisurvey

DPSVI performance significantly below the reference sample and below the same population cluster average



Room for improvement (below average): Proneness to experiment; Data management; Digital service innovation maturity; Change management; Societal engagement; Procurement; Institutional capacity

Figure 10 - Performance of the city of Magdeburg in the DPSVI relative to the reference sample and the population cluster average

7 Case Study: Milan (Italy)

7.1 Overview and approach to digital innovation

Milan is the capital city of the Lombardy region and the second most populated city in Italy, after Rome. The city has a population of 1.3 million⁴³⁵, with 3.2 million at the province-level⁴³⁶. However, in 2006, the population reached its lowest point since 1945, and seemed to “have lost part of its historical drive” with a not so attractive business and investment environment⁴³⁷. However, since the aftermath of the financial crisis, this situation seems to have been reversed with a “new renaissance” based on a dynamic innovation ecosystem and steady economic development that since 2008 added 100,000 new residents to the core city⁴³⁸.

Milan is currently a leader in the information and communication technology sector, contributing decisively to the Lombardy region. It is the largest ICT district in Italy with almost one-fourth of the county’s ICT business⁴³⁹. This key position is related to the heavy presence of semiconductor and telecommunications equipment manufacturing industries.

To some extent, this leadership position in ICT reinforces the significant digital transformation that the City of Milan has been following over the years, being ranked for a period of six years as the smartest city in Italy⁴⁴⁰. The digital transformation plan is anchored in four pillars- *Services, Infrastructure, Digital education and Digital competences*. As a result, the City has been prioritizing investments to update the city’s technological infrastructure and to digitalise its public services. Milan is also a reference in city networks, also actively involved in European programs to foster knowledge exchange and further collaboration with different partners.

Even with a significant internal capacity to deliver digital solutions, the City of Milan leverages from regular interactions with its innovation ecosystem and has made significant progress to put citizens at the centre of the digital transformation process. Nevertheless, there is still room for improvement in the procurement domain, as there is no significant application of innovation procurement practices.

7.2 Proneness to Change

Milan concentrates most of the coordination of the digital transformation projects under the Directorate of Information Systems and Digital Agenda. However, other city departments are frequently involved to cooperate and contribute to the development of new digital solutions.

The City’s approach to digital transformation gives particular importance to the interoperability and scalability of solutions. For this reason, the City has the capacity to keep building on already existing solutions to add new capabilities or update technology components. Additionally, this is also a requirement when the City follows procurement processes which has also allowed for sharing solutions with other

⁴³⁵ [Demographic balance and resident population on 31th December 2019 \(istat.it\)](#)

⁴³⁶ [Demographic balance and resident population on 31th December 2019 \(istat.it\)](#)

⁴³⁷ OECD (2006). Milan Territorial Review. OECD: Paris. [OECD Territorial Reviews: Milan, Italy - OECD](#)

⁴³⁸ [Milan-Study.pdf \(netdna-ssl.com\)](#)

⁴³⁹ [ict-booklet-jan-2021.pdf \(ice.it\)](#)

⁴⁴⁰ [Smart City 2019: Milano la città più smart d'Italia, sequita da Firenze \(forumpa.it\)](#)

municipalities. Data has been increasingly leveraged to inform decision-making and support the service design process.

The City aims to increase the efficiency and accessibility of public services and has been moving from a reactive to a proactive service delivery thanks to digitalisation. Moreover, the projects implemented have placed the needs of the user at the center, prioritising co-creation processes and relying on them to improve the channels of communication with citizens.

7.2.1 Innovation governance

7.2.1.1 Institutional Capacity

Digital strategy

The strategic foundations of the City of Milan in the digital domain were laid down in 2012⁴⁴¹, with further and complementary additions made over the years. **The process kicked off with the signature of a written protocol between Milan City Council and the Milan Chamber of Commerce**, with the objective of designing and sharing a smart strategy for the city including the key guidelines as well to implement this vision. Importantly, from the start it was recognized the need to involve citizens and stakeholders, not only by collecting their perspectives on city matters but also in the implementation phase.

In 2013, the City organized a public hearing to promote the discussion on the digital strategy. This initiative created seven “smart” thematic working groups with different stakeholders, namely *Wellbeing in the city*, *Enterprises creation*, *Administrative simplification*, *Social inclusion and diversity*, *Global city*, *Sustainable urban mobility* and *Environmental and energy policies*⁴⁴². Afterwards, the City organized events to collect in more detail the views from stakeholders on each theme. Additionally, a mapping of the key stakeholders helped to identify all the possible promoters of the implementation phase. **The protocol signed between the Municipality and the Chamber of Commerce resulted in the creation of the Smart City Association⁴⁴³ and, subsequently, the Yes Milano brand⁴⁴⁴.** The Association was created to actively promote collaborations and partnerships with local companies, universities, cultural institutions and other public bodies. In this process, Yes Milano has the responsibility for enhancing the city’s attractiveness for visitors, investors, and talent. **The City Council approved in 2014 the final strategic document⁴⁴⁵**, which included the guidelines for each dimension, without establishing concrete targets.

Later, in 2016, under a new Mayor, the City launched its Digital Transformation Plan⁴⁴⁶, closely aligned with its Smart City Strategy⁴⁴⁷. The plan is organized around four complementary and interconnected pillars- *Services*, *Infrastructure*, *Digital education* and *Digital competences*, defining specific projects for each pillar. Moreover, the plan counts with an “internal dimension” to ensure the integration and coordination of the digital portfolio across all departments, and an “external dimension” to harmonize and simplify services and interaction points with citizens. In addition, the Plan also puts emphasis on creating a “digital

⁴⁴¹ www.ponmetro.it/wp-content/uploads/2019/12/MI_Siragusa.pdf

⁴⁴² [PowerPoint Presentation \(ponmetro.it\)](#)

⁴⁴³ [Milanosmartcity - Berita informasi Pengembangan dan pembangunan kota Milan italia](#)

⁴⁴⁴ [YesMilano.it il sito ufficiale per la promozione di Milano | Homepage \(comune.milano.it\)](#)

⁴⁴⁵ [milano smart city - linee guida.pdf \(comune.milano.it\)](#)

⁴⁴⁶ [Piano di trasformazione digitale - area tematica Luglio \(comune.milano.it\)](#)

⁴⁴⁷ [Milan | SynchroniCity \(synchronicity-iot.eu\)](#)

bridge” through the participation in international partnerships and regular knowledge exchange mechanisms on topics related to digital transformation.

Importantly, in response to the pandemic, the City developed the Milan 2020 Adaptation Strategy⁴⁴⁸, in order to promote anticipatory governance and increase preparedness for the COVID-19 crisis. The City followed a co-creation process, as citizens were invited to contribute to the strategy. In the end, 2,967 proposals from citizens were integrated in the final version of the strategy. The digital dimension was present, particularly as an enabler for public services that meet the needs of citizens.

Governance

The City of Milan has a complex organisational structure⁴⁴⁹ to manage digital priorities, in the sense the implementation of the digital transformation plan follows under two main internal structures- the Smart City Unit and the Directorate of Information Systems and Digital Agenda. The **Smart City Unit** was created at the time of the design of the Milan Smart Strategy and integrates the *Project Management, Economic Innovation and Business Department*, under the Directorate of Urban Economy and Labour⁴⁵⁰. This department counts 16 employees out of the 331 people employed in this Directorate. The Smart City Unit is mainly responsible for the promotion of Smart City projects including the coordination between internal departments, external relations, and the management of buildings that are owned by the Municipality and were dedicated to this purpose⁴⁵¹.

On the other hand, the **Directorate of Information Systems and Digital Agenda**, under the lead of the Chief Operating Officer⁴⁵², coordinates the development and implementation of digital transformation projects. The Directorate counts with 165 employees, from which 33 belong to the **Digital Lead Division⁴⁵³**. The former is responsible for the internal development of digital solutions due to the technical and technological expertise of its staff. The **Digital Lead Project Management Team⁴⁵⁴** is organized across three main units - user experience office, the transversal application design office and the customer relationship management unit- to deliver new public services⁴⁵⁵.

The Directorate of Information Systems and Digital Agenda also incorporates in its structure aspects related to the implementation of digital projects. For example, this directorate integrates the Finance Projects Office, responsible for finding external financing for technological and innovation projects, and the Data Management and Integration Division⁴⁵⁶, responsible for all the questions related to City data. In practice, **there is a strong internal capacity, with regular collaboration** between all these units within the directorate, only relying on external skills when there are specific needs not available internally.

In order to assess the state of its internal governance, the City of Milan has implemented periodic quality control mechanisms across its departments, including a periodic monitoring of the processes and the

⁴⁴⁸ [Microsoft Word - ENGMilano 2020 Strategia di adattamento_English_2.docx \(comune.milano.it\)](#)

⁴⁴⁹ [Organigramma - Comune di Milano](#)

⁴⁵⁰ [Direzione Economia Urbana e Lavoro | Portale Economia Urbana Lavoro e Formazione - Comune di Milano](#)

⁴⁵¹ [65dde8a4-aaf0-ee2a-d3e7-e2df53efc220 \(comune.milano.it\)](#)

⁴⁵² [Organigramma - Comune di Milano](#)

⁴⁵³ [Direzione di Progetto Digital Lead - Comune di Milano](#)

⁴⁵⁴ [Direzione di Progetto Digital Lead - Comune di Milano](#)

⁴⁵⁵ [Direzione di Progetto Digital Lead - Comune di Milano](#)

⁴⁵⁶ [Area Gestione ed Integrazione dati - Comune di Milano](#)

evolution of relevant indicators. The quality management system of the City is in compliance with the international certification ISO 9001:2015⁴⁵⁷.

7.2.1.2 Data Management

The City of Milan has placed data as an important driver of the City digital transformation process.

As a result, the City has made significant progress in terms of data governance and data management practices. Nowadays, there is a central open data platform, from which other projects were derived and that support a data-driven decision making, promote the creation of new services, and boost the transparency of operations.

A cornerstone of the data management of the Municipality is the Open data platform⁴⁵⁸. This platform encompasses more than 1,400 datasets provided by the different City departments in a logic of open government and better governance. The datasets are organized around 13 topics, covering several city domains, such as *Environment, Energy, Transport and Education*, all in the CKAN format to allow further reuse of these data. CKAN is a tool for making open data websites with a powerful machine interface that helps to manage and publish collections of data⁴⁵⁹. The portal also wants to **foster the sharing of data practices** between institutions. **The maintenance, dissemination and management of the open data portal is under the responsibility of the Open data Unit⁴⁶⁰** that belongs to the previously mentioned Data Management and Integration Division.

More specifically, the Data Management and Integration Division is also composed of the Analytics and Data Science Unit, the Statistical Service Unit and the Territorial Information System Unit. The latter has under its responsibility the **Geoportal of Milan⁴⁶¹**, dedicated to managing the geographical information of the City. **The portal is also a collaborative tool**, where both internal and external participants can send their contributions. At the internal level, the Budget and Revenue Department⁴⁶² and the Urban Planning Department⁴⁶³ have both joined the project by providing their own information to the Geoportal. At the external level, the Municipality signed an agreement with the Archive Service of the Polytechnic University of Milan to promote the re-use of the data for research purposes⁴⁶⁴.

The City data management and interoperability practices have already allowed the City to leverage on the data available to support different projects and address specific problems in Milan. An example of that is the digital mapping tool for the underground infrastructure of the city. This project aimed to provide detailed information on the different city infrastructures, such as the cables and pipes that are responsible for providing essential public services to the citizens (e.g.: electricity, telecommunications, drinking water).

The relevance of having access to reliable information on this domain is particularly high when there are new construction projects or excavations that require to know with precision the underground infrastructure

⁴⁵⁷ [UNI EN ISO 9001 : 2015 \(icc-iso.org\)](https://www.iso.org/standard/72430.html)

⁴⁵⁸ [Portale Open Data | Comune di Milano](https://www.comune.milano.it/it/area-gestione-ed-integrazione-dati)

⁴⁵⁹ [User guide — CKAN 2.9.5 documentation](https://docs.ckan.org/en/2.9.5/)

⁴⁶⁰ [Area Gestione ed Integrazione dati - Comune di Milano](https://www.comune.milano.it/it/area-gestione-ed-integrazione-dati)

⁴⁶¹ [Geoportale SIT | Comune di Milano](https://www.comune.milano.it/it/geoportale-sit)

⁴⁶² [Adesione | Geoportale SIT \(comune.milano.it\)](https://www.comune.milano.it/it/adesione-1)

⁴⁶³ [Adesione 2 | Geoportale SIT \(comune.milano.it\)](https://www.comune.milano.it/it/adesione-2)

⁴⁶⁴ [\[SBA - TeDOC servizio tesi e documentazione\] \(polimi.it\)](https://www.polimi.it/it/area-gestione-ed-integrazione-dati)

in a specific location. In the past, this information was spread on several entities, which created difficulties to access and compile this information, slowed down the process and increased costs.

The platform is currently in a beta release and was coordinated internally by the Territorial Information System Unit with the collaboration of the Underground Services Unit⁴⁶⁵ within the Mobility Department. The Data Analytics Unit⁴⁶⁶ of the Information Systems and Digital Agenda Department had the responsibility of developing the platform. The project also counted with the collaboration of Bloomberg Associates in the process of conceiving the platform and with the support of a specialized company on geospatial digital solutions⁴⁶⁶. The design process included moments of interaction with several teams, and workshops to exchange feedback with users to improve the platform. In its current version, the platform has 17 layers of information on the underground infrastructure of the city. To ensure the training of the stakeholders more interested in this solution, such as contractors, the City launched a capacity-building campaign to train over 500 people.

Nowadays, the platform is a tool extensively used, with demonstrated added value to the planning activities of the City. Even at the pilot stage, the tool revealed its potential with a decrease for users in the approval time of construction plans (estimations point out to 214 minutes per procedure now being saved) and for the City (with a previous situation of more than 40 individual approvals being streamlined into one end-to-end digital process thus saving 45 minutes per digitalised procedure)⁴⁶⁷.

As a result of the COVID-19 pandemic, the City of Milan used the services of the Big Data Test Infrastructure (BDTI) provided by the European Commission⁴⁶⁸ to conduct a six-month pilot project to apply predictive analytics for the movements of citizens.

This project was part of the Milan 2020 Adaptation Strategy and the main goal was to support the City's decision-making capabilities during the pandemic. The BDTI encompasses a set of data services funded by the Connecting Europe Facility (CEF)⁴⁶⁹ to help “public administrations to explore and experiment with various data sources, software and methodologies”. The project was implemented by the Analytics and Data Science Unit under the Data Management and Integration Division. The City also collaborated with two national Telecom players, Vodafone and TIM, as providers of complementary data on telecommunications. This collaboration provided the Municipality with the capacity to characterize citizens movements in particular locations and periods. The BDTI platform allowed the City to build an environment where all these data elements available could be integrated to monitor the flows of people. This project also brings opportunities for knowledge exchange with other BDTI partners, notably on how they are using the resources available, new ways to use the data, and new methodologies to improve data analysis.

7.2.1.3 Societal Engagement

In respect to societal engagement, the City of Milan has been promoting the “empowerment of citizens to be agents of change”⁴⁷⁰ in the city. In order to so, it has been following a user-centric approach when designing new digital services and with a strategic focus on the digital literacy and in skills development

⁴⁶⁵ [Area Gestione ed Integrazione dati - Comune di Milano](#)

⁴⁶⁶ [MilanDigitalWeek_Factsheets_02_032921_v3.pdf \(comune.milano.it\)](#)

⁴⁶⁷ [Making digging safe - Eurocities](#)

⁴⁶⁸ [big data test infrastructure \(europa.eu\)](#)

⁴⁶⁹ [Milan uses the European Commission's Big Data tool to predict citizen flow as lockdown lifts \(europa.eu\)](#)

⁴⁷⁰ [MilanDigitalWeek_Factsheets_Mission_032921_v4.pdf \(yesmilano.it\)](#)

of Milan citizens. Additionally, the City has also been relying upon technology to promote a two-way dialog with its citizens.

To this end, the City developed a tool where anyone can consult the city budget⁴⁷¹ and verify how it's being applied and managed. The budget tool offers some attractive and interactive features to display the information, namely through dynamic infographics with filter options and economic forecasting data. Additionally, it includes a glossary section where it explains some of the concepts related with the budgetary topic. Open Bilancio⁴⁷² is one of the projects derived from the open data platform previously described.

Regarding participatory budgeting, Milan participated as pilot city in the Horizon 2020 EMPATIA Project⁴⁷³, with the ambition to “enhance the inclusiveness and impact of participatory budget processes” by relying on adequate tools and an ICT platform. The EMPATIA project has a network of multidisciplinary researchers and private partners with expertise in traditional and ICT-based participatory processes. This network included the University of Milan as a partner.

In 2015, the City of Milan adopted for the first time a city-wide Participatory Budget⁴⁷⁴. The EMPATIA project contributed to this initiative in 2017, by providing a monitoring cycle platform⁴⁷⁵ to track the implementation of the winning projects⁴⁷⁶ from the first edition of this initiative.

In the same year, the City launched a second edition to invite citizens for their proposals. From the 242 proposals presented, those with the biggest support went for a second phase of collaborative work with the City employees to further develop their ideas. Following the voting phase by citizens, the winning initiatives moved to the implement phase. A monitoring platform described the present state of each project and their future developments along the way. This edition counted with a budget of € 4.5 million euros, equally divided by nine City areas.

Citizen participation is also possible through the digital platform *Milano Partecipa*⁴⁷⁷. The platform includes participatory moments on certain proposals, referendums, petitions, citizen consultations and public hearings. The City defined regulations that set the rules and conditions of each participatory act⁴⁷⁸. The platform is based on open source Decidim software⁴⁷⁹, also adopted by other European cities for the management of democratic process activities that involve citizens⁴⁸⁰.

The City has also been relying on projects to promote the digital skills of the population of Milan. The **STEMintheCity initiative⁴⁸¹** started in 2017 as a one-month program with events, courses and initiatives, specifically dedicated to “spread the culture of STEM⁴⁸² and to remove cultural stereotypes” that contribute to gender inequalities in technical-scientific subjects. The annual event is organized in collaboration

⁴⁷¹ [Open Bilancio \(comune.milano.it\)](https://comune.milano.it)

⁴⁷² [Open Bilancio \(comune.milano.it\)](https://comune.milano.it)

⁴⁷³ [Empatia Project – Enabling Multichannel Participation \(empatia-project.eu\)](https://empatia-project.eu)

⁴⁷⁴ [Empatia Project – Enabling Multichannel Participation \(comune.milano.it\)](https://comune.milano.it)

⁴⁷⁵ [Milan – Empatia Project \(empatia-project.eu\)](https://empatia-project.eu)

⁴⁷⁶ [Home | Bilancio partecipativo di Milano 2017-2018 \(comune.milano.it\)](https://comune.milano.it)

⁴⁷⁷ [Comune di Milano | Milano Partecipa](https://comune.milano.it)

⁴⁷⁸ [Il Regolamento per la Partecipazione - Comune di Milano | Milano Partecipa](https://comune.milano.it)

⁴⁷⁹ [Decidim](https://decidim.org)

⁴⁸⁰ [Decidim in use | Decidim](https://decidim.org)

⁴⁸¹ [STEMintheCity - Naturalmente STEM](https://steminthecity.com)

⁴⁸² Science, Technology, Engineering and Math

and with the financial support of national and international stakeholders and organisations⁴⁸³, such as the United Nations and local universities, and is coordinated internally by the Digital Transformation and Citizens Services Office⁴⁸⁴.

The project has grown over time with a participation of around 3,000 people in 2017, up to more than 14.000 in the last in-person edition in 2019⁴⁸⁵. In 2020, the event was readapted to an online format, because of the pandemic, and counted with more 312,000 views and 11,000 unique participants⁴⁸⁶.

Additionally, the Digital Week⁴⁸⁷ is another cornerstone of societal engagement and skills for the digital age. The week consists of a series of events to promote digital inclusion, digital culture and sustainability. In 2019, the project involved more than 300 public and private organisations in more than 500 events and with 85,000 participants⁴⁸⁸. This type of event is relevant to engage citizens, stimulate the innovation network and create awareness around the digital transformation of the City.

The City has also been introducing user-centric practices in the development of new digital services. In fact, the City recently joined the ongoing Horizon 2020 UserCentriCities project⁴⁸⁹ to develop a platform for local administrations to support cities in assessing and benchmarking their performance vis-a-vis their peers, and to launch a European community of decision-makers to exchange knowledge and lessons learned on how to implement user-centric approaches⁴⁹⁰. The project consortium includes the Lisbon Council think-tank, Eurocities network association, VTT Technical Research Centre of Finland and five other European municipalities.

7.2.1.4 Procurement

Traditional and innovative procurement

The City representatives recognize the limitations and frequent misfit of traditional procurement processes when compared with the funded needs. However, the City does not significantly rely on pre-commercial procurement (PCP) or public procurement of innovative solutions (PPI) to overcome these limitations. Alternatively, there are some, though not frequent, joint procurement procedures mostly due to the need of specific skills and expertise. In their tenders for procuring innovative digital services or goods, the City demands, when applicable, a data sharing agreement and specific technical aspects with reference to open standards or open APIs. The City's Finance Projects Office is the entity fully dedicated to looking into external financing sources to support digital and technological projects.

According to the European Commission report⁴⁹¹ on the benchmark of innovation procurement practices in the EU member states, **Italy is a moderate performer** in the overall ranking, **slightly above the EU average**. The Lombardy region that has Milan as its capital was recognized as reference region in the country on this domain. In fact, the region implemented PCPs in their operational programmes co-financed by the

⁴⁸³ [Partner della Maratona \(steminthecity.eu\)](https://www.steminthecity.eu/)

⁴⁸⁴ [MilanDigitalWeek_Factsheets_04.pdf \(citiesfordigitalrights.org\)](#)

⁴⁸⁵ [MilanDigitalWeek_Factsheets_04.pdf \(citiesfordigitalrights.org\)](#)

⁴⁸⁶ [Piano di trasformazione digitale - area tematica Luglio \(comune.milano.it\)](#)

⁴⁸⁷ [Milano Digital Week • 17-21 Marzo 2021](#)

⁴⁸⁸ [Piano di trasformazione digitale - area tematica Luglio \(comune.milano.it\)](#)

⁴⁸⁹ [Towards common digital government indicators and support for European cities | UserCentriCities Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](#)

⁴⁹⁰ [Welcome to UserCentriCities | UserCentriCities](#)

⁴⁹¹ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=70306

European Structural and Investment Funds and set that at least and 3% of the resources annually spent for the purchase of goods and services from the region's public bodies should be allocated on innovation public procurement. Nevertheless, the country registered a **poor performance on the adoption of innovative solutions based on ICTs**, acknowledging that **"a large increase of investments in buying innovative ICT-based solutions is needed" to speed up the modernization of the public sector**. In this sense, at the national level, the Italian government has also been promoting initiatives to drive innovative procurement practices. In fact, through its participation in the European Procure2Innovate project⁴⁹², the government announced the creation of a national Competence Center on Innovation Procurement.

Indeed, the Horizon 2020 Procure2Innovate project aimed to set up a network of centers of competence on innovative procurement to improve the practices of public institutions in the European Union, specifically through PCP and PPI⁴⁹³. The Italian Centre of competence will be integrated in the joint-stock company Consip⁴⁹⁴. The twenty year company is owned and managed by the Italian Ministry of Economy and Finance, with the mission "to make the use of public resources more efficient and transparent, providing administrations with tools and skills to manage their purchases"⁴⁹⁵. Consip areas of action include the procurement of specific tender-projects that support the implementation of the Italian Digital Agenda⁴⁹⁶. The national Digital Agenda sets the three-year plan to promote the digital transformation of the public sector in Italy.

Financing digital solutions

The City of Milan has a dedicated budget for digital innovation. According to City representatives, this is a crucial element to finance the development of digital solutions. In fact, the open budget tool reveals that the Directorate of Information Systems and Digital Agenda, one of the main entities responsible for the development of digital solutions in the City, registers current expenses around 30 million euros in 2019 and 2021, with similar values forecasted for 2022. However, it is also acknowledged the **relevance of European programmes**, such as Horizon 2020 (e.g.: Sharing Cities⁴⁹⁷ and Synchronicity⁴⁹⁸) to support the digital transformation of the city.

7.2.2 Change Management

As part of the strategic digital transformation plan, Milan considered the importance of building "digital bridges with the most valuable digital cities and worldwide excellent stakeholders in order to share best practices on a peer-to-peer learning process"⁴⁹⁹. Thus, the City has been an active agent in international city networks and participated in several European programs⁵⁰⁰.

For instance, **the city belongs to the first group of 31 signatory cities to join the Open & Agile Smart Cities (OASC) network in 2015**⁵⁰¹. OASC, as an international city network, works towards supporting local public administrations in their digital transformation journeys. The organisation is particularly relevant in

⁴⁹² [P2I | European network of competence centres for innovation procurement \(procure2innovate.eu\)](#)

⁴⁹³ [P2I | The Project \(procure2innovate.eu\)](#)

⁴⁹⁴ [Home | Consip](#)

⁴⁹⁵ [Chi siamo | Consip](#)

⁴⁹⁶ [Home page | Agenzia per l'Italia digitale \(agid.gov.it\)](#)

⁴⁹⁷ [SHARING CITIES](#)

⁴⁹⁸ [Milan | SynchroniCity \(synchronicity-iot.eu\)](#)

⁴⁹⁹ [Driving the Digital Transformation of Contemporary Cities \(itif.org\)](#)

⁵⁰⁰ [Reti e Partnership - Comune di Milano](#)

⁵⁰¹ [Open & Agile Smart Cities - Open & Agile Smart Cities \(oascities.org\)](#)

creating a common ground through minimal interoperability mechanisms (MIMs) that act as enablers of knowledge and digital solutions exchanges among its members⁵⁰². On April 2017, the City of Milan hosted the first OASC meeting of Italian cities⁵⁰³ and was elected as the Italian representative to the OASC Task Force⁵⁰⁴. The event counted with the participation of the Italian city members of the OASC initiative⁵⁰⁵.

Milan is also a co-founder of Eurocities⁵⁰⁶ - a large network of European cities “dedicated to support learning, exchange and cooperation among its members, to create better cities”⁵⁰⁷. It focuses on five key areas, namely *Cities as drivers of quality jobs and sustainable growth; Inclusive, diverse and creative cities; Green, free-flowing and healthy cities; Smarter cities; Urban innovation and governance in cities*. Therefore, Eurocities relies on thematic Working Groups and is also directly involved in European projects, such as the Sharing Cities program⁵⁰⁸.

The Sharing Cities Program brings together several city stakeholders - industry, academia, public administration, and non-governmental organisations- to, together, foster local collaborations and citizen engagement across the different smart cities domains⁵⁰⁹. The program involves six cities and thirty-four partners from across Europe. The project counts with Horizon 2020 funding of twenty-four million euros but aims to trigger five hundred million euros of additional private capital and reach over a hundred cities to scale-up solutions⁵¹⁰. In this project, Milan, together with London and Lisbon, belongs to the group of lighthouse cities that “have implemented replicable urban digital solutions and collaborative models”⁵¹¹. In this framework, Milan developed three citizen-centred projects on the areas of *Sustainable mobility, Sustainable living, Public lighting, Environmental quality and Collection and use of data through an interoperable platform*. The projects were implemented in the city specific district of Porta Romana and Chiaravalle, to create a model of a smart district.

In order to help achieve the CO2 reduction objectives and promote a more sustainable mobility, the City extended the bike sharing service area with fourteen new bike sharing stations and 150 new e-bikes with child seats to accommodate the needs of users with children. The City also intervened in more than 300 apartments and 6 buildings, to improve the thermal insulation, energy efficiency and the comfort. As a result, there was a 60% energy consumption reduction and 470,000 kg /CO2 year saved⁵¹². Additionally, the City implemented more than 1,000 smart lamp posts equipped with monitoring devices that collect air quality, traffic and noise levels data. The lamp posts are connected to a long-range wide network that enables better monitoring of the performance and the creation of new services. These projects resulted from the collaboration of several city and international partners⁵¹³.

⁵⁰² [WORK - Open & Agile Smart Cities \(oascities.org\)](http://oascities.org)

⁵⁰³ [277-LocandinaProgrammaOASC_4aprile.pdf \(strategieamministrative.it\)](#)

⁵⁰⁴ [Open and Agile Smart Cities – TDM \(tdm-project.it\)](#)

⁵⁰⁵ Milan, Lecce, Palermo, Messina, Ancona, Genova, Brescia, Pescara, Benevento, L'Aquila, Novara, Pisa, Varese, Cagliari, Terni

⁵⁰⁶ [Milan - Eurocities](#)

⁵⁰⁷ [A better quality of life for all – Eurocities' strategic framework 2020-2030 - Eurocities](#)

⁵⁰⁸ [SHARING CITIES](#)

⁵⁰⁹ [SHARING CITIES](#)

⁵¹⁰ [Sharing Cities | Sharing Cities Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](#)

⁵¹¹ [SHARING CITIES /](#)

⁵¹² [SHARING CITIES](#)

⁵¹³ [Sharing Cities - Fondazione Politecnico](#)

Within the 100 Intelligent Cities Challenge (ICC)⁵¹⁴, the city of Milan was considered as a reference city in the digital transformation area. Reference cities are considered as mentors because of their proven track record in at least one of the ICC's Thematic areas. Therefore, Milan will share with other cities the work developed and best practices and collaborate further with other municipalities.

Milan also promotes regularly promotes collaboration with external stakeholders to better find digital solutions that address city problems and citizen's needs. For instance, the City announced a collaboration with two reference companies in the field of satellite navigation, Waze and Tomtom, to address traffic congestion difficulties⁵¹⁵. In the project Mobility 3.0, the municipality will share real-time data of construction sites and road deviations, closures and restrictions, which will be used by the private partners, to suggest alternative road routes that improve traffic management. The project will be in an experimental phase until 2022.

The City also benefits from an active innovation ecosystem in the digital field. For instance, in 2021 a group of private and innovative firms led by the City's business association, Assolombarda⁵¹⁶, founded the **Milan Smart City Alliance**⁵¹⁷. The goal is to contribute to the creation of a smart city that addresses the current and future urban challenges, through a collaborative model of public private partnerships. The project Resilient Milan⁵¹⁸ is the first example of collaboration with the Municipality of Milan, to identify and assess the risks that the organisations operating in the metropolitan area of Milan are exposed to, and their level of preparedness. The collaboration resulted in a final report⁵¹⁹ focusing on three main risk categories- *cyber risk, female employment and hydraulic risk*.

In addition, the opening of the first Smart City Lab of Italy⁵²⁰ is scheduled for 2022 and will be based in Milan. The Lab will be an incubator fully dedicated to smart cities projects. The construction of the infrastructure was under the responsibility of the national development agency, Invitalia⁵²¹, which received funding of five million euros from a loan of the national government. In this process, the Municipality of Milan contributed with a concession of the land and half million euros to the acquisition of IT equipment. It is expected that the Lab will contribute to the attraction of new investments in smart city projects and to the acceleration of the digital transformation in the region.

7.3 Digital Service Innovation Maturity

The City of Milan has been following a **consistent path of digital transformation** and advanced its digital agenda by **promoting investments in critical, advanced and competitive digital infrastructure**. The free Wi-Fi network is one of those components on the City ICT infrastructure⁵²². The network is composed of an indoor and outdoor component that have been constantly evolving and enhanced with a growing

⁵¹⁴ [Sharing Cities - Fondazione Politecnico](#)

⁵¹⁵ [Mobilità 3.0. Waze e TomTom per Milano, con l'obiettivo di migliorare l'uso della rete stradale cittadina - Mobilità 3.0. Waze e TomTom per Milano, con l'obiettivo di migliorare l'uso della rete stradale cittadina - Comune di Milano](#)

⁵¹⁶ [Assolombarda è l'associazione delle imprese che operano nella Città Metropolitana di Milano e nelle province di Lodi, Monza e Brianza, Pavia.](#)

⁵¹⁷ [Milano Smart City Alliance](#)

⁵¹⁸ [Milano Smart City Alliance - Milano Resiliente](#)

⁵¹⁹ [milano-resiliente-risk-assessment-e-disaster-recovery-per-la-mitigazione-dei-rischi-delle-imprese-delle-persone-e-della-citta-def.pdf \(milanosmartcity.it\)](#)

⁵²⁰ [Smart City Lab: avviso per la gestione | Portale Economia Urbana Lavoro e Formazione - Comune di Milano](#)

⁵²¹ [Invitalia - Agenzia nazionale per l'attrazione degli investimenti e lo sviluppo d'impresa](#)

⁵²² [WiFi gratuito del Comune di Milano - Comune di Milano](#)

number of hotspots in the city⁵²³. In 2018, it went one step further by initiating a 5G transmission technology trial to cover the whole city with high-speed internet connectivity. At the time, this was the largest European initiative to develop this technology⁵²⁴. The project counted with an investment of 90 million euros⁵²⁵ and was supported by the Municipality, the regional and metropolitan authorities, in collaboration with more than 30 partners led by the telecommunications company, Vodafone and Politecnico di Milano. This kind of project acts as an enabler of new and more advanced digital solutions, opens new perspectives for the delivery of public services and benefits technologies such as IoT that build on city infrastructure.

As a result, in May 2021, the Milan City council and its public transport company, ATM, joined Politecnico di Milano, Vodafone and IBM and announced the Tech Bus project under the Joint Research Lab⁵²⁶. The Joint Research Lab for urban mobility is an ecosystem composed by universities, industry and public institutions mostly dedicated to innovating on the smart mobility domain through self-driving vehicles⁵²⁷. The project Tech Bus consists of the development of the first self-driving trolley bus fleet in the city. In order to do so, it connects to the 5G network and the Vodafone cloud. Additionally, each vehicle will be equipped with intelligent sensors that allow along the route the communication with other road elements (traffic lights, streetlamps, shelters) also equipped with 5G technology. The first phase started as an assisted guide version to support safe driving with increased visibility and anticipation capacity, but the ambition is to have in two years the project extended to 90 trolleybuses and to achieve self-driving vehicles⁵²⁸.

Also, under the Synchronicity project⁵²⁹, the City of Milan prioritized the improvement of urban mobility through IoT based solutions. Milan partnered with seven other cities to test innovative digital solutions based on the Internet of Things and Artificial Intelligence. The solutions had to comply with minimal data standards and interoperability mechanisms to allow the sharing and re-use by other cities at a lower cost. Among the four pilot projects performed in the Municipality, there is Kissmybike⁵³⁰ to improve the micromobility solutions available in the city. The project used an IoT tracking device designed for shared bicycles, that would collect relevant data to optimize the fleet management operations and better address the cyclists' needs, which ultimately will encourage more people to use these micromobility alternatives⁵³¹. Overall, this and other similar projects have placed the City of Milan as the most sustainable city in Italy in terms of transportation and urban mobility⁵³².

On the other hand, one of the main priorities of the City has been to guarantee a more efficient and agile public service provision, with the **Fascicolo Digitale Del Cittadino being a crucial element of this objective.**

⁵²³ [ArcGIS Web Application \(comune.milano.it\)](https://www.comune.milano.it)

⁵²⁴ [Sperimentazione 5G a Milano: un passo avanti per l'IoT - Telemar Internet of Things \(tiot.it\)](https://www.tiot.it)

⁵²⁵ [Piano di trasformazione digitale - area tematica Luglio \(comune.milano.it\)](https://www.comune.milano.it)

⁵²⁶ [Trasporto pubblico. Politecnico di Milano, ATM e Comune di Milano annunciano "Tech bus", verso una mobilità urbana assistita e connessa - Trasporto pubblico. Politecnico di Milano, ATM e Comune di Milano annunciano "Tech bus", verso una mobilità urbana assistita e connessa - Comune di Milano](https://www.comune.milano.it)

⁵²⁷ [JRL: Joint Research Lab for Urban Mobility - Fondazione Politecnico](https://www.fondazione.politecnico.it)

⁵²⁸ <https://www.italy24news.com/local/50015.html>

⁵²⁹ [Milan | SynchroniCity \(synchronicity-iot.eu\)](https://www.synchronicity-iot.eu)

⁵³⁰ [Homepage | Kissmybike](https://www.kissmybike.com)

⁵³¹ [Kissmybike | SynchroniCity \(synchronicity-iot.eu\)](https://www.kissmybike.com)

⁵³² [Log in to Eltis | Eltis](https://www.eltis.com)

Box 6 - Zoom-in: Fascicolo Digitale del Cittadino

○ Overview

The Digital Citizen Folder or, in Italian, “*Fascicolo Digitale del Cittadino*”, is a **constantly evolving project, under the slogan “Milan for all”**⁵³³ that, in 2021, culminated with the launch of an app. This process began in 2017, with the creation of a website, also compatible with mobile, where each citizen could access in a single place all his/her personal data. The profile of citizens was managed internally by the Citizen Relationship Management System and the access to the personal folder was done through the national electronic identity system (SPID) or the strong authentication system.

Over time, the website evolved from a more static version of the citizen folder to become more service-oriented and less narrative-focused. The second version of the website, presented in 2019, integrated several city services and changed from a proprietary software to open source, in order to incentivize the re-use by other public administrations. Moreover, this reviewed version allowed for scheduling appointments and included the concept of families, where citizens could also access the “files” of their family members.

With the creation of the app, “the city is in the pocket of Milan citizens”⁵³⁴, whereby new services were added, and additional features were incorporated. For instance, a new map section was added for citizens to access the location and additional information concerning different public services, from municipal offices, sport facilities to public Wi-Fi access points. Additionally, the new app version also added to the section of payments the possibility to monitor payments records or check the ones that are due.

○ Relevance and uniqueness

The project is a crucial element of the two-way dialog objective that the City has with its citizens. In fact, this project offers some distinctive features stemming from its **capacity to be a centralized and personalized service provider**, with currently 40% of the public services having the option to be executed through *Fascicolo del Cittadino*. It also improves the user experience when using public services, **moving from a reactive to a proactive approach**, through real-time updates and notifications of their duties and obligations (e.g.: pay taxes or renew ID cards). The citizen engagement is also a relevant aspect of this project, namely through workshop with citizens during the Milan Digital Week 2019 edition, to understand their needs and through the **collaboration with around 100 citizens to test a beta version of the application**, to collect and integrate their feedback into the final versions. The digitalisation of public services was particularly relevant to adjust to the changing conditions more smoothly during the pandemic.

○ Challenges & Drivers

The project was put forward by the City to renew and improve its channels of interaction with citizens. In fact, the project was mostly funded by the internal budget, counting with only some contributions of vertical projects, funded by European projects, that support the final version.

⁵³³ [Milano, nasce il fascicolo digitale del cittadino: molte, pratiche e certificati del Comune sono online - la Repubblica](#)

⁵³⁴ [Trasformazione digitale. Nuovi servizi sull'app del Fascicolo del cittadino - Trasformazione digitale. Nuovi servizi sull'app del Fascicolo del cittadino - Comune di Milano](#)

The internal capacity to design and develop the service was another key driver behind the *Fascicolo*. The project was internally developed by the Digital Lead Division from the Directorate of Information Systems and Digital Agenda. However, it also involved other city departments, notably from the Communication and the Analytics Division. The latter was particularly relevant to assess the internal information on the most requested services by citizens. Throughout the design and development phases, **the internal divisions relied on the data provided by the website and the feedback from users.** According to the City, another **challenge to be overcome is the lack of a centralized editorial management team.** In practice, as they are involved in multiple service areas, with each of them having the responsibility for the publication of content related to the services that they provide, there are some issues of harmonization.

○ **Implementation and Monitoring**

In the development of the mobile application, the internal departments of the Municipality followed a design process that started by **identifying the “user experience needs and applying global best practices to create responsive online services”**⁵³⁵. The City **organized internal design thinking sessions** with the main purpose of identifying the services in higher demand. Additionally, in the Milan Digital Week of 2019, a **workshop was organized with the direct involvement of citizens, to better understand their needs and collect their feedback** on what to include and what kind of application they were looking for. Afterwards, the municipality searched for similar applications or digital solutions developed by the other Municipalities to compare processes and identify best practices. Then, it relied again on the citizens’ feedback, collecting quantitative and qualitative information, by **testing a first pilot version of the application with 100 citizens, to improve the user experience in the final version.** Both the website and the mobile application give the chance for users to provide their suggestions and proposals through the “Write” section.

The COVID-19 delayed the launch of the application for some months, but this gave the chance to add the COVID-19 certificate component. The **degree of replicability of this solution is high**, with Genova already developing a similar solution⁵³⁶, where they took advantage of the interoperability component of the platform⁵³⁷.

○ **Impacts**

The first official communication campaign was done through email by relying on the list of *Fascicolo Del Cittadino* web users. As a result, in August 2021, there were already over 120.000 downloads of the application⁵³⁸. The City has put forward some indicators⁵³⁹, that show the increasing interest of the users and the web page visualizations of *Fascicolo Del Cittadino*. As a result, this has also generated a positive impact on the online service payment transactions and in the issuance of online certificates. For instance, the electronic identity cards, represented, in the last trimester of 2020, 98.6% of the total of new identity cards emitted. Also, from 2018 up to 2020, the percentage of electronic identity cards in circulation went from 12,2% up to 42,2%. The trend of replacement of physical channels by digital alternatives on the

⁵³⁵ [3bcb883-d449-c3d0-ef2a-4793fb951107 \(comune.milano.it\)](https://www.comune.milano.it/3bcb883-d449-c3d0-ef2a-4793fb951107)

⁵³⁶ [Fascicolo del Cittadino | Comune di Genova | Sito Istituzionale](#)

⁵³⁷ [Il Fascicolo digitale del Cittadino Comune di Genova \(interregeurope.eu\)](#)

⁵³⁸ [Trasformazione digitale. Nuovi servizi sull'app del Fascicolo del cittadino - Trasformazione digitale. Nuovi servizi sull'app del Fascicolo del cittadino - Comune di Milano](#)

⁵³⁹ [Rendiconto di Mandato - Trasformazione Digitale \(comune.milano.it\)](#)

access of public services is also present in several other domains, such as Education, with online subscriptions representing 89,6% of the total for the 2020/2021 school year, when compared to 73,9% in 2015.

According to the City's **Digital Sustainability Model**⁵⁴⁰, developed by the city to calculate the outcomes of digitalisation in terms of time, money, and emissions saved, the access of certificates through digital channels, can save up to one hour in travel time for citizens and 4,40 euros per certificate⁵⁴¹. This model was tested in Milan's Registry Office and concluded that in 2019 "the administration saved approximately eight minutes per digital certificate, totalling 45,500 hours, and €1.2 million and 450,000 sheets of paper, as well as 49 tons of CO₂ (equivalent to planting 3,266 trees)"⁵⁴².

These encouraging numbers mirror the impact that digitalisation can generate, with citizens ready to accommodate the city digital transformation process.

7.4 Conclusions and lessons learned

The City of Milan has made significant progress to enable more digital mature public service provision. This positive evolution comes from its city internal organisation, with a **clear orientation towards the different phases of development of digital solutions** and the promotion of an **open and data-driven government**, where the involvement of citizens and their needs are taken into account. The **investments in digital infrastructure and the prioritization of interoperable solutions** are also relevant components that should be considered.

Below we explore in more detail some potential **lessons learned from the experience of Milan** in transforming its public service provision through digitalisation:

- i) ***Milan's internal organisation under a common directorate, that is structured around complementary elements for the implementation of digital projects, promotes a more efficient collaboration between different units.***

Despite being a complex structure to navigate, the City has a solid internal capacity to develop digital solutions in-house with specialized units on specific elements of the digital transformation. Moreover, the structure promotes the efficiency of cross-department collaboration, and, under the same department, it organizes horizontally the main components for the development of a digital solution, namely the data management, the interoperability and the digital project management tasks.

- ii) ***The City invests in modern ICT infrastructure to create new opportunities and services, and the innovation ecosystem plays a key role in accelerating its development.***

The digital maturity of the City is benefiting from the investments of the City in ICT infrastructure that is capable of accommodating technologically advanced projects. The development of this infrastructure, such as the 5G network, was based on the collaboration of the City with specialized stakeholders and from there new collaborations have emerged.

⁵⁴⁰ [Rendiconto di Mandato - Trasformazione Digitale \(comune.milano.it\)](https://www.comune.milano.it/it/trasformazione-digitale)

⁵⁴¹ [Milan, Italy Offers Open Source Digital Sustainability Model For Global Cities – Smart Cities Connect](https://www.smartcitiesconnect.it/milan-italy-offers-open-source-digital-sustainability-model-for-global-cities)

⁵⁴² [MilanDigitalWeek Factsheets_05_model FINAL 04-08-21\(1\)\(1\).pdf \(yesmilano.it\)](https://www.yesmilano.it/it/milan-digital-week-factsheets-05-model-final-04-08-21(1)(1).pdf)

iii) The City has focused on improving digital public service provision by applying user-centric approaches and fostering a two-way dialog of the City with its citizens.

Over the years, the City has turned the Fascicolo del Cittadino into the central point of contact and the main provider of digital public services. The platform evolved from a reactive to a proactive approach where the system provided alerts on deadlines and duties of each user. In its development process, the digital tool was developed following a bottom-up approach- citizens were involved in the design and test phase. The user-centred service was created under an open source and a clear interoperability framework to promote the integration of additional services and allow its replication by other cities.

iv) Milan’s active participation in European networks and programs is an important pillar supporting its digital transformation journey.

Milan has regularly engaged in the main city networks (Eurocities and OASC), participated in several European Programs (Synchronicity, Sharing Cities) and joined major European initiatives (100 Intelligence Cities Challenge in which it was distinguished as a mentor city). As a result, the City benefited from being a pilot city for interoperability, exchanged knowledge with other cities and promoted collaborations with other reference stakeholders to develop the digital solutions.

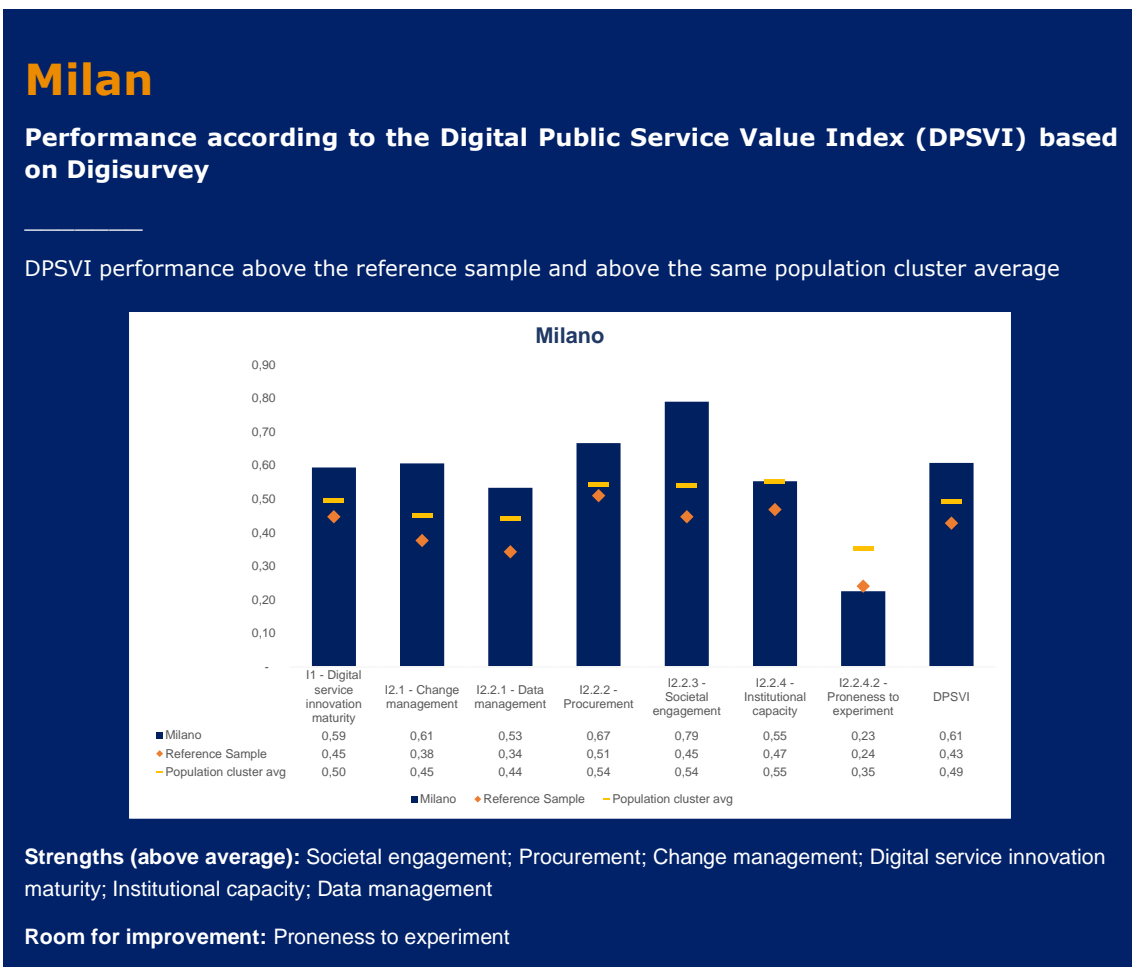


Figure 11 - Performance of the city of Milan in the DPSVI relative to the reference sample and the population cluster average

8 Case Study: Porto (Portugal)

8.1 Overview and approach to digital innovation

The city of Porto is not just a European medium size city of around 250 thousand inhabitants. It is also the centre of a metropolitan area of 1.8 million inhabitants.

City's **economic structure is oriented towards services**, namely Tourism, Commerce and Health. In recent years, **Porto has seen its reputation as a tourist destination rise** with the number of tourist overnights growing 171% between 2010 and 2019⁵⁴³. The City has received several Tourism awards, including *Best European Destination* in the 2020 edition of the World Travel Awards. The Metropolitan Area of Porto is the most service-based economy⁵⁴⁴ within the Northern Region of Portugal.

Other parts of the region are more industry-driven and show a strong performance in the export of goods at the national level in sectors such as textiles, footwear, agriculture, rubber, among others. At the same time, Porto has increasingly attracted new activities related to **creative and high-tech industries** due to its dynamic innovation ecosystem composed of well-ranked universities, tech hubs, skilled talent and motivated entrepreneurs.

In this context, since 2004 the City prioritised the promotion of its innovation ecosystem alongside investments in digitalisation to enable a modern transformation in the City that is conducive to better public service provision and improved quality of life for both its citizens and visitors. To deliver on that promise, the City has anchored this transformation in seven pillars: i) Modern ICT infrastructure; ii) Good governance of the digital portfolio; iii) Interaction with the ecosystem; iv) User-centric and co-creation approaches; v) Capacity-building activities; vi) Participation in European City networks and other programs; vii) Alignment with European and national priorities and funding opportunities.

Overall, the City has made significant progress to build and continuously improve its ICT infrastructure and data management policies. Porto has also become an active member of European networks and programs, and those collaborations have led to new ideas, models, technologies and structures underpinning the City's digital transformation efforts. In addition, the creation of a horizontal institution has enabled a new way of governance that allows for more structured and regular interactions with key stakeholders in the innovation ecosystem, which feed back into policymaking. In other words, collaboration and co-design are more and more part of the "DNA" of how the City operates. On the other hand, there still is room for improvement in capacity-building activities in line with the digital capabilities required to thrive in the digital age. The procurement of innovation also does not seem to be exploiting its full potential as a demand-side innovation instrument.

8.2 Proneness to Change

Porto is increasingly evolving from reactive to proactive service delivery. Porto's horizontal institution - *Porto Digital* - is implementing a culture of regular engagement and experimentation with innovation stakeholders and the different departments of the City Hall. These are important steps to remove silos and to

⁵⁴³ Source: Pordata

⁵⁴⁴ Source: [1612459867-3e2Ko2qAEo.pdf \(cm-porto.pt\)](https://www.cm-porto.pt/pt/1612459867-3e2Ko2qAEo.pdf)

counteract internal resistance to change in a public administration. Capacity-building activities related to leadership skills and profile or career-specific skills are being promoted by the City, even though there is still a lack of particular expertise in the digital field. Leveraging the power of data for decision-making and user-centric public service delivery has also become an essential aspect for the City, which intends to improve the quality of life of citizens and the city experience of an increasing number of tourists that visit Porto every year. Hence, technological improvements have been made to digitalise and ease both the access to city services and facilities by Porto's inhabitants and the tourists' experience.

Porto has capitalised on European networks to get inspired on new technological developments. The city is nowadays a strong player at the EU level in relevant areas such as open standards, open-source data management systems, capacity-building, management of digital tools, among others. At the same time, the City's efforts in the digital transformation have led, for instance, to its revamped status as a 'mentor city' in some EU initiatives. These networks and programs also offer Porto the opportunity to pool resources and apply for funding together with other cities for projects of common interest aligned with EU priorities.

8.2.1 Innovation governance

8.2.1.1 Institutional Capacity

Governance of the digital portfolio

The journey of digital transformation of the City of Porto truly kickstarted in 2004, with the creation of the non-profit organisation named Porto Digital⁵⁴⁵. Porto Digital is an effort led by the Municipality of Porto in collaboration with the University of Porto (UP) and the subway company *Metro do Porto*. The overarching goal was to promote strategic projects for the City and the Porto Metropolitan Area in the ICT field. The role of Porto Digital has evolved organically to support the digitalisation of public services in the municipality for citizens and visitors, to increase the city's attractiveness for entrepreneurship and experimentation, to incentivise the participation in cities' networks, and to foster societal engagement. Porto Digital, for example, has the mandate from the Municipality to boost the digital infrastructure in the City in wireless communication networks⁵⁴⁶, an effort co-funded by the European Regional Development Fund and national funding streams.

In addition, while Porto Digital is the key association leading the digital transformation of public services in the City, the **City Hall also has an ICT department** supporting different departments and service areas in more general ICT-related issues.

⁵⁴⁵ [Porto Digital Association - Associação Porto Digital](#)

⁵⁴⁶ [Fiber network - Associação Porto Digital](#)

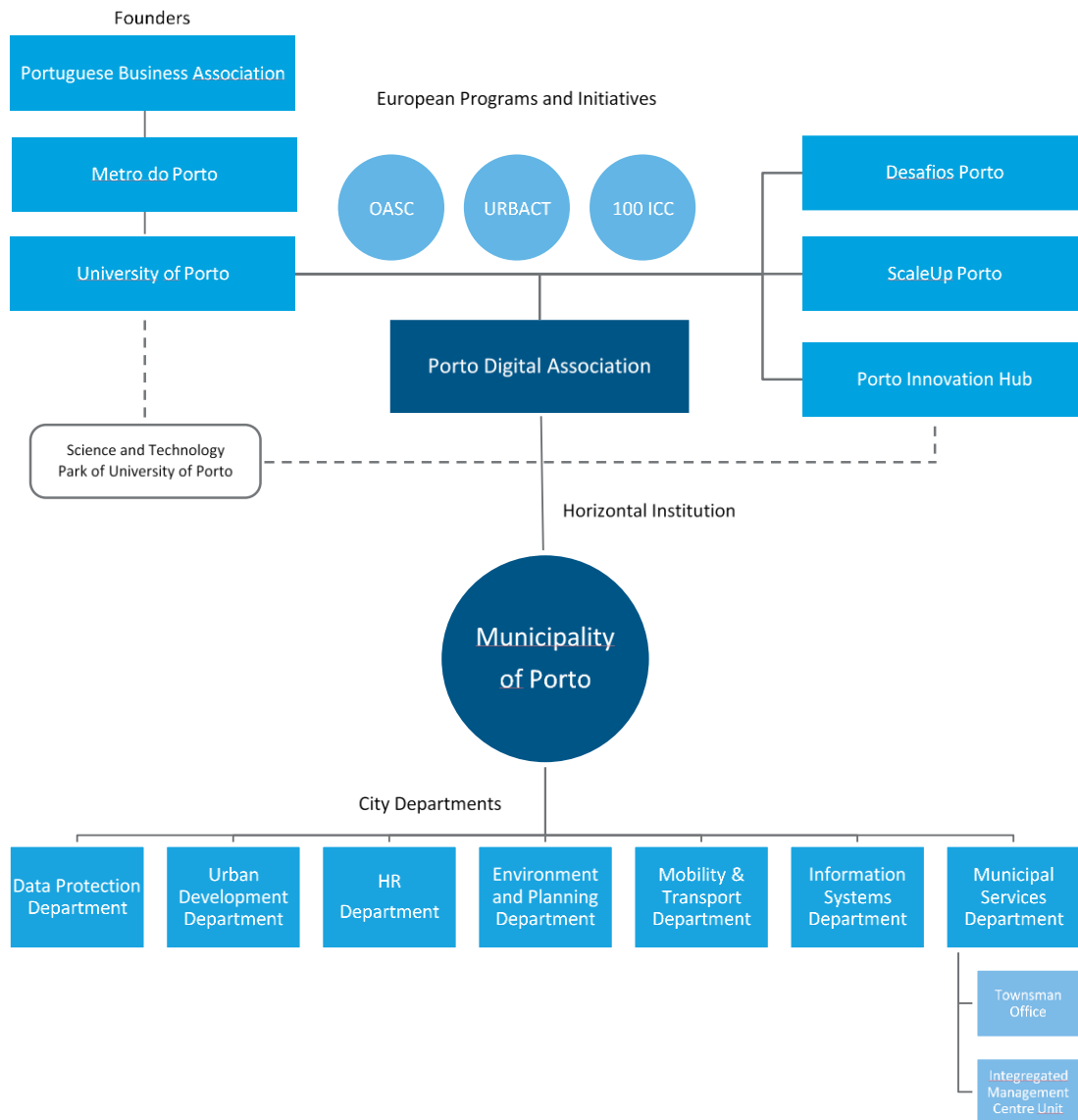


Figure 12 - The role of Porto Digital in the city's ecosystem – main activity areas and stakeholders

Source: Authors' own representation based on [Estrutura Orgânica | Câmara Municipal do Porto \(cm-porto.pt\)](#) and [Porto Digital - Associação Porto Digital](#)

Strategic priorities

The electoral manifesto proposed by the current Mayor and his City Councillors establishes clear goals regarding Innovation and Digital Transition:

- Develop the **"Porto Digital+" program** with the aim of promoting the use of digital technologies as catalysts for "more knowledge", "more security", and "more development and inclusion". The program will be based on providing broadband Internet access to all citizens and visitors, namely through the expansion of the **"Porto Free Wi-Fi" network**, which will assure access points in public spaces, at less than 500 meters from each other. The "Porto Digital+" program will also include a

plan of actions to increase the digital literacy, promoting greater social cohesion and addressing issues such as ethics and digital rights, or even the potential of the digital transition in the development of society.

- Develop the **Second-Generation Integrated Management Center**, based on the concept of "digital twin", that enhances the coordinated operation of the City, improving real-time and predictive information in a logic of promoting the concept of "data driven decision making" and that, at the same time, guarantees that the developed services are disclosed in a perspective of transversal valorisation of the knowledge produced, both in a logic of open data and in an international perspective. In this axis there is the intention of to ensure an alignment with several European initiatives in areas related to Smart Cities and Smart Communities. This alignment is seen as essential for the evaluation and continuous improvement of the work developed. The Second-Generation Integrated Management Center should also be supported by reinforced investment in the City's sensors' infrastructure, as well as in the traffic monitoring camera infrastructure, which will evolve to create new services oriented to video-protection in conjunction with the Public Security Police.

Capacity-building

The Municipality of Porto has the ambition to mainstream professional development through training and other initiatives⁵⁴⁷. For example, the Municipality has defined **Training Paths** by career and field of specialisation. As a result, the Municipality is fostering a process of integration of new hires with adequate plans for continuous skills development, and more successful mobility between services, while preserving knowledge in critical areas of the City. Furthermore, the Municipality has also established a Leadership Program to revamp the leadership skills of its managers in topics such as the motivation and empowerment of workers, or how to build a collaborative environment that encourages participation and constructive feedback. To fund many of these capacity-building efforts, the Municipality received financial support under COMPETE 2020's System of Support to the Digital Transformation of the Public Administration (SAMA2020)⁵⁴⁸.

Porto Digital also plays a role in this strategy of capacity-building since it assumes the role of accelerator of the City's transformation, contributing to more efficient public services with an impact on increasing the quality of life of citizens and sustainable development. In fact, Porto Digital positions itself as the toolbox for Porto's Innovation and Digital Transition and its services are aimed at the citizens but, in an indirect way, at the municipal teams, in the sense that these are crucial to convey innovation to the city.

The innovation strategy provides capabilities and tools to all departments, areas and individual workers (with Porto Digital working across sectors). Indeed, **Porto Digital acts as the middleman between the Municipality and the ecosystem**. Teams from the Municipality are involved from the problem-setting phase until the design of the solution. Porto Innovation Hub, an initiative developed by Porto Digital, has a key component related to organisational innovation which has for instance led to the "Innovation Day at the Municipality", an event aimed at bringing the staff of the Municipality together to discuss the best practices to (re)design public services. Moreover, PIH also launched a "Guide for Innovation" and a "Toolbox for Innovation" to support service design thinking activities.

⁵⁴⁷ [Formação e Desenvolvimento | Câmara Municipal do Porto \(cm-porto.pt\)](https://cm-porto.pt)

⁵⁴⁸ [Sistema de Apoio à Transformação Digital da Administração Pública \(compete2020.gov.pt\)](https://compete2020.gov.pt)

In view of improving its internal capacity further, **the Municipality has joined Urbact's Innovato-R Transfer network**⁵⁴⁹ that supported innovative projects improving the performance of public administration. Activities were focused on “service quality, goods/services acquisition, costs rationalisation, energetic optimisation, bureaucratic impact reduction and increase in data and in digital tools management”.

8.2.1.2 Data Management

Porto has been prioritising investments and efforts to better leverage data for new services and better decision-making. This translates into a recently adopted Data Management Strategy, in the development of a new open data platform and in the creation of an Urban Platform compliant with international data standards and from which new services have already emerged.

In January 2013, the University of Porto, through its **Centre of Competence in Future cities (CCFC)**, launched the **Porto Living Lab (PLL)**. PLL was created under the EU-funded Future Cities Project⁵⁵⁰ with a contribution of €1.6m to the overall budget of €1.7m. The PLL resulted from a long-term partnership between the Municipality, Porto Digital, Telecommunications Institute and the Universities of Porto and Aveiro. The PLL main objective was to turn Porto into a smart city living lab, in order to do so, it was developed a technological facility, that ended up being the building block for the city digital transformation over the years.

The technological infrastructure developed under the PLL combined sensors, communication equipment and other advanced technologies that allowed the data collection and information extraction at city level. A key component of this infrastructure is the **Urban Sense Platform**, created under the Future Cities Project, which started by being a large-scale hybrid sensor network dedicated to local monitoring of environmental indicators. The Urban Sense Platform benefited with the decision of Porto in 2015 to join the **Open and Agile Smart Cities (OASC)** network⁵⁵¹. As a result, all the data collected from this infrastructure was aggregated in a central server and made publicly available following the FIWARE standard format. This format allows cities to adopt common standard APIs and information models which enables the interoperability among city systems.

Considering that Porto Digital owns and manages key technological assets of this platform, namely the optical fiber and the public Wi-Fi network, the Association was appointed the city operator of the Urban Sense Platform. The platform kept expanding and started receiving information from additional sources, such as waste management and water supply counters, with the city aspiring to place the platform as the central point of its **Integrated Management Center (CGI)**.

The CGI is indeed another example of how Porto has been investing to better leverage the power of data in its service creation and in decision-making. **The CGI was created to provide real-time information on the occurrences and accidents in the city and to promote an integrated and more efficient action amongst the several entities that intervene in the operations of the city.** As a result, it aggregates in one single entry point the city services responsible for mobility, municipal police, fire brigade, civil protection and environment. The real-time information comes from a network of more than 140 cameras and sensors (such as vehicle counters) spread all over the city. The project started with the mapping and simplification

⁵⁴⁹ [Sistema de Apoio à Transformação Digital da Administração Pública \(urbact.eu\)](http://urbact.eu)

⁵⁵⁰ [Expand the Centre of Competence in Future Cities of the University of Porto to Strengthen Inter-Disciplinary Research and Knowledge Transfer to the Industry in the Norte Region of Portugal | FUTURE-CITIES Project | Fact Sheet | FP7 | CORDIS | European Commission \(europa.eu\)](http://urbact.eu)

⁵⁵¹ [History - Open & Agile Smart Cities \(oascities.org\)](http://oascities.org)

of the processes to be integrated in the center. One year after being launched, new investments were made and the CGI was placed in a new space, in order to accommodate its growth and upcoming needs.

Over time, the city of Porto has been involved in several European programs, such as the previously described Future Cities Project, that have been **contributing directly or indirectly** to the integration of systems that **support the continuous creation of the city Urban Platform**.

Under the **European Innovation Partnership for Smart Cities and Communities (EIP-SCC)**⁵⁵², Porto participated in 2016 in the development of the Urban Platform Management Framework document. Moreover, the implementation of pilot projects under the **Synchronicity project**⁵⁵³, namely the Community Policy Suite and the Multimodal Transportation, improved the city sensing network which supported the development of the Urban Platform.

In 2020, **Porto Digital integrated the “City Catalyst Project”**⁵⁵⁴, **supported by structural Funds and with more than 20 partners** from the innovation ecosystem (research centers, telecommunication institutions, technological firms, universities, etc). The City Catalyst Project, still running, aims to investigate and develop new products and services that contribute to an integrated management of cities. Porto Digital Association considers that the involvement on the City Catalyst Project will also support the further expansion of the city urban platform. The Urban Platform has been developed on open APIs, open data models and open standards, and the reference architecture is based on the Minimal Interoperability Mechanisms (MIMs) adopted by the Open & Agile Smart Cities (OASC), which ensures the interoperability between systems. Despite being a project under development, the urban platform has already promoted the creation of new services in the city, such as Explore Porto.

The Municipality approved in 2021 a new data management strategy for the City⁵⁵⁵ that will be coordinated by the Data Protection Department at the Municipality of Porto. The document has two key components, namely the Data Meta-indexer and the Strategy for Open data. The **Porto Municipality Data Meta-Indexer (INDEX)**, developed under this strategy, is a unified data cataloguing system, accessible to all employees through a portal, which aims to register and catalogue all data resources from the Municipality of Porto. The INDEX will be relevant to manage in a harmonised way the data collected which endorses a data-driven decision-making culture by smoothing the internal sharing of information between organic units. Furthermore, the INDEX works as a crucial element for the Open Data Strategy. This second component started being discussed in 2015, from which resulted the Open Data Platform⁵⁵⁶, accessible to all city stakeholders. The Open Data Platform, developed by the Municipality of Porto, uses CKAN⁵⁵⁷'s opensource data management system as a basis, and currently counts with 12 thematic categories and by the end of 2022 will have more than 200 datasets. The overarching goal of the Open Data Strategy is to contribute to the continuous development of this platform and to accelerate the implementation of data-driven decision-making in the Municipality, in line with the priorities of the EU Digital Agenda.

⁵⁵² [EIP_Mgnt_Framework.pdf \(europa.eu\)](#)

⁵⁵³ [Porto | SynchroniCity \(synchronicity-iot.eu\)](#)

⁵⁵⁴ [Consórcio – CityCatalyst \(efacec.com\)](#)

⁵⁵⁵ [Plano-de-Gestão-e-Valorização-de-Dados-do-Município-do-Porto- VFinal.pdf \(portodigital.pt\)](#)

⁵⁵⁶ [Plano-de-Gestão-e-Valorização-de-Dados-do-Município-do-Porto- VFinal.pdf](#)

⁵⁵⁷ [CKAN - The open source data management system](#)

The focus on a data-driven decision-making approach by the Municipality was also evident during the pandemic period with the project Data4Covid19⁵⁵⁸ to monitor the spread of COVID-19 in the Northern and Lisbon Regions. The project, supported by the National Innovation Agency through the European Regional Development Fund (€392M) and regional operational programs, involved a consortium of academic partners (University of Porto and Nova University in Lisbon) and private firms (the telecommunications company NOS and TekPrivacy, a spin-off of University of Porto). The project was supported by OASC and counts with the collaboration of local stakeholders as data suppliers, namely *Metro do Porto* (Porto Subway Company), STCP (Collective Transport Society of Porto), *Transportes Intermodais do Porto* and Porto Digital. The aim of this project was to develop an enhanced data platform that would cross and integrate multiple data sources, thus allowing the relevant entities to design, implement and monitor the measures to fight COVID-19 in an articulated manner. The Faculty of Sciences of the University of Porto was responsible for generating the algorithms underpinning this system, namely the patterns and matrixes of mobility and risk. The platform has been an information tool important not only for the Municipality but also for Health institutions (ARSN – Northern Regional Health Administration) and Tourism agencies (Tourism of Porto and the North of Portugal).

Porto has been also acknowledged by the World Council on City Data⁵⁵⁹ with the Platinum level⁵⁶⁰, regarding the ISO 37120 Sustainable cities and communities - Indicators for city services and quality of life. The ISO 37120 is the first standard published by the International Organisation for Standardization (ISO) in Geneva and encompasses 100 indicators, “grouped accordingly to 19 topics related to services and life quality, standardising the economic, social and environmental performance measurement in the city”.

8.2.1.3 Societal Engagement

The City has been promoting mechanisms of co-creation in the service design structure and fostering new channels of interaction with citizens.

The **Townsmen Office (“Gabinete do Município”)**, created in 2005, was designed to address citizens’ needs, by providing a platform with several City services in a more user-friendly and efficient way. The conception of this project began by considering the views of the different Municipal divisions on the services that they wanted to see ensured to the public and then, establishing flowcharts correspondent to the whole process. Over time, this project, under the supervision of the Directorate for Municipal Services to the Citizens, has been integrating more services and alternative channels of communication (from face to face, to phone and lastly an online platform). In 2018, and for the first time, the demand for digital channels exceeded the demand for in-person channels, which reveals an increasing acceptance and adaptation of citizens to digital solutions.

In the renewed strategical vision for the Municipal Cabinet, more competencies have been added and a broader platform was launched- the “**Portal do Município**”. This version includes “**Linha Porto**”, a new telephone number that consolidates and manages all municipal services, hence avoiding the multiplication of inefficient contact points and addressing the increasing demand registered recently. The platform will be subject to constant improvements based on the user experience and feedback.

⁵⁵⁸ [Ficha-Projecto-Data4Covid19.pdf \(portodigital.pt\)](#)

⁵⁵⁹ [ABOUT WCCD — World Council on City Data \(dataforcities.org\)](#)

⁵⁶⁰ [Porto is ranked at the top of the international certification on life quality - News Porto.](#)

Porto's engagement with citizens is present not only through the services created but also in the initiatives promoted. *Desafios Porto* is an ideas competition, that starts by inquiring directly the citizens on the problems that they identify in the city. In a second step, the project establishes a bridge with the entrepreneurial ecosystem by challenging them to provide solutions for the issues previously identified. The first phase of *Desafios Porto* counted with more than 300 challenges and around 100 local firms. Then, for each category of challenges- *Health and Well-being, Energy, Digital City, Mobility and Environment*-, the best ideas were supported through financing and mentorship, to be ultimately implemented in the city. In the category of energy, Omniflow was the winning company, with the solution "Omniled". The product is a "hybrid system of autonomous lighting that generated its own energy through photovoltaic and wind power" and ended up being implemented in a busy city area, Asprela, with security concerns due to poor lightning conditions.

Porto Innovation Hub was created in 2016 under the coordination of Porto Digital. It is a living lab of engagement of the different city innovation stakeholders. In its first initiative, for three months, PIH promoted an open program to debate innovation in the transformation of the city. The program included initiatives of different nature (talks, innovation sessions, public laboratories, workshops, public exhibitions, among others) to engage with the broadest spectrum of citizens possible and encouraging them to be innovation drivers. The ideas shared, the needs assessed, and the input collected were incorporated into a summary report⁵⁶¹, which ended up contributing to the Municipality Implementation Plan in the field of innovation.

In 2018, PIH inaugurated a new space that has been developing other citizen-centric initiatives such as **City Café**, an informal moment of dialogue that encompasses topics of different nature, such as: innovation, knowledge sharing, the role of cities in environmental sustainability or tips to adapt for remote work. Up to now this initiative counted with more than 955 attendees on the 12 sessions already done. The final goal of this initiative is to encourage the interaction and collaboration among its participants.

From all these initiatives and following the methodologies of service design determined in European Programs, **Porto has concrete examples of citizen-centric approaches and co-creation dynamics when designing new services or improving existing ones.** The **Beacons Porto project**, that led to the **Explore Porto** service, started by a research phase including online surveys, brainstorming activities to collect citizens' perspectives and perceptions on the mobility in the city, as well as MVP development, and a co-creation session. Then, pilot beacons were introduced in strategic points across the city to capture how the citizen engaged with such technology. Secondary documental research was conducted to explore alternative applications of beacons in other European cities. From this initial research stage, the project was technologically improved up to the launch of Explore Porto.

Moreover, before proceeding to the most recent expansion of the public Wi-Fi network in the city, Porto Digital coordinated a study to collect information about who uses the Wi-Fi network, as well as why and how are they using it. This study of satisfaction and improvement gave opportunity for the users to directly make proposals for improvement. It took place for two months and collected more than 83,000 responses from city Wi-Fi users. The results confirm the importance of this service, with a significant proportion of users relying on it to study and work. From this study, new investments of expansion were planned to be concluded throughout 2021.

⁵⁶¹ [relatoriosintese.pdf \(portodigital.pt\)](#)

8.2.1.4 Procurement

In the national benchmarking study of the *Strategic use of public procurement for innovation in the digital economy*⁵⁶² commissioned by the European Commission, Portugal integrates the group of low performing countries in implementing a policy mix conducive for mainstreaming innovation procurement. In particular, **there isn't a dedicated national strategy for Public Procurement for Innovation**⁵⁶³ which means regional and local governments may lack a national reference model to shape their policies. However, the National Innovation Agency (ANI) has taken the lead to develop since 2018 activities to stimulate innovative public procurement notably by coordinating the Portuguese participation in the European projects⁵⁶⁴ Interreg Europe *iBuy* and *Procure2Innovate*⁵⁶⁵. These participations have also incentivised the creation in October 2021⁵⁶⁶ of a **national Competence Centre specialised in innovation-related public procurement** with a key focus on structuring nation-wide capacity-building on the topic. The Centre has received financial support from COMPETE 2020, a national operational program financed by European structural and investment funds (ESIF).

In the Municipality of Porto, information on traditional public procurement can be found at the Citizens' Portal (Portal do Município⁵⁶⁷), though the City has decided to have its public procurement activities outsourced in the **e-procurement platform** *acinGov*⁵⁶⁸, owned by the company Academia de Informática Brava, Engenharia de Sistemas, Lda. This is one of the platforms available in Portugal for public procurement activities of public administrations. While providers are usually contracted through normal public procurement processes which the City does not always consider to be very friendly⁵⁶⁹, the City has taken steps to engage with the entrepreneurial ecosystem by offering small contracts to local start-ups and SMEs to experiment and to test pilots and innovative solutions.

Considering the need to also deliver on the green transition, the City's vision⁵⁷⁰ is to become a reference public administration in **Sustainable Procurement** by promoting information campaigns with suppliers to integrate sustainable requirements in the purchases, which has materialised in concrete guidelines listed in the Code of Conduct for Suppliers subcontracted⁵⁷¹ by *Porto Ambiente*. The Municipality is also part of the Horizon 2020 *CityLoops project*⁵⁷² together with six other European cities. One of the ambitions for the City of Porto is to develop circular procurement guidelines for the Social Economy and the Tourism sector⁵⁷³.

Digital innovation in Porto has not only been funded by a set of European programmes such as Horizon 2020 (e.g., Synchronicity project⁵⁷⁴) and European Funds (e.g. Regional Development Fund and Cohesion Funds) **but also through the City budget** (e.g. new systems and digital platforms)⁵⁷⁵, as the topic is

⁵⁶² [The strategic use of public procurement for innovation in the digital economy - Publications Office of the EU \(europa.eu\)](#)

⁵⁶³ [Compras Públicas de Inovação - Iniciativas Estratégicas - IMPIC - Instituto dos Mercados Públicos, do Imobiliário e da Construção](#)

⁵⁶⁴ [Public Procurement of Innovation | ANI](#)

⁵⁶⁵ [P2I Competence Centres Factsheet - Portugal.pdf \(procure2innovate.eu\)](#)

⁵⁶⁶ [ANI apresenta Centro de Competências em Compras Públicas de Inovação | ANI](#)

⁵⁶⁷ [Contratação Pública - Portal do Município \(cm-porto.pt\)](#)

⁵⁶⁸ [acinGov - A plataforma eletrónica de compras públicas](#)

⁵⁶⁹ [Lei da contratação pública continua a dificultar a execução de projetos e obras do Município - Portal de notícias do Porto. Ponto.](#)

⁵⁷⁰ [Procurement Sustentável | Porto Ambiente](#)

⁵⁷¹ [1624013975-qJ08TxeHrd.pdf \(portoambiente.pt\)](#)

⁵⁷² [City Loops | CityLoops project](#)

⁵⁷³ [City Loops | CityLoops project](#)

⁵⁷⁴ [Porto | SynchroniCity \(synchronicity-iot.eu\)](#)

⁵⁷⁵ [Atividades | Câmara Municipal do Porto \(cm-porto.pt\)](#)

strategic for the City. In fact, as a whole, **Porto is the Portuguese city that has shown the strongest attraction capacity from Portugal 2020**, i.e. the partnership agreement between Portugal and the European Commission to define the interventions, investments and funding priorities from ESIF between 2014 and 2020. In particular, Porto's ecosystem has received €1.4bn (or 6% of the total) of the approved funds until March 2020⁵⁷⁶. Over the same period, the Municipality of Porto has received €52.2M from Portugal 2020 for a total of 28 projects. Specifically in the digital field, this included €434k to support the Integrated Management Centre⁵⁷⁷, €240k for its Open data platform for the Cities of the Future⁵⁷⁸ and €184k for capacity-building⁵⁷⁹. These are all important activities underpinning the digital transformation in the City. The Municipality has an Office for Managing European Funds and Financing instruments. Moreover, the Municipality is working on an economic development plan to maximise the access to European Funds available until 2027 including a strong priority to expand capacity-building activities⁵⁸⁰.

8.2.2 Change Management

Porto has been actively involved in European Programmes and cities networks, which place the city as a reference in the national and European context. For instance, Porto is the Portuguese City with the most participations in Urbact programs.

Urbact⁵⁸¹ is a European exchange and learning programme with the goal to find solutions to tackle common urban challenges and to promote a sustainable urban development mindset in European cities. In the last edition, *Urbact III* (2014-2020), among the several projects⁵⁸² that the city was involved in, it is worth to mention the engagement in the Smart Impact network⁵⁸³. This two-year project (2016-2018) brought together ten European cities, where the most experienced and larger cities, such as Porto, could share their experiences with smaller ones on the best practices and policies to deliver smarter cities. The project was mainly focused on five smart impact topics: organisational development, smart financing and procurement, local innovation ecosystem, data integration and support regulation and incentives.

Over the course of the project, among the several interactions, workshops and events between cities, the main output was an integrated action plan per city, where an Urbact Local group (ULG) assessed the state-of-play and recommended new actions to share with their municipal leaders. Following the framework of the project to develop the **Integrated Action Plan⁵⁸⁴**, Porto ULG involved the most relevant city departments in the Smart cities field, namely Porto Digital Association, Innovation Department, Mobility Department, Information System's Department, among others. The plan was relevant to assessing the needs of the City and mapping current and new actions to address them. Among the several actions recommended, this action plan included the development of a new urban platform focused on smart governance by providing a "logical architecture to data flows within and across municipal services". Moreover, the creation of a working group that encompassed several City departments was another significant output from this project. This

⁵⁷⁶ [Prioridades estratégicas já trouxeram ao Porto 1,4 mil milhões de euros do Portugal 2020 - Portal de notícias do Porto. Ponto.](#)

⁵⁷⁷ [Mais Transparência \(transparencia.gov.pt\)](#)

⁵⁷⁸ [Mais Transparência \(transparencia.gov.pt\)](#)

⁵⁷⁹ [Mais Transparência \(transparencia.gov.pt\)](#)

⁵⁸⁰ [Mais de 1,4 mil milhões de euros. Porto é líder na captação de fundos europeus \(tsf.pt\)](#)

⁵⁸¹ [URBACT |](#)

⁵⁸² [Porto | URBACT](#)

⁵⁸³ [SmartImpact | URBACT](#)

⁵⁸⁴ [integrated_action_plan-final-light.pdf \(urbact.eu\)](#)

type of interaction enables the creation of synergies, informs on the state-of-play and promotes a governance modernisation with “de-siloing” of the city organisational structure.

Porto has also been a frontrunner in what concerns the engagement in international cities networks.

An illustration of this is that Porto was one of the 31 founding members of the OASC (Open & Agile Smart Cities) network back in 2015. Indeed, Porto’s Urban Platform uses open APIs, open data models and open standards as building blocks, and the reference architecture is based on OASC’s Minimal Interoperability Mechanisms (MIMs). Moreover, the CEO of Porto Digital is currently the coordinator of the Council of Cities⁵⁸⁵, which is one of the governing boards of OASC.

Moreover, in a most recent European Commission supported initiative, the 100 Intelligent Cities Challenge (ICC)⁵⁸⁶, **Porto was distinguished as a mentor city**. Mentor cities are chosen by having a proven track record in at least one of the ICC’s Thematic areas. In this context, Porto’s role it is to share with other cities the work developed and best practices, but at the same time this role also naturally stimulates engagement and further collaboration with other municipalities.

In fact, European knowledge exchange channels have contributed to the efforts of the City towards digital transformation and improved public service delivery.

For example, from the successful Citizen card implemented in Gijon and Zaragoza, Porto joined the so-called **Citizen Card Project**. The project started with a study promoted by Eurocities⁵⁸⁷ with the ambition of **developing and design a ‘white label’ Citizen Card. The ‘white label’ created followed interoperable international and European frameworks** and in this way could be scalable and adapted the reality of each city. The project involved seven other cities at different stages of development of this solution. Porto was one of the partner cities that had more to leverage from this project, given that it belonged to the group of cities that, at the time, did not have the citizen card but had plans to develop one.

This first phase of development concluded with a building-block report⁵⁸⁸ guiding the introduction of this service in cities. The project implementation was impacted by the Covid-19 pandemic. However, further collaboration and developments are planned through the Living-in.EU initiative⁵⁸⁹. The **Living-in.EU initiative**, launched in 2020, is a citizen-centric and city-driven movement for open innovation based on open standards, in which Porto was one of the founding⁵⁹⁰ members.

In the meantime and relying on the work and knowledge exchange of these projects and initiatives, **Porto launched this year its “Porto Card”⁵⁹¹**. The card can be obtained online and allows citizens to get discounts on cultural activities, museums, libraries and sporting facilities and also integrated the free public transport for young citizens. The Card also informs the user by SMS about parking, traffic conditioning or weather warnings. In the first month since the launch, the Card counted with more than 5,000 users. “Porto Card” is one illustrative result of the outcomes that Porto’s derives from its role and position in its network.

⁵⁸⁵ [integrated_action_plan-final-light.pdf \(oascities.org\)](#)

⁵⁸⁶ [Porto | Intelligent Cities Challenge](#)

⁵⁸⁷ [Eurocities - Home](#)

⁵⁸⁸ [Eurocities-KSF-Lab-Citizen-Card-report-2021_2.pdf](#)

⁵⁸⁹ [Eurocities-KSF-Lab-Citizen-Card-report-2021_2.pdf \(living-in.eu\)](#)

⁵⁹⁰ [Citizen Card | Living in EU \(living-in.eu\)](#)

⁵⁹¹ [Cartão Porto. já está disponível para abrir caminhos por toda a cidade - Portal de notícias do Porto. Ponto.](#)

Overall, the city participation in these programs and networks is mostly managed by Porto Digital which is also responsible for the promotion of Porto's innovation ecosystem, mostly through the coordination of the previously mentioned Porto Innovation Hub⁵⁹² and ScaleUp Porto⁵⁹³.

In particular, **ScaleUp Porto is an initiative launched by the Municipality of Porto and the Science and Technology Park of University of Porto (UPTEC) counting also with the support of several local stakeholders**, to further develop the innovation ecosystem at different levels (i.e.: funding, access to market, ecosystem communication, etc). Through this initiative, Porto joined the Scale Cities⁵⁹⁴, an "European collaborative force", where the public ecosystem stakeholders work together to "strengthen and connect the European Startup ecosystem for entrepreneurs". This engagement has been relevant to get information and access to the opportunities in acceleration, incubation, soft landing programs and funding calls. ScaleUp Porto also monitors the evolution and impacts of the innovation ecosystem⁵⁹⁵ in the City of Porto. The fact this is an initiative coordinated and supported by the Municipality, reveals a proactive position on the role that it has as a promoter of an innovation ecosystem focused on delivering public value.

Hackacity⁵⁹⁶ represents another relevant example on how the Municipality engages with local stakeholders (University of Porto and Data Science Portugal) **to involve the ecosystem in a way that ends up supporting the innovation in digital service development and provision**. The hackacity is an event where data scientists are invited to derive, from the city's data platform, concrete solutions to improve the quality of life in the City. The event started in 2015 and counted with the participation of mentors and jury panels from numerous city institutions (INESC-TEC, University of Porto, Telecommunications Institute) and businesses such as Veniam and Ubiwhere. Over the years, the event has evolved and, in collaboration with OASC, it was replicated in several other cities (Santander, Zagreb, Cuiabá, etc) relying on the previously mentioned FIWARE standards.

In 2020, Porto's investment and efforts on this dimension were recognised internationally with the "The **Smart City Innovator Award**"⁵⁹⁷ on the Annual Investment Meeting in Dubai.

8.3 Digital Service Innovation Maturity

The building block for the digital maturity of the City lies in its ICT infrastructure, namely optical fiber and Wi-Fi networks. This effort to promote digital infrastructure in the City started already back in 2003, and the extension and availability of this municipality-owned network is a unique example in the country.

Such infrastructure supported the connection of all IoT devices and collaborative online platforms developed under the different projects over the years. For instance, the city bus company, STCP, provides a free Wi-Fi service reliant upon this infrastructure. This service was developed through a partnership within the previously mentioned Future Cities Project and in collaboration with the Telecommunication Institute, the Municipality and the universities of Porto and Aveiro. In the same context, the *QUAMTRA*⁵⁹⁸ solution,

⁵⁹² [Porto Innovation Hub - Porto Innovation Hub](#)

⁵⁹³ [ScaleUp Porto. | From Stand, to Start, to Scale.](#)

⁵⁹⁴ [Who we are - Scale Cities](#)

⁵⁹⁵ [Dashboard | Scaleup Porto](#)

⁵⁹⁶ [Porto 2019 – Hackacity](#)

⁵⁹⁷ [Annual Investment Meeting places Porto on the podium of foreign investment and "smart cities" - News - InvestPorto](#)

⁵⁹⁸ [Improvements in Calatayud and Porto with Quamtra | SynchroniCity \(synchronicity-iot.eu\)](#)

which is part of the Synchronicity pilot project⁵⁹⁹, relied on this infrastructure to monitor the fill level, status and location of the refuse bins. In order to do so, it used volumetric measurement sensors, which consequently promoted an optimisation of waste collection operations. It is a solution also applied in Calatayud, Spain.

The digital maturity is also evident in the city Division for Environment. This division, responsible for waste management and collection, relies on several other integrated information systems to optimise and digitalise their operations. The application *Drivers*⁶⁰⁰, designed for the employees to register their shifts, communicate exceptional events and to signal waste abandoned in inappropriate places, reduced the amount of bureaucracy and improved the communication within the division. In addition, the application *Stratio*⁶⁰¹ involved the installation of a device in each vehicle to collect data about the vehicle performance and its permanent geolocation. Subsequently, the cloud-based software application analyses all the data collected and, using configured alerts and artificial intelligence, allows for the detection of current and potential malfunctions of each vehicle. Since 2019, the division has invested in application programming interfaces (APIs) to integrate all these internal systems and to connect with others from external partners, which improved the efficiency and transparency of its operations, following data sharing⁶⁰² reports on a regular basis with external stakeholders.

The fact that Porto adopted in 2015 the open standards from FIWARE meant that the City became capable of storing and sharing the data received from different sources in a harmonised and interoperable way; in other words, it opened up the City to new avenues in research and new applications, including from external partners or companies. Additionally, the City was able to provide “Open APIs for software developers and management tools for city officers, as well as live dashboards and apps for citizens”⁶⁰³. The Citibrain Smart Air Quality system was one of the integrated solutions created in Porto by Ubiwhere, a company based in Aveiro. The company installed 75 air quality stations to monitor the conditions in real-time.

The digital service innovation maturity is also evident in the mobility domain, as illustrated by *Explore Porto* (Box 7), the reference project that we will further explore in this case study.

Box 7 - Zoom-in: Explore Porto

○ Overview

Launched in June 2021, **Explore Porto** is an innovative digital tool that allows users to explore the city with real-time data information. Building on the city urban data platform, it combines information from mobility solutions (such as bus, subway and micro mobility) and tourism & cultural activities, creating a more convenient experience for users. The digital tool is further complemented with physical points across the city, the beacons, which through a QR code reader offer additional information. Its creation benefited from the collaboration and deep interest from a wide range of stakeholders, including the City of Helsinki – its open-source application is the basis of Explore Porto.

⁵⁹⁹ [Porto | SynchroniCity \(synchronicity-iot.eu\)](https://synchronicity-iot.eu)

⁶⁰⁰ [1623746482-1KSwKlp6a9.pdf \(portoambiente.pt\)](#)

⁶⁰¹ [1623746482-1KSwKlp6a9.pdf \(portoambiente.pt\)](#)

⁶⁰² [Ambiente.bi | Porto Ambiente](#)

⁶⁰³ [Porto Air Quality | Case studies - Ubiwhere](#)

The City aims to further develop the solution and integrate real-time data from taxis and trains as well as from other domains other than mobility, for instance the space occupation in real time of the points of interest and local commerce and weather information.

○ **Relevance and uniqueness**

This service aims to be more than an ordinary route journey planner. It is a pioneer service in Portugal and in Europe, as there are not many cities offering real-time information on the City. This allows for an informed mobility decision-making and eases the citizen's mobility experience.

The uniqueness of this service comes from:

- **The service design:** prior to project development, the project started with consultations to better address citizen needs. The process began with research to understand the best practices and the existing solutions in this field. Then, it introduced pilot beacon points that directed to an online survey to capture the interaction of citizens with this technology. Only after this initial research stage did the project development phase start.
- **Stakeholder engagement:** the City collaborated with mobility partners (bus, taxis, metro, micro mobility entities), tourism associations, citizens, other cities all over the process.
- **Accessibility, technical capabilities and data integration:** the City has put a strong emphasis on developing an urban data platform to manage operations and create a data-driven city. This service, which would not exist without this urban platform, is therefore a good example of how the city plans to evolve to deliver digital services based on real-time data to its citizens and tourists.
- **Environmental and tourism perspective:** This initiative is also a strong contributor for public transportation usage, as it gives an overview of the available options, which drives efficient decision-making. It has also the goal of promoting tourism and spreading visitors across the city, showing diversity of interest points and avoiding high concentration of people.

○ **Challenges & Drivers**

The service was not created from scratch. It evolved from an already existing online service to plan bus trips from STCP (public company that runs the bus and trams the service in the city). However, the former was not optimised to use real-time data, nor did it include a multimodal approach to mobility. The project also benefited from its participation in the SynchroniCity, through its pilot, **Porto Multimodal Assistant**. Moreover, the interaction with other cities under this initiative enabled the selection of Helsinki as a partner in the project development. The advanced stage of development of Helsinki in mobility solutions and the fact that it has open-source applications (Digitransit⁶⁰⁴, Open Street, etc) that are scalable to other cities, were crucial factors for this engagement. According to the city representatives, the fact that Porto's citizens are becoming "increasingly digital" is driving the digital transformation of this service and of the city as a whole.

○ **Implementation and Monitoring**

As mentioned fore, the project was triggered by SynchroniCity in 2018 and was structured around some key steps. To begin with, the continuous investments around the technological development of the urban

⁶⁰⁴ [Digitransit](#)

data platform. Another important step was the **identification of the right open-source application** – and here the connection with the City of Helsinki influenced the choice. Simultaneously, there was a relevant task of **coordinating and governing the set of partners involved in the initiative**, as they had different goals, interests and digital maturity levels. Indeed, the City wanted to ensure they were all equally involved, engaged and updated, so it organised working groups and made sure that **information was shared across teams**. The first meeting with STCP happened in 2019. The service design process kicked-off afterwards (in an agile way, listening to the users on a regular basis and adjusting the design accordingly), while **the technical team worked on identifying data inputs, preparing data collection and the data model, transforming data and standardising it**, to make sure the user would have the right information in just a single platform and in a single language.

Explore Porto was launched in May 2021. Porto is tracking the number of users of the service but has **not yet implemented a monitoring process**. According to city representatives, they are currently in the process of developing that model, understanding the right targets and KPIs. The solution is growing at the same time, with new features (for instance, customisation to the user, with an account and login), corrections and additional content layers on the roadmap.

○ *Impacts*

There have been 26.000 users in the first month of implementation, with 50% of users returning to the service. In order to better evaluate the impact, the City is working towards optimising metrics and getting reviews from users – thus leading to the creation of a short and long-term monitoring mechanism. So far, the City has identified a strong interest for the service from young people at university hubs (those are the physical points which generated higher interaction). As the City is developing new layers of content – for example, integrating data from taxis and taxi rank occupation rates - the city is adding new segments of users and broadening the usage of the service.

The service is being developed in a way that will eventually turn into “Explore City”, which means it could be replicated by other cities and thus generate a broader impact. Some cities have already expressed their potential interest in this solution.

8.4 Conclusions and lessons learned

The digital transformation journey of the City of Porto is increasingly leading to a more digital mature public service provision, thanks to important **organisational innovations** in the City (e.g. an horizontal institution that governs different structures for effective societal engagement), **priority-setting aligned with EU’s Digital Agenda** and European and national funding opportunities available for cities, and **investments in digital infrastructure and data management systems** that underpin new opportunities in research and applications not only by the City Hall but also by universities and businesses, among other factors.

Below we explore in more detail some of these potential **lessons learned from the experience of Porto** in transforming its public service provision through digitalisation:

i) Porto’s horizontal institution- Porto Digital- is embedding the collaboration with innovation stakeholders in the “DNA” of public service provision

The analysis of this case study shows that a key element behind the digital transformation of the City was the creation of an horizontal institution – a private non-profit association- , responsible for the coordination

and implementation of the city's digital strategy and ICT-related projects. Moreover, the fact that Porto Digital was founded thanks to the collaboration between relevant city stakeholders (academia, business association, transportation company) and the City Hall, ended up promoting the interaction between them. Therefore, multiple coordinated actions and cooperative projects have been emerging over time.

ii) *Prioritising the development of ICT infrastructure from the start of the digital transformation journey enabled the City Hall and its stakeholders to build on it for new systems, solutions and services*

The initial main purpose of Porto Digital Association was the coordination of projects related to the development of ICT infrastructure. As a result, since 2006 there has been a continuous investment in improving and expanding both the optical fiber and Wi-Fi networks. Throughout the years, this infrastructure has led to the development of new technological projects by the City Hall and also by other local stakeholders (e.g.: University of Porto with the Centre of Competences in Future Cities). The extension of these networks has also enabled generalised access to the public to on-line opportunities, hence contributing to closing the digital gap that remains in the City (i.e. it fostered digital inclusion).

iii) *The urban data platform has been a key asset leveraged by the City to improve its decision-making capabilities, and it had a determinant role to manage the evolution of the pandemic*

Leveraging on City's data was placed by the Municipality as one of its most valuable assets for service provision and decision-making. In this context, Porto has been investing in infrastructure, tools and methods to capture, manage and analyse data efficiently.

The city urban data platform is an outcome of this continuous focus on developing a centralised integrated system, composed by an infrastructure capable of collecting real-time information standardised and interoperable formats (e.g., FIWARE standards). The infrastructure, composed by machine-generated data from IoT devices, covers several key domains of the city (mobility, environmental and tourism). As a result, the platform has been enabling the creation of new services more tailor-made to citizen needs (e.g.: Explore Porto) and has promoted more sustained and well-informed decisions (e.g., Data4Covid Platform).

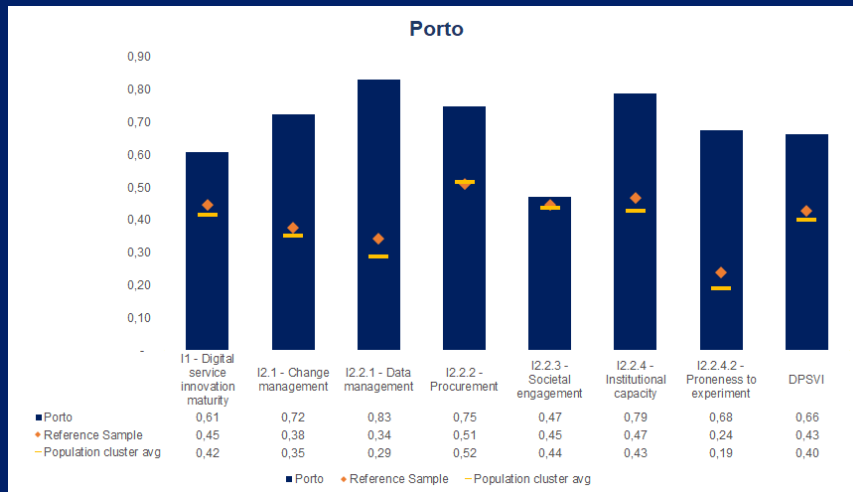
iv) *The participation of Porto in European networks and programs has reinforced its technological readiness to deliver digital public services and to scale-up some of these solutions.*

Porto is nowadays an international reference in the digital and innovation domains. Over time, it opted to engage in several city reference networks (OASC and Eurocities), joined European initiatives (100 Intelligent Cities Challenge and Living-in.EU) and participated in different European Programs (Synchronicity or Urbact, among others). By doing so, the city exchanged knowledge with other municipalities, adopted international reference frameworks and standards, and used technological platforms fundamental to the creation and development of several services in the City, such as the Explore Porto and the Porto Card.

Porto

Performance according to the Digital Public Service Value Index (DPSVI) based on Digisurvey

DPSVI performance above the reference sample and above the same population cluster average



Strengths (above average): Data management; Institutional capacity; Procurement; Change management; Proneness to experiment; Digital service innovation maturity; Societal engagement

Figure 13 - Performance of the city of Porto in the DPSVI relative to the reference sample and the population cluster average

9 Case Study: Poznan (Poland)

9.1 Overview and approach to digital innovation

Poznan is the capital of the largest region in Poland, Wielkopolska,⁶⁰⁵ with a population of 532,000⁶⁰⁶ and around 1 million in the Metropolitan Area⁶⁰⁷. The city benefits from being the third largest academic center in the country⁶⁰⁸, with 102,000 students, 24 universities and 33 research institutes⁶⁰⁹. Poznan is also an **important economic center in the country**, with access to **advanced IT infrastructure**⁶¹⁰ and with a growing ICT sector⁶¹¹.

Overall, the City has been leveraging these conditions to support its digital transformation journey. In 2017, the Mayor's Proxy for Smart City was appointed and, in 2019, the City created a Smart City Team to work across departments to ensure more agile decision-making. This team is responsible for coordinating all City initiatives on this domain. In 2020, the City set an ambitious roadmap for the smart future of the city, and identified six main areas- *Smart Living, Smart Economy, Smart Environment, Smart Community, Smart Mobility* and *Smart Digital City*. At the same time, past efforts have already been distinguished in 2019 with the Polish Smart City Award⁶¹² which shows the City is on the right track.

The City has oriented its smart priorities towards the digitalisation of public services and channels to enhance communication with citizens. Capacity-building has also been identified as important to drive digital transformation, and there are already some initiatives in place such as general and specific training courses, conferences or the possibility of co-financing employees' studies, and access to e-learning platforms.

In addition, **the City has been an active participant in European initiatives and cities' networks**, which have enabled further contacts of reference to continue to exchange expertise and practices. On the other hand, there is room for improvement in the use of innovative procurement and to leverage from data to improve decision-making and create new solutions that deliver impact for citizens.

9.2 Proneness to Change

Poznan consolidated a more mature approach to digital innovation through the creation of a horizontal Smart City Team. This was an important organisational change to transform the internal governance by removing silos and enabling more efficient cross-department collaboration essential to the implementation of the different smart city initiatives.

However, the City had already initiated some steps in this regard. For instance, the **Development Strategy for the City of Poznan 2020+**, presented in 2017, was co-created with citizens and other agents from the innovation ecosystem. This was the document that paved the way for the Poznan's Smart City Model. There

⁶⁰⁵ [Wielkopolska Region](#)

⁶⁰⁶ [Wielkopolska Region \(badam.poznan.pl\)](#)

⁶⁰⁷ [Demographic structure of Poznań - I study \(badam.poznan.pl\)](#)

⁶⁰⁸ [LOKALNY PLAN DZIAŁANIA \(urbact.eu\)](#)

⁶⁰⁹ [LOKALNY PLAN DZIAŁANIA \(badam.poznan.pl\)](#)

⁶¹⁰ [\(PDF\) Common Data and Technological Partnership - The Foundation for the Development of Smart Cities - Poznań Case Study \(researchgate.net\)](#)

⁶¹¹ [Potencjal inwestycyjny sektora IT w Poznaniu raport_eng-1.pdf \(manpowergroup.pl\)](#)

⁶¹² [Poznan wins Smart City Award | TheMayor.EU](#)

has been some progress towards the creation of new channels and **initiatives to promote citizen engagement**, but the implementation of regular co-design practices with citizens in the development of new projects is still lacking. The City **already leverages data in some areas** (e.g., spatial domain) but is not yet taking full advantage of the data for decision-making. At the same time, the relatively advanced ICT infrastructure and the continuous involvement in European initiatives are two relevant dimensions that will keep supporting the City's digital transformation path.

9.2.1 Innovation governance

9.2.1.1 Institutional Capacity

Strategy

The strategic document **"Development Strategy for the City of Poznan 2020+"**⁶¹³ was adopted in 2017 and sets out the vision for Poznan in the short and long-run. The Strategy was designed under the assumption of **"a city for people"**, translated into **permanent co-creation between citizens, city administration and other city stakeholders** (e.g., scientific experts, social activists, representatives of professional and social groups). In this process, several meetings, surveys and open workshops were organized to collect insights on the main concerns, needs and vision for the city from each group represented. The overarching mission is to **"shape conditions for all residents to co-create the city"**, with five main priorities for the City development, namely *Green mobile city, Strong Metropolis, Friendly residential estates and Smart Entrepreneurship*. **In each of the priorities it defines the main ambitions and specifies 55 implementation tasks and the financial resources to achieve them**⁶¹⁴.

When designing Poznan's 2020+ City Strategy, a request for smart initiatives emerged, which was the driver for developing a Smart city model in 2020 entitled **"Smart City Poznan"**⁶¹⁵. The strategy defines the smart city model for Poznan, aligned with the guidelines established in the City's main strategy. It was developed by an internal and multidisciplinary team of City Hall workers from several city departments (e.g., mobility, environment, etc) and it focuses on 6 areas: *Smart Living, Smart Digital City, Smart Mobility, Smart Community, Smart Economy and Smart Environment*. Each area included a **mapping of the current initiatives in place and also identified the projects to pursue in the future**. In order to do so, the team established criteria⁶¹⁶ to identify "smart" projects, with over 150 projects identified. In addition, it selected indicators to monitor the progress of the implementation phase.

Governance

Following local government and administrative reforms in Poland after 1990, the local government has received new competencies and guaranteed a share in the exercise of power⁶¹⁷. The City of Poznan was considered as both a commune ('gmina') and a district ('powiat')⁶¹⁸. As a result, the Mayor holds power at

⁶¹³ [Development Strategy for the City of Poznan to 2020+ - Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶¹⁴ [Development Strategy of the City of Poznań 2020+ - Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶¹⁵ [The idea and current activities - Smart City Poznań - Application and Smart Solutions for the City of | Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶¹⁶ [Smart project criteria - Smart City Poznań - Application and Smart Solutions for the City of | Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶¹⁷ <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiHq8ey7dP0Ah-WJHRQKHeHICSwQFnoECAQQAQ&url=https%3A%2F%2Fwww.ejournals.eu%2Fplik%2Fart%2F18385%2F&usg=AOv-Vaw3GRQZbF7hZfRF4AP8bDIJ7>

⁶¹⁸ Act of 5 June 1998 on district government. Journal of Laws 1998 No. 91, item 578.

both levels and is responsible for policymaking across various city areas such as transport and public roads, public education, welfare and spatial development⁶¹⁹.

To achieve a more agile and efficient City structure, in 2019 Poznan created the Smart City Team, responsible for the coordination and implementation of all smart initiatives. The **multidisciplinary team** of over 40 people is composed of a core group of 8 members fully dedicated to smart projects. The remaining team members integrate other Departments (which includes directors), **to ensure alignment across the City Hall administration, rapid responses and to promote cooperation between departments**. The team is organized in interrelated groups according to the six areas foreseen in the Smart City Strategy⁶²⁰.

The City's organisational structure also reflects this 'simplification'. Indeed, the Digitalisation and Cybersecurity Office, to which the Smart Team reports to, is now directly under the City Secretary and the Mayor⁶²¹. For this reason, the **Team benefits from a high level of autonomy to initiate smart initiatives**, in which only the bigger projects, more demanding in terms of funding, require the Mayor's approval.

With respect to the City's internal capacity, the **Strategy recognized the lack of certain competencies as a possible barrier to its effective implementation**. Therefore, the strategy⁶²² included training initiatives to civil servants accompanied by an appropriate communication/information policy to overcome the resistance to change by the employees.

To this end, since 2018 the Municipality offers courses on several topics (from foreign languages, cybersecurity up to communication with customers), via an internal **e-learning platform**⁶²³. In 2018, more than 1,600 employees participated in courses through the platform, which includes training on English in administration, and customer service and courses for officials and executives on the **GDPR** (General Data Protection Regulation)⁶²⁴. In 2020, around 1,500 civil participants participated in training initiatives, conferences, or saw their courses being co-financed by the City. In the digital field, only nearly **2% of the employees received training in digital competencies**. After the training, each department usually conducts a performance analysis, to evaluate the improvements registered. An example of a mandatory course cross-cutting to all the workers was the **training on the Agile Methodology**⁶²⁵. This course introduces an agile way of thinking to manage complex projects, particularly IT projects. The methodology focuses on how to handle and promote a close cooperation between several parties. It is also an iterative and more effective way of delivering results through flexible adaptation to changing circumstances. In addition, in partnership with the University of Social Sciences and Humanities of Poznan, the City of Poznan launched the program **"Change Leaders"**, as they believe that digital transformation must be accompanied by a change in the mindset of civil servants which is still a bit "silo-oriented". This program provided by the partner University was undertaken by 13 city officials in 2018 and 2019⁶²⁶.

⁶¹⁹ [Organisational Structure - City of Poznan | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶²⁰ [Smart City Team - City of Poznan | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶²¹ [Organisational Structure - City of Poznan | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶²² [Development Strategy for the City of Poznan to 2020+ - Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶²³ [Samorządowa Platforma Edukacyjna \(www.poznan.pl\)](https://www.poznan.pl)

⁶²⁴ [Kryteria projektów smart - Smart City Poznań - Aplikacja i Inteligentne Rozwiązania dla Miasta | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶²⁵ **Error! Hyperlink reference not valid.**

⁶²⁶ [Agile methodology in poznań City Hall - Smart City Poznań - Application and Smart Solutions for the City of | Poznan.pl \(badam.poznan.pl\)](https://www.poznan.pl)

9.2.1.2 Data Management

The City strives to optimize the decision-making process through data and there are already some concrete examples of such efforts. In 2018, the City launched **BaDaM**⁶²⁷, a **database of the City of Poznan**, that presents statistical indicators related to many aspects of the development of the city (demographic, labour market, education, economy, environment). The platform provides city stakeholders with an overview of the evolution of the city, and knowledge on specific domains, while fostering transparent communication with citizens. The setup of BaDaM involved more than 80 units and organisations, within the City Hall, private sector and non-governmental institutions. The National Statistical Authority, Statistics Poland (GUS)⁶²⁸ also contributed to this effort by providing part of the data. The portal presents an annual report of the City of Poznan that characterizes the city performance on the basis of statistical information but also taking into account different policies and actions⁶²⁹.

However, **the City recognizes that the lack of data standard formats is a limitation of this portal.** For this reason, **the City Hall recently partnered with the Poznan Supercomputing and Networking Center to develop an open data platform that will accelerate data modelling integration.** For the future, the City also plans to better leverage on open data, particularly for Mobility and Urban Planning.

For instance, in the mobility domain, since 2019, the Urban Transport Authority of Poznan (ZTM - Zarząd Transportu Miejskiego)⁶³⁰, a company in which the City holds shares, uses different tools to collect and share data. The infrastructure is composed by on-board computer units installed on vehicles and a database schedule system provides information on the real time location of vehicles and other related data (e.g.: whether it is a low-floor or low-entry vehicle, air conditioning, space for vehicles). The data collected is open and follows Google guidelines and standards GTFS – General Transit Feed Specification).⁶³¹ This project, GTFS-RT Schedules⁶³² is already used by the ZTM in managing urban transportation, but will also be **useful for developers to create new applications**⁶³³. The infrastructure created will also be relevant for the development of a traffic model capable of providing the real picture of road traffic flows and intensity in the city⁶³⁴.

The City also cooperates with data providers for the development of digital services. For instance, this includes the company Aquanet⁶³⁵ which is a great source of water consumption data for the City, and also inner providers, such as the City Cadaster Board GEOPOZ⁶³⁶, active in the field of geodesy and property management in Poznan, that provides the City with valuable spatial information.

The City has yet to develop an interoperability strategy, but already follows some international standards, namely OASC's Minimal Interoperability Mechanisms (MIMs).

⁶²⁷ [Education in Poznań in 2020/2021 - data - BADAM Poznań](#)

⁶²⁸ [Statistics Poland](#)

⁶²⁹ [Statistics Poland \(badam.poznan.pl\)](#)

⁶³⁰ [Transport guide » Zarząd Transportu Miejskiego w Poznaniu \(ztm.poznan.pl\)](#)

⁶³¹ [Visão geral da GTFS Realtime | Realtime Transit | Google Developers](#)

⁶³² [Poznan.pl - Plan Poznania - Transport \(www.poznan.pl\)](#)

⁶³³ [For Developers » Public Transport Authority in Poznań \(ztm.poznan.pl\)](#)

⁶³⁴ [Smart City Poznan - City of Poznan | Poznan.pl \(www.poznan.pl\)](#)

⁶³⁵ [www.aquanet.pl](#)

⁶³⁶ [Board of Geodesy and Municipal Cadastre GEOPOZ](#)

9.2.1.3 Societal Engagement

The City of Poznan has highlighted in its strategic priorities the importance of **co-creation to better address citizen's needs**. In order to do so, the City has enabled **new points of interaction and communication** for a more trust-based and transparent relationship with citizens.

To begin with, **citizens were engaged in the co-design phase of the City Development strategy**. In addition, BadaM is an example of a new channel of interaction, which enables a transparent monitoring of the operations of the City. This platform is complemented by other city initiatives such as the City **participatory budget**⁶³⁷ and the **platform for public consultations**⁶³⁸.

In 2020, 55 public consultations were undertaken in several domains, from local spatial development plans up to road projects⁶³⁹. Due to the COVID-19 pandemic, a significant part of these activities moved to the online format, while before they were mostly held physically. Nevertheless, there was opportunity to arrange participatory activities directly with residents at their residencies⁶⁴⁰. These consultation processes have involved several City Departments and 7,174 people participated⁶⁴¹. All **information concerning the City's public consultations is available online**⁶⁴². The procedure starts with the online announcement of the consultation on the website with an article specifying all the related details (the topic under discussion, when it will be held and how to participate). At the end of the consultation, a report is made available, in which the City officials address the comments received.

The Poznan's Civic Budget⁶⁴³ **invites citizens to make real budgetary decisions on the best use of a certain amount of the City's budget (around 0,5% of the total budget)**. Citizens can submit proposals and vote on the online platform. The initiative started in 2013⁶⁴⁴ and takes place on a yearly basis. According to a research study on the participatory budget of 2018 in the major cities in Poland⁶⁴⁵, Poznan follows a strategy of supporting less projects (30) but with higher amounts, when compared with other cities. Additionally, the study found that the voting moment, held online resulted in participation rates of 10% of the population. This participation can be considered positive from the perspective of the consultation process. In 2020, a record number of votes was registered, with 87,575 electronic votes⁶⁴⁶. Also in the last edition, a new feature was introduced, the **Green Budget**, oriented towards the development of public green areas, according to the conditions set in the Spatial Development Plan of the City. The team responsible for coordinating this activity is composed by representatives of several city groups (residents, Poznan City Council, City Hall, non-governmental organisations)⁶⁴⁷. Even considering that since 2019 the local Participatory Budget became mandatory for bigger cities⁶⁴⁸, **the relevance of this initiative is that it triggers the demand for other participatory mechanisms, such as more public consultations and civic labs**.

⁶³⁷ [Poznański Budżet Obywatelski - 2022 - \(um.poznan.pl\)](https://um.poznan.pl)

⁶³⁸ [Public consultation | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶³⁹ [PUBLIC CONSULTATION - Public consultation | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶⁴⁰ [PUBLIC CONSULTATION - Public consultation | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶⁴¹ [PUBLIC CONSULTATION - Public consultation | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶⁴² [Public consultation | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶⁴³ [Poznański Budżet Obywatelski - 2021 - \(um.poznan.pl\)](https://um.poznan.pl)

⁶⁴⁴ [Poprzednie edycje PBO - Poznański Budżet Obywatelski - 2021 \(um.poznan.pl\)](https://um.poznan.pl)

⁶⁴⁵ [PDF\) Participatory Budgeting in the Major Cities in Poland – Case Study of 2018 Editions \(researchgate.net\)](https://researchgate.net)

⁶⁴⁶ [Poznan Civic Budget - City of Poznan | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl)

⁶⁴⁷ [Znamy skład Zespołu ds. PBO - Poznański Budżet Obywatelski - 2022 \(um.poznan.pl\)](https://um.poznan.pl)

⁶⁴⁸ [Poland \(pbatlas.net\)](https://pbatlas.net)

In 2016, the City Mayor also launched the **Centre for Local Initiatives (CIL)**⁶⁴⁹ to improve the conditions for the cooperation and development of local communities. Each CIL promotes its own initiatives but also collaborates and supports the activities of other non-governmental organisations. The program considered two types of CIL- the **CIL Neighbourhood (CIL Sąsiedzki)**, **focused on a smaller and specific territorial area**, and the **CIL Regrant (CIL Regrantingowy) at the city level**- with 20 and 1 centers created, respectively⁶⁵⁰.

Moreover, **a central element in the societal interaction of the City with its citizens is the Smart City Poznan App**⁶⁵¹. According to the Smart City Team, this project "is probably one of the most remarkable creations" developed by the team so far. **Its functionality connects different solutions, normally used separately in city management and essential for communication and decision-making**, such as the direct to Poznan Contact Office, easy access to city information or the opportunity to report non-emergent situations. The application combines the functionalities and replaces two other applications- "Intervencje" (Interwencje)⁶⁵² and "Poznań in order" (Poznań w porządku)⁶⁵³.

The app is essential for the communication between the City Hall and its citizens, where apart from sharing information on the city it also provides several alerts (e.g.: air pollution, road works or meteorological warnings). Additionally, it allows citizens to report problems, participate in city surveys and submit suggestions of initiatives. After submitted, their ideas or proposals are allocated to the competent department and the user is able to check whether the submitted idea was accepted or not. The application also enables the users to directly connect to the relevant city websites, web portals and projects.

The Smart City App project was under the coordination of the Smart City Team involved also other Poznan City Hall departments (Digitalisation and Cybersecurity Office, Municipal Management Department, Department for Support of Municipal Auxiliary Units, the City Traffic Engineer, Crisis Management and Security Department, the Poznan Contact Office and the Security Department and Municipal Road Administration). At the external level, other organisations were also involved, namely the Wielkopolska Investment Support Center Ltd (Wielkopolskie Centrum Wspierania Inwestycji Sp. z o.o.)⁶⁵⁴, the Municipal Guard, the Poznań Municipal Transport Company and the team from the portal Atmosphere for Poznań (Atmosfera dla Poznania)⁶⁵⁵. Their involvement was important in terms of information and data sharing, and in the implementation phase. Additionally, **in terms of data management and API integration, the City Hall team was supported by the Poznan Supercomputing and Networking Center**⁶⁵⁶ and **Geopoz**⁶⁵⁷, with the app development under the responsibility of Veracity Foundation⁶⁵⁸.

According to City representatives, the development of co-design initiatives for the development of digital solutions depends to some extent on the departments that are involved. **In some situations, the Smart City Team may develop new projects following a top-down approach** (e.g.: from the long waiting times

⁶⁴⁹ [Local Initiatives Centers - City of Poznan | Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶⁵⁰ [CIL 2021 - Centre for Local | Initiatives Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶⁵¹ [Smart City Poznan App - City of Poznan | Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶⁵² [Interwencje - Apps on Google Play](#)

⁶⁵³ ["Smart City Poznań" zamiast "Poznań w porządku" - Aktualności - Gospodarka komunalna | Poznan.pl \(www.poznan.pl\)](http://www.poznan.pl)

⁶⁵⁴ [Wielkopolska Investment Support Center Ltd | WCWI.com.pl](http://WCWI.com.pl)

⁶⁵⁵ [Atmosfera for Poznan \(www.poznan.pl\)](http://www.poznan.pl)

⁶⁵⁶ [Poznan Supercomputing and Networking Center | PSNC |](#)

⁶⁵⁷ [A short history - History - Board of Geodesy and Municipal Cadastre GEOPOZ](#)

⁶⁵⁸ [Veracity Foundation - we support managers and employees of enterprises and public administration](#)

registered in some of the city public services provided it was recognized the need to update the e-services portal of the Municipality). Nevertheless, on other initiatives, citizens are invited to participate and collaborate in the design process. For instance, in 2021, the Smart City Team together with operators of e-scooters, local companies and the Municipal Guard, organized an event with workshops and public consultations related to safe micromobility in the city⁶⁵⁹. Many people were offered a free ride on an electric scooter and shared their opinion on the future of urban micromobility zones. Hundreds completed online questionnaires (also through the Smart City Poznan App), the analysis of which will be the basis for changes in the city.

9.2.1.4 Procurement

Traditional and innovative public procurement

In 2021, the European Commission published a study assessing the performance of each Member State in terms of national policy frameworks and on the adoption of innovative procurement practices and investments⁶⁶⁰. From the country specific analysis, **Poland was considered a low-performing country in this domain**, ranking 21st out of the 30 countries analysed⁶⁶¹.

The main national authority responsible for the innovation procurement policy in Poland is the Ministry of Entrepreneurship and Technology. Besides that, the Public Procurement Office (PPO)⁶⁶², a government agency under the supervision of the Ministry, prepares drafts and revisions of legislative acts on public procurement, and organizes training programs or other events, and promotes international cooperation on this issue. In this context, under the project “Effective public procurement 2017-2018”⁶⁶³, the PPO promoted 52 trainings sessions, targeting central, regional and local administrations, which counted with the participation of nearly 1,700 public officials. However, most of the trainings were broad and not specifically dedicated to in-depth insights on innovation-related procurement.

Despite the poor performance at the national level, the report also highlighted the **high decentralization of the Polish public procurement system, which allows all contracting authorities (including local administrations) to set their own secondary policies and objectives.** In fact, this is bringing some benefits to local administrations, as procurers at local level account for the highest fraction of public procurement of innovative (PPI) investments (56%) and for the ICT-based PPI investments (40%), significantly above the European averages of 29% and 10%, respectively.

Nevertheless, Poznan City representatives regard **procurement processes has an obstacle to innovation.** In practice, **the City does not follow public procurement of innovative solutions (PPI) on the digital domain, but in some instances, it adopts pre-commercial procurement (PCP) and joint procurement procedures to overcome the limitations of traditional procurement procedures.** The joint procurement procedures save on administrative costs, which was the case in the co-creation of the city’s film platform with a public partner. The City has regular interaction and cooperation with the PPO, notably on the report of irregularities related to the functioning of the e-procurement platform, and submission of requests to address inaccuracies in the regulations governing joint procurement procedures. Additionally,

⁶⁵⁹ [Micromobility in Poznań - News - City of Poznan | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl/en/news/micromobility-in-poznan)

⁶⁶⁰ [Results of EU wide benchmarking of innovation procurement investments and policy frameworks across Europe | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/eip/eip-2017-2018/)

⁶⁶¹ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=70281

⁶⁶² [Strona główna - Urząd Zamówień Publicznych \(uzp.gov.pl\)](https://uzp.gov.pl/)

⁶⁶³ [Effective public procurement – strengthening the potential of administration \(OP WER\) - 2017-2018 - Public Procurement Office \(uzp.gov.pl\)](https://uzp.gov.pl/)

recently the City Hall also collaborated with PPO on a training - the first edition of POZAP– Poznan on Public Procurement⁶⁶⁴. The event counted with the participation of 20 experts on the topic of public procurement and with the honorary patronage of the President of the Public Procurement Office. Apart from the training initiatives of PPO, the City also participated in trainings and conferences of public procurement from the private partner ApexNet⁶⁶⁵, or from Przetargowa,⁶⁶⁶ a Community of Public Procurement Practitioners.

Financing digital solutions

The key funding sources for digital innovation have been **Cohesion funds and Horizon 2020**. Since 2004 the City has mobilised around €1.088 bn⁶⁶⁷ in European funds, with €326 mn⁶⁶⁸ referring to the programming period 2014-2020⁶⁶⁹. For instance, the **Poznan 3D map project**⁶⁷⁰, received indirect support from EU funds, namely through the digitalisation and modernization of the geodetic and cartographic resources of the City of Poznan, of approximately €1.154 mn, and on the improvement of the quality of data on land in Poznan with €333,000⁶⁷¹. Also, the City considers regional funds as highly relevant to finance their digital initiatives.

9.2.2 Change Management

At the beginning of its digital transformation process the **City placed its involvement in EU initiatives and European networks as a relevant aspect to support knowledge exchange with other cities that face similar problems**⁶⁷².

Nevertheless, its involvement in European cities networks started even before the digital topic became a topic on the policy priorities of the City. **In 2004, when Poland became a EU Member State, Polish cities could apply for membership in the Eurocities network**⁶⁷³. In the same year, Poznan joined the network and since then it has been participating on its annual general meetings, forums and working groups⁶⁷⁴. This network, founded in 1986, provides a platform for knowledge exchange between cities to find innovative solutions to common problems.

Also, they took into consideration the importance of international data standards. As a result, in 2016, the City of Poznan joined the Open & Agile Smart Cities Initiative (OASC)⁶⁷⁵, a network that aims to “promote the exchange experiences and good practices with regard to using open data and interoperable systems for the creation of innovative solution of smart cities”. In 2020, the **City of Poznan became the coordinator of the participation of Polish cities in OASC**⁶⁷⁶.

⁶⁶⁴ [POZAP](#)

⁶⁶⁵ [APEXNET - About APEXNET | ApexNet Training](#)

⁶⁶⁶ [Strona główna - PRZETARGowa.pl](#)

⁶⁶⁷ According to ECB Euro foreign exchange reference rates of 8 December 2021.

⁶⁶⁸ According to ECB Euro foreign exchange reference rates of 8 December 2021.

⁶⁶⁹ [Home - PRZETARGowa.pl \(badam.poznan.pl\)](#)

⁶⁷⁰ [virtualcityMAP - 3D-Stadtmodelle im Browser \(sip.poznan.pl\)](#)

⁶⁷¹ Information provided by the City representatives.

⁶⁷² [Smart City Leader Interview: Michal Lakomski, Smart City Poznan \(beesmart.city\)](#)

⁶⁷³ [Eurocities - Home](#)

⁶⁷⁴ [Eurocities - Poznan Biznes Partner | Poznan.pl \(www.poznan.pl\)](#)

⁶⁷⁵ [Open & Agile Smart Cities \(oascities.org\)](#)

⁶⁷⁶ [Miasto Poznań zostało koordynatorem OASC Poland - Aktualności - Smart City Poznań - Aplikacja i Inteligentne Rozwiązania dla Miasta | Poznan.pl \(www.poznan.pl\)](#)

Additionally, the City of Poznan was a leader coordinator of the European project - **Cities of Change (CCnet)**⁶⁷⁷-, that took place between 2013-2015. The objective was to **establish an European network for the exchange of experiences and good practices in the broad field of development policies** and counted with the participation of 14 other European cities⁶⁷⁸. In order to do so, **the project included capacity building activities** (conference, workshops and lectures) focusing on three key thematic areas: *systems of strategic monitoring, methods of public consultations involving citizens and analysis of quality life indicators*⁶⁷⁹. These events were attended by representatives of each partner city, 658 citizens in total, and employees from the Poznan City Hall⁶⁸⁰. The content of each event was designed by the coordinators of the City of Poznan, in collaboration with a Scientific Council composed by several academics from Poznan universities⁶⁸¹. According to City representatives, there is still today interaction and communication with partners and the learnings from the events were useful in the development of the City Strategy. The project was funded by the European Commission, under the framework of the Programme Europe for Citizens⁶⁸².

The City has also signed the Living-in-EU declaration⁶⁸³, devoted to “building the European way of Digital Transformation” in European Cities, through key principles such as the citizen-centric approaches, with interoperable digital platforms and an open innovation ecosystem⁶⁸⁴. In 2021, **Poznan integrated the 100 Intelligent Cities Challenge (ICC)**, the European Commission initiative dedicated to support 136 cities in “using cutting-edge technologies to lead the intelligent, green and socially responsible recovery”. Poznan’s ambition on being part of this network is to be part of the leading cities on the “green and digital transitions”.⁶⁸⁵

The involvement within EU initiatives and European networks has been important to nurture ecosystem collaboration (with NGOs, universities, tech centres). However, the City representatives recognize that they still have work to do, in order to better engage with its innovation ecosystem and full leverage from its capabilities. In this regard, the Poznań Supercomputing and Networking Centre (PSNC) has been an important partner for the development of digital solutions. In fact, in 2017, PSNC was appointed as “the official technological partner of the City Hall in the area of digitization”⁶⁸⁶ as part of the Digital Transformation Program PSNC led for Poznan. However, there were already some visible results even before this official partnership was established. In fact, the PSNC collaborated in the design and development of the **Municipal Multimedia Guide (MIM)**⁶⁸⁷, a platform of communication between the City, visitors and residents. The content available on MIM is prepared by several City departments and it offers useful information on the interests and concerns of citizens. For instance, in 2020, the MIM registered 9 million visits, in which the most

⁶⁷⁷ [City of Poznań - Poznan.pl - Poznan.pl \(ccnet.poznan.pl\)](http://City of Poznań - Poznan.pl - Poznan.pl (ccnet.poznan.pl))

⁶⁷⁸ [CC NET. CITIES OF CHANGE - cooperation of cities in the field of city development" - Europe for citizens, Partner cities networks - Environment | Poznan.pl \(www.poznan.pl\)](http://CC NET. CITIES OF CHANGE - cooperation of cities in the field of city development)

⁶⁷⁹ CCnet - Poznan.pl - Poznan.pl

⁶⁸⁰ CCnet - Poznan.pl - Poznan.pl

⁶⁸¹ [Scientific Council - Poznan.pl - Poznan.pl \(ccnet.poznan.pl\)](http://Scientific Council - Poznan.pl - Poznan.pl (ccnet.poznan.pl))

⁶⁸² <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:377:0009:0013:EN:PDF>

⁶⁸³ [We signed | Living in EU \(living-in.eu\)](http://We signed | Living in EU (living-in.eu))

⁶⁸⁴ [We signed | Living in EU \(living-in.eu\)](http://We signed | Living in EU (living-in.eu))

⁶⁸⁵ [The European Commission's Intelligent Cities Challenge enters its next phase - News - City of Poznan | Poznan.pl \(www.poznan.pl\)](http://The European Commission's Intelligent Cities Challenge enters its next phase - News - City of Poznan | Poznan.pl (www.poznan.pl))

⁶⁸⁶ [\(PDF\) Common Data and Technological Partnership - The Foundation for the Development of Smart Cities - Poznań Case Study \(researchgate.net\)](http://(PDF) Common Data and Technological Partnership - The Foundation for the Development of Smart Cities - Poznań Case Study (researchgate.net))

⁶⁸⁷ [Strona główna - Poznan.pl \(www.poznan.pl\)](http://Strona główna - Poznan.pl (www.poznan.pl))

searched topics were bicycles in Poznan and the Poznan website⁶⁸⁸. The sections of the MIM most visited in 2020 were the Public Information Bulletin⁶⁸⁹ and Info⁶⁹⁰ and Education⁶⁹¹.

More recently, PSNC and the City Hall co-organized the City Development Forum⁶⁹², in collaboration with Association of Polish Cities, the Union of Polish Metropolises and the Group MTP⁶⁹³ (a Polish company specialized in the organisation of events and conferences). The event started in 2017, and the edition of 2021 was focused on the topics of *Smart Inclusive City Actions*, *Open Smart City Actions* and *Energy Cleantech Smart City*⁶⁹⁴.

The Wielkopolska Investment Support Center Ltd (WCWI)⁶⁹⁵ is another important partner on smart city projects. The WCWI cooperation with the City involves, participating as experts on projects, coordinating pilots that make use of advanced technologies and also analyses of the world's trends and best practices⁶⁹⁶. For instance, the project Coworking Space Plus One⁶⁹⁷ (“+jeden”) is a co-working place of incubation and knowledge exchange for new startups in the technological field. The project resulted from a joint venture of the City Hall and the WCWI. In 2020, this place counted with 1,144 registered users (from the IT industry, students and architects), and offered 200 training initiatives and consulting sessions, organized by several non-governmental organisations or from the Advisory and Training Center (ODS), the Faculty of Economic Activity and Agriculture, that benefited a total of 8,800 participants⁶⁹⁸.

9.3 Digital Service Innovation Maturity

The ICT infrastructure of Poznan is an important factor supporting the efforts of the City to increase the digital maturity of public service provision.

In 2011, the City collaborated with the PSNC to build an optical fiber network which resulted in the connection of distributed branches of the City Hall to the scientific institutions⁶⁹⁹. In fact, PSNC is the operator of the POZMAN network with a length of 200km of optical fiber cables that cover almost the entire city⁷⁰⁰ and provide the City administration as well as academic institutions (universities, schools and research centers) with access to several network services⁷⁰¹. The PSNC is also responsible for managing the City Wireless network that offers free Wi-Fi access to residents and tourists⁷⁰². The Wi-Fi network range covers not only the City old town but also some specific locations in other municipalities of Poznan's Metropolitan Area⁷⁰³.

⁶⁸⁸ [Strona główna - Poznan.pl \(badam.poznan.pl\)](#)

⁶⁸⁹ [Otwarta administracja Miasta Poznania - Badam](#)

⁶⁹⁰ [Info - Info | Poznan.pl \(www.poznan.pl\)](#)

⁶⁹¹ [Poznański Serwis Oświatowy | Poznan.pl \(www.poznan.pl\)](#)

⁶⁹² [Main page - Forum Rozwoju Miast](#)

⁶⁹³ [Grupa MTP](#)

⁶⁹⁴ [programme - Forum Rozwoju Miast](#)

⁶⁹⁵ [About | Wielkopolska Investment Support Center Ltd WCWI](#)

⁶⁹⁶ [The idea and current activities - Smart City Poznań - Application and Smart Solutions for the City of | Poznan.pl \(www.poznan.pl\)](#)

⁶⁹⁷ [Plus Jeden - Strefa +jeden](#)

⁶⁹⁸ [Plus Jeden - Strefa +jeden \(badam.poznan.pl\)](#)

⁶⁹⁹ [\(PDF\) Common Data and Technological Partnership - The Foundation for the Development of Smart Cities - Poznań Case Study \(researchgate.net\)](#)

⁷⁰⁰ [ICT - Facts and figures | Poznan.pl \(www.poznan.pl\)](#)

⁷⁰¹ [Poznańskie Centrum Superkomputerowo-Sieciowe | PCSS |](#)

⁷⁰² [Jak to działa? - Poznan.pl \(wireless.poznan.pl\)](#)

⁷⁰³ [Free WiFi access in and around Poznań - POZnan.travel](#)

Moreover, in 2019 **Poznań received funds from WiFi4EU**⁷⁰⁴, the EU initiative to “promote free Wi-Fi connectivity for citizens and visitors in public spaces such as parks, squares, public buildings, libraries, health centres, and museums everywhere in Europe”. The official communication from Smart City Poznan states that “the funds will be used to develop wireless, open and universal access to information about the city and the resources and services of the Internet”⁷⁰⁵. Thanks to this, **access to free internet has already been granted in 10 new locations in Poznan**⁷⁰⁶.

At the national level, there have also been efforts to overcome some of the bottlenecks of the ICT infrastructure. For instance, Poland has received, through the Operational Program Digital Poland (2014-2020)⁷⁰⁷, around € 2 bn from the European Regional and Development Fund (ERDF) to address disparities in the access to fast broadband, improve digital competencies, and support the progress of digitalisation of public services. So far, only 20,000 households out of the 2 million target have access to broadband of at least 30 Mbps, with the remaining planned for the next period.

Nevertheless, a report from the Polish National Statistical Authority⁷⁰⁸, pointed out that in 2019 **the metropolitan area of Poznan was amongst the best in the country in terms of internet access and citizens’ use of e-government services**, 93% and 63.8%, respectively.

According to the City, the **integration of more advanced technologies in public services**, such as artificial intelligence or an urban platform, **faces key obstacles such as the high complexity of procurement procedures and the lack of adequate IT infrastructure.**

However, the City has invested in more advanced technologies to provide more efficient public services. In this sense, the **3D Map tool** is an example of that (Box 8).

Box 8 - Zoom-in: 3D Map of the city

○ Overview

The 3D map⁷⁰⁹ illustrates the progress made by the City in the field of spatial & building. This solution is a digital 3D model covering the whole area of Poznan (262km²) and nearly 100,000 buildings, with easy online access. Created in 2018 with the purpose of serving citizens, real estate developers, and the City Hall workers, the City embraced the journey from physical to online maps by creating first 2D maps, and ultimately the goal is to develop a full digital twin. Currently, the 3D map brings several benefits, such as: new possibilities for data analysis and easy participation from relevant stakeholders in the field; better and digitally-enabled planning of the city; facilitated real estate management; and better environmental planning.

○ Relevance and uniqueness

⁷⁰⁴ [Wifi4EU Free Wifi for Europeans \(europa.eu\)](https://europa.eu/wifi4eu/)

⁷⁰⁵ [Poznań otrzymał środki z WiFi4EU - Aktualności - Smart City Poznań - Aplikacja i Inteligentne Rozwiązania dla Miasta | Poznan.pl \(www.poznan.pl\)](https://www.poznan.pl/aktualnosci/Smart-City-Poznan-Aplikacja-i-Inteligentne-Rozwiazania-dla-Miasta)

⁷⁰⁶ [10 new hotspots in Poznan thanks to WiFi4EU - TELKO.in](https://www.telko.in/10-new-hotspots-in-poznan-thanks-to-wifi4eu/)

⁷⁰⁷ [OP Digital Poland - Regional Policy - European Commission \(europa.eu\)](https://europa.eu/digital-poland/)

⁷⁰⁸ [Statistics Poland / Topics / Science and Technology / Information society / Information society in Poland. Results of statistical surveys in the years 2015–2019](https://stat.gov.pl/topics/science-and-technology/information-society/information-society-in-poland-results-of-statistical-surveys-in-the-years-2015-2019)

⁷⁰⁹ [virtualcityMAP - 3D-Stadtmodelle im Browser \(sip.poznan.pl\)](https://sip.poznan.pl/virtualcityMAP-3D-Stadtmodelle-im-Browser)

The City wanted to be a pioneer in terms of visual data. The service is unique for technical reasons, which allow for rapid scalability and integration with data from other municipalities. It is also compliant with the City's Geographic Markup Language (GML) 2.0 standards, and the map is updated regularly. Importantly, it operates with various data formats, makes use of open-source software and aims to pave the way for a digital twin. An ongoing project aims to expand the solution to the whole metropolitan region (18 municipalities).

This project also drives citizen engagement, as the City instigates principles of collaboration between stakeholders, i.e., transparency and open access to data, thus creating a 3D map is an important step to consolidate the strategy and incentivize participation. Indeed, the online map has new features on the service that allow the user to interact directly with the platform for making suggestions, recommendations, or claims.

This service also paves the way for better predictions and anticipatory governance amidst external shocks. Additionally, this solution contributes to the City's ambition to be a pioneer in digitalisation in Poland, as no other city has developed such a service.

○ **Challenges & Drivers**

In the journey of going from physical maps to digital ones, the City started creating 2D maps of the city and later developed the current solution. Faced with an increasing demand for spatial data, both within the City Hall and externally, in 2018 the City and GEOPOZ – a city unit which has developed the initiative – decided to improve the visualisation capabilities of the 3D map. With the proper infrastructure in place, this was a natural evolution.

○ **Implementation and Monitoring**

The team started by conducting a SWOT analysis to have a clear overview before advancing with the initiative, taking into account the City's needs in terms of technological developments, the expected impact, as well as the time and costs allocated for the maintenance of the system. All project documentation was prepared by the team composed by: the Geopost unit, a contractor (which was found through public procurement) to develop the solution, and the Municipality, responsible for supervising the process (with the department of Projects Coordination being directly involved) and with some input also from Poznan's University of Technology.

The team put a strong focus on data collection and processing; it was very important to ensure the collection of real-time data (based on a city GML 2.0 standard), to guarantee weekly updates and to make sure the needs of the users were addressed. Overcoming technical conditions for processing large data sets was one of the key barriers at the implementation phase. Additionally, the City faced some bottlenecks in terms of financing, finding the right team and skills to support the creation of 3D map, and some resistance to change, as no other city in Poland had implemented such a solution. The City continues to monitor the solution and provides corrective maintenance. However, no KPIs for success have been set yet. The service was mostly financed by internal funds but previous European projects also indirectly contributed to the development of part of the infrastructure used in the project.

○ **Impacts**

Users downloaded 1.5 million objects (as of July 2021) – on the 100.000 buildings the solution covers. Since the service was created, the feedback from the users has been mostly positive. In particular, users

believe this solution supports the planning activities of City Hall employees, allowing for informed decisions on real estate purchases and a visualisation of the City's development plans.

While no official information besides the number of downloads has been tracked, every single plan of the city is nowadays presented in a digital way through this 3D map, thus making it easily available to everyone. The City believes that the solar potential layer (which is being added to the service soon and which will allow for the identification of areas with solar light potential) will make the service even more popular. The service is also improving the security of citizens, as the solution produced heat maps of some wild animals that are invading the city, and hence supports targeted and informed decision-making.

9.4 Conclusions and lessons learned

The City of Poznan has already progressed on its digital transformation journey, which will be reinforced by the implementation of the Smart City strategy, with investments in crucial aspects to support future priorities, such as the creation of a cross-cutting team responsible for the coordination of all smart city initiatives, the prioritization given to citizen engagement and the increasing participation and alignment with European initiatives and cities' networks.

Below we explore in more detail some of these **potential lessons learned from the experience of Poznan** to transform public service provision through digitalisation:

i) *The creation of the Poznan Smart City Team has already improved the coordination and governance of the digital portfolio in the City.*

The establishment of a multidisciplinary team focused on the coordination and implementation of the Smart city strategy shows that digitalisation is high in the political agenda. The fact that it is composed of not only by a core team but also by representatives from other City departments, including their leaders, leads to more agile decision-making through better communication and alignment of priorities. This structure is also conducive to the identification of the internal expertise within the City that can then be mobilised for the development of each project.

ii) *The lack of an open data platform means there is untapped potential from the use of data towards better informed decisions, and to truly activate a consistent collaboration with the innovation ecosystem.*

The City already undertakes some open data practices in specific domains such as the mobility-related *GTFS-RT Schedules* project, or the creation of the 3D Map for better urban planning, in which the open-source solution and the standardization of data are allowing the project to evolve and to expand to encompass the whole region.

However, the City recognizes that a unique and common open data platform is an element lacking to fully leverage from it to make decisions and boost collaboration with the different actors of the ecosystem. The City Hall is already working towards developing this open data platform in cooperation with PSNC.

iii) *The prioritization given to ensure better communication and engagement with citizens is a crucial element to establish a stronger and more participatory community.*

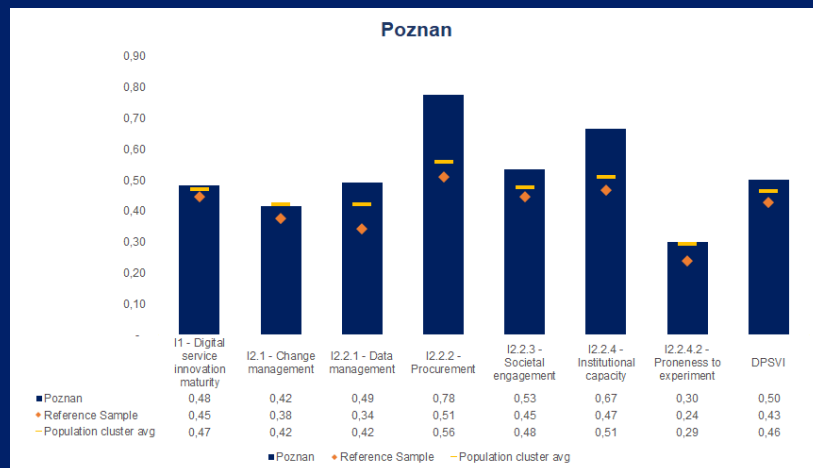
The investment in projects and initiatives to better communicate with citizens is a clear priority of the City. The co-creation process part of the main City Strategy was crucial to support the clear identification of citizens' needs and concerns to then shape the City priorities and plan future developments.

Nevertheless, the City has already put in place some initiatives to keep promoting regular interactions, some more technology-driven, such as the Smart City App, and others not so tech-focused but still relevant such as the Joint Community Centers, public consultations or participatory budgets. These initiatives are also behind the progress made in generating bottom-up initiatives, but there is still room for improvement to have fully community-driven projects.

Poznan

Performance according to the Digital Public Service Value Index (DPSVI) based on Digisurvey

DPSVI performance slightly above the reference sample and above the same population cluster average



Strengths (above average): Procurement; Institutional capacity; Societal engagement; Data management; Digital service innovation maturity; Proneness to experiment; Change management

Figure 14 - Performance of the city of Poznan in the DPSVI relative to the reference sample and the population cluster average

10 Case Study: Rotterdam (The Netherlands)

10.1 Overview and approach to digital innovation

The City of Rotterdam is the second-largest city in the Netherlands, with a population of 651,157⁷¹⁰. The city is well known for being home to Europe's largest port, making it a "gateway for Europe" and an important centre of trade⁷¹¹. Rotterdam is shifting from an industrial to a service-based economy, with growth in the sectors of the health, consumer services, logistics, knowledge and education⁷¹². The city has an important education centre which is well-connected to the Municipality and the innovation ecosystem⁷¹³.

Rotterdam aims to be an "**exemplary digital city by 2025**"⁷¹⁴, ensuring that digitalisation efficiently contributes to the social, economic, and physical development of the city. In order to achieve this, the City has already made significant efforts with proven results. In 2019, the City was considered one of the six most innovative cities in Europe⁷¹⁵ and was the winner of the International GeoBIM Award 2020 for 'Excellence in digital cities'⁷¹⁶. In 2021, the City was also recognised by UNESCO as a 'digital pioneer', being awarded with the 2021 Linking Cities Award in datasphere⁷¹⁷.

In the same year, the City **appointed for the first time a Chief Digital Officer**⁷¹⁸ responsible for the City's Digital Agenda⁷¹⁹ while ensuring the **liaison with the stakeholders outside the organisation**. In fact, in Rotterdam there is a **strong tradition of collaboration with the innovation ecosystem** and an increasing effort to involve citizens into the city's decision-making. **The City is also an innovator in procurement practices** to which European programs and national authorities have been also contributing to. **There is significant participation in European programs and national networks, from which the City has leveraged to develop its projects and accelerate the digital transformation**. The Digital Twin is one of those examples, being also an **important step towards the vision of becoming a data-driven organisation**.

10.2 Proneness to Change

Rotterdam has made significant efforts to use digitalisation as an enabler for efficient management and to achieve its ambitions in terms of "sustainability, circularity and inclusivity"⁷²⁰. For the City, digitalisation is more than a tool, in fact it is a completely new dimension that impacts the concept of 'city' and the way it interacts with the ecosystem.

The City adopted a **Digital Agenda** with technological infrastructure and innovative collaborative projects as strong foundations. The City is a reference in the use of innovative procurement practices to overcome the limitations of traditional processes. The City has been finding new opportunities to support its projects

⁷¹⁰ [StatLine - Population dynamics: birth, death and migration per region \(cbs.nl\)](#)

⁷¹¹ [Microsoft Word - DRAFT Final report Rotterdam CRC. 16 Aug 2010.doc \(oecd.org\)](#)

⁷¹² [international_cities_rotterdam.pdf \(jrf.org.uk\)](#)

⁷¹³ [Microsoft Word - DRAFT Final report Rotterdam CRC. 16 Aug 2010.doc \(oecd.org\)](#)

⁷¹⁴ [Rotterdam receives a datasphere award from UNESCO | TheMayor.EU](#)

⁷¹⁵ [European Capital of Innovation \(iCapital\) 2019 | European Commission \(europa.eu\)](#)

⁷¹⁶ [Archive - GEOBIM 2020 | Geospatial & BIM Virtual Conference \(geo-bim.org\)](#)

⁷¹⁷ [Archive - GEOBIM 2020 | Geospatial & BIM Virtual Conference \(unesco.org\)](#)

⁷¹⁸ [Rotterdam's first Chief Digital Officer prepares to take the helm - Cities Today \(cities-today.com\)](#)

⁷¹⁹ [De-digitale-organisatie.pdf \(rotterdam.nl\)](#)

⁷²⁰ [Rotterdam receives a datasphere award from UNESCO | TheMayor.EU](#)

and to deliver better public services to its citizens through its active participation in European, national and local networks.

10.2.1 Innovation governance

10.2.1.1 Institutional Capacity

Strategy

The digitalisation of Dutch cities has been placed as a priority not only at the local level but also at the national level. In 2017, a consolidated National Smart City Strategy⁷²¹ was presented at the request of the Dutch Prime Minister himself in the Summer of 2016⁷²². The national strategy was co-created with more than 140 people, among Dutch city representatives and employees, scientists and companies. The co-creation included joint workshops, bilateral meetings and the participation in the Smart City World Expo in Barcelona⁷²³.

The main objective of the Strategy was to create a **common vision for the direction of Smart Cities in the country**. In order to do so, the strategy set five preconditions to focus on: *Secure and standardize digital infrastructure, Public-private partnerships with room for improvement, New government models integrating citizens, Digital education and employability and Regional cooperation with cities as a network*. For each of these priorities, the state-of-play of Dutch Cities was assessed. For instance, the topic “*secure and standardize digital infrastructure*” involves focusing on data management, interoperability, cyber resilience and privacy law. Then, the last chapter of the strategy aims to specify action points for each of these areas, also with the collaboration of the national government. The leadership of the implementation and coordination of the strategy was attributed to the national networks of cities G5 and G32⁷²⁴, *i.e.*, the group of the largest 5 municipalities and the group of 32 middle to large size Dutch towns, respectively⁷²⁵.

This national strategy was preceded, in 2016, by a regional plan designed by the Metropolitan Region Rotterdam The Hague⁷²⁶ - *Metropoolregio Rotterdam Den Haag (MRDH)*. The strategic document ‘Roadmap Next Economy’⁷²⁷, sets the ambitions to renew the economy of the region, relying on five pathways: *smart digital delta, smart energy delta, circular economy, entrepreneurial region and next society*. Regarding Smart Digital Delta, the approach was to define projects that would set the basic conditions to achieve “breakthroughs to transform the sectors” that are part of this pathway, such as mobility, health, manufacturing and maritime and logistics. For example, the project **Digital Port**, designed to digitalise and “connect everything” in the Port of Rotterdam, has as foundational projects the Nautical efficiency (Port Call Optimization), Port Base (port community system); IoT for Logistics and Field lab Blockchain in Logistics. In 2021, the **City of Rotterdam was part of the group of 12 municipalities that, with the MRDH, developed**

⁷²¹ [NL-Smart-City-Strategie---DEFINITIEF.pdf \(ovlnl.nl\)](#)

⁷²² <https://observatory.mappingtheinternet.eu/item/dutch-smart-city-strategy-under-development>

⁷²³ [NL-Smart-City-Strategie---DEFINITIEF.pdf \(ovlnl.nl\)](#)

⁷²⁴ [G40 | G40 City Network \(g40stedennetwerk.nl\)](#)

⁷²⁵ [G40 | G40 City Network \(smartcityhub.com\)](#)

⁷²⁶ [WORKING TOGETHER MAKES STRONGER | MRDH](#)

⁷²⁷ [Roadmap-Next-Economy-Nederlandse-versie.pdf \(mrdh.nl\)](#)

the **Digital Strategy Guide**, to support the development of digital strategies of other municipalities in the region⁷²⁸.

Despite the national and regional digital framework in place, the City has also defined its own digital plans. In fact, according to the City, the **existing national and regional umbrella is not completely aligned with the City views on how to face and integrate the digital transformation process.**

The City considers that at both the national and regional level, Digital is still perceived as an instrument that can be used and not realizing that the reality, as the City perceives it, has changed. Accordingly, **the concept of “city” is changing.** In the past, the city as a concept was relying mainly on two dimensions, social and physical, and it was the interaction between these two that has defined how cities were created over centuries. **However, technological evolution and societal development brought a third dimension, the digital dimension,** which also interacts and impacts the other two. Starting from this argument, the City looked for a better understanding of what kind of role it should have, as an organisation, to accommodate this transformation. To this end, the City developed also in 2017 its own **Digital Agenda (DA)**⁷²⁹.

The DA integrates several projects and programs that have been jointly selected “to achieve user-friendly, efficient and contemporary services and to enable innovative projects” for the entire City. The DA is based on two main pillars- the *first* related to **building a solid foundation** (to guarantee a secure and reliable network, with good ICT infrastructures), and a *second* component that **establishes “differentiated and innovative projects to create conditions to work in a modern and efficient way”**⁷³⁰. The DA is not a static document, being annually updated, redefining priorities, deriving new projects, and recalibrating programmes considering the reality at each moment. The DA's programmes (such as the **Data-Driven Working Programme**⁷³¹ or the **Digital City Program**⁷³²) are cross-department projects that have a narrow focus and contribute to the accelerated implementation of digital services by the municipality and to the overall digital transformation of the city.

Governance

In 2015, the Dutch government introduced a new institutional reform that led to the abolition of the eight city regions established since 1995⁷³³. The reform put an end to the 2 city-regions of Rotterdam and The Hague, which then joined 21 other neighbouring municipalities to form the **new metropolitan organisation Rotterdam The Hague**, as mentioned earlier⁷³⁴. A similar metropolitan governance organisation came up in Amsterdam⁷³⁵.

Rotterdam and The Hague are the two biggest municipalities of the Metropolitan Region Rotterdam The Hague⁷³⁶ - *Metropoolregio Rotterdam Den Haag* (MRTH) which has two main responsibilities. On the

⁷²⁸https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjXqK7Khe30AhXxl2oFHU-OTaIsQFnoECAUQAQ&url=https%3A%2F%2Fwww.mrdh.nl%2Ffile-download%2Fdownload%2Fpublic%2F2349&usg=AOvVaw2UD-BAoiwYVYTuzVikNK_Bw

⁷²⁹ [De-digitale-organisatie.pdf \(rotterdam.nl\)](#)

⁷³⁰ [Information provision and automation | Budget Rotterdam 2020](#)

⁷³¹ [Information provision and automation | Annual accounts Rotterdam 2020](#)

⁷³² [Information provision and automation | Annual accounts Rotterdam 2020](#)

⁷³³ [profile-Netherlands.pdf \(oecd.org\)](#)

⁷³⁴ [SAMENWERKEN MAAKT STERKER | MRDH](#)

⁷³⁵ [profile-Netherlands.pdf \(oecd.org\)](#)

⁷³⁶ [WORKING TOGETHER MAKES STRONGER | MRDH](#)

one hand, MRTH is the transport authority of the region, with 90 out of the 100 employees of the organisation allocated to this area, where it receives direct funds from the central government (an annual budget of approximately €600 million)⁷³⁷. On the other hand, the MRTH has been assuming a function of promoter of regional economic development, with around 10 employees and a budget of EUR 5 million that comes directly from contributions of the municipalities.

The MRTH has also a role of promoter of collaboration between the municipalities, leveraging from the advanced stage of some to develop the all-region. The involvement and collaboration with the network of partners from academia and business communities is also promoted⁷³⁸.

At the City level, Rotterdam is structured around the City Council, “the highest administrative body of the municipality”⁷³⁹. The members of the Council are directly elected by the citizens and are responsible for setting the policies followed by the City. The City Council is organized in seven committees, covering the different city areas (e.g., energy transition, employment, mobility, or healthcare) that meet and choose, among them, the projects and policies to then be voted at the City Council. The executive body of the city is the College of Mayor and Aldermen⁷⁴⁰, composed of the Mayor and 10 council members, also part of the City Council, each one responsible for a different area of the city.

Apart from the political legislative and executive bodies, the City has also an administrative body, not politically appointed and six directorates that then embed multiple departments⁷⁴¹: Socio-Cultural Development Directorate, City Management Directorate, Urban Development Directorate, Employment Directorate, Citizen Services Directorate and Administrative and Group Support Directorate⁷⁴². The latter includes the **Department of Innovation, Information, Facilities and Research, known as IIFO** (Inovatie, Informatievoorziening, Facilitair en Onderzoek)⁷⁴³, Finance and Purchasing Department, Communication and Legal Management Department and the Management of Corporate Staff and Strategy.

The IIFO is composed of eight divisions, each one having its own Head and team⁷⁴⁴. Among these divisions, there is a team for project development, information management and user support. **The IIFO is responsible for the coordination of the Digital Agenda across the entire organisation**. To incorporate the views of the different Directorates and to align priorities with the Digital Agenda, **the coordination team of DA is also composed of two members of each of the six directorates**⁷⁴⁵.

In August 2021, the City appointed the first Chief Digital Officer (CDO)⁷⁴⁶ and created the Chief Digital Office with a team of 6 members. The CDO is an expert on the digital world and the decision of the nomination was taken by the Mayor to address a need of an ‘outside-inside’ perspective for the organisation to understand more clearly what the role of the municipality should be to promote the digital transformation of the city. As such, the CDO is deliberately positioned across the entire organisation. Its function is to

⁷³⁷ [MRDH organisation | MRDH Metropolitan Region Rotterdam The Hague](#)

⁷³⁸ [MRDH organisation | MRDH Metropolitan Region Rotterdam The Hague](#)

⁷³⁹ [| City Council Rotterdam.nl](#)

⁷⁴⁰ [College of B and W | Rotterdam.nl](#)

⁷⁴¹ [Rotterdam: From working city to network city - ppt download \(slideplayer.nl\)](#)

⁷⁴² [De-digitale-organisatie.pdf \(rotterdam.nl\)](#)

⁷⁴³ [De-digitale-organisatie.pdf \(rotterdam.nl\)](#)

⁷⁴⁴ [Decision of the group director cluster Administrative and Group Support of the Municipality of Rotterdam containing rules regarding powers \(Decree on submandate, sub-proxy and under-authorisation cluster Board and Concern Support\) \(overheid.nl\)](#)

⁷⁴⁵ [1550483108presentatie jos maessen, rotterdam.pdf \(pleio.nl\)](#)

⁷⁴⁶ [Rotterdam's first Chief Digital Officer prepares to take the helm - Cities Today \(cities-today.com\)](#)

transpose and to be the liaison of what is happening 'outside' to the 'inside' departments, ensuring that the municipality is aligned with the overall digital evolution and that it has the skills and knowledge to become a true a smart city⁷⁴⁷.

The City staff includes programmers, data analytics employees on the different directorates, and several technology-oriented experts⁷⁴⁸. Nevertheless, to prepare and build the internal capacity further, the City has put in place some initiatives. Initiated in 2018, the City has developed the **Digital Experimentation Centre (DEC)**⁷⁴⁹ in partnership with a private company, Inspark⁷⁵⁰. The DEC is a space for experiments and to share knowledge currently designed for the city employees of the Urban Development and the City Management Directorates. It allows them to try IT solutions and digital developments to experience the added-value of each solution and understand which ones improve internal work processes. In March 2022, a new center called **VONK** will open, which will also be externally focussed to create a 'digital-physical dataspace' for new innovations in the city.

10.2.1.2 Data Management

The City has the ambition to become a data-driven organisation. In order to do so, the Municipality started by hiring two data management specialized companies, Scamander⁷⁵¹ and Shared Business, to support the setup of a data management strategy. This process began with an internal awareness-raising campaign to show the importance of data within the organisation. The campaign included the Scamander Datapoly game⁷⁵² to stimulate discussions among participants about the role of data, provide insights into information security and privacy and to determine the responsibility for data management. The process also included the selection and adoption of the "Insights-driven Organisation Model"⁷⁵³ as the development methodology, where "analysis, data and reasoning are embedded into the decision-making process"⁷⁵⁴. From this model, it was possible for the City to assess the state-of-play and to **set ambitions for the City departments, considering five dimensions: strategy, people, processes, data and technology.** The results provided inputs to the **City Data-Driven Working Programme (DGW).**

According to City representatives, so far the City has searched for the right software in the market and has also identified the main data needs. Problems of data interoperability and integration have emerged, thus leading to data being largely unconnected, *i.e.*, in silos. With the DGW, the City is reverse engineering, as it is starting by identifying the data and then will find a software capable of handling this kind of data.

The DGW initiated in 2018 to accelerate Rotterdam's transition to a data-driven organisation and to address the problem of software-driven orientation. The software-driven orientation consisted in a practice within the municipality that led to first acquire a software and only after verifying if the data available or its format was compatible with that software. This logic creates problems of data integration into the acquired systems and reduces data potential. The DGW was based on three tracks: Change management approach, Digital infrastructure, and Use cases with practical insights to be tackled with data⁷⁵⁵. The change

⁷⁴⁷ [Rotterdam digital | Rotterdam.nl](#)

⁷⁴⁸ [Datagedreven werken binnen gemeenten: In gesprek met Jos Maessen - Morgens](#)

⁷⁴⁹ [Rotterdam digital | Rotterdam.nl](#)

⁷⁵⁰ [InSpark | De #1 partner in digitale transformatie](#)

⁷⁵¹ [Your experienced dates tour guide \(scamander.com\)](#)

⁷⁵² [Datapoly – Scamander](#)

⁷⁵³ [Geen woorden maar data! - Shared Business](#)

⁷⁵⁴ [Insight-Driven Organisation | Deloitte US](#)

⁷⁵⁵ [No words but dates! - Shared Business](#)

management approach consists of a different way of working with data-driven decisions, relying on clear communication and stressing the importance of **capacity-building on issues such as data privacy and ethics**. In this context, in 2021 the City initiated a group training plan to ensure that all employees have the necessary skills to be able to accommodate this data-driven transformation⁷⁵⁶.

The underlying digital infrastructure is another crucial factor to guarantee that the data being collected can directly flow into the city ecosystem. The City is developing a **3D digital twin**⁷⁵⁷, which has led to significant efforts to improve the sensor network and overall data collection practices. The digital twin will be a central point of the data collection systems of the city and will create the conditions for the participation of the innovation ecosystem in the development of digital solutions for the City.

Another key aspect to be considered is data interoperability, in which open data standards form the basis. So far, the **City's open data portal**⁷⁵⁸ has not implemented open data standards, which forces interested parties to rely on external software from private companies because the data format is only readable by that software.

The Municipality also partners with its innovation ecosystem to reap the benefits from the use of data. For instance, the City, together with the Erasmus University of Rotterdam, the Rotterdam University of Applied Sciences and other partners, formed the **Urban Big Data Rotterdam project**⁷⁵⁹. This consortium has been collaborating on several fronts. For instance, with research on the topic of urban data platforms,⁷⁶⁰ useful for the development of the city digital twin. This research also includes a partnership with the Municipality⁷⁶¹ to support thesis on big data of master students. Then, the best research projects are distinguished with the Rotterdam Urban Big Data Thesis Award⁷⁶². The Urban Big Data group has also been organising since 2015 an annual Hackathon around different themes of interest for the city (e.g., tourism, health, etc).

In 2020, the City of Rotterdam and the City of The Hague joined the province of Zuid-Holland and announced a collaboration on the **project "Borderless Data Landscape", to create a "single data landscape to jointly test and shape policies"**⁷⁶³. The project intends to build a strong network where data and knowledge are shared, with the participation of companies and knowledge institutions of the region. Moreover, the municipalities are working together on the **Program Total Free Dimension**, to combine and upgrade the 2D building and to address registrations to 3D. In the project, the Municipality of Rotterdam is seen as a reference city considering its advanced practices in terms of data interoperability and data management.

10.2.1.3 Societal Engagement

The City of Rotterdam has put several initiatives in place to create a stronger community and to promote citizen engagement. For instance, the **Citizen Panel**⁷⁶⁴ (*Burgerpanel*) is a group of about 25 volunteers and independent citizens⁷⁶⁵ that share their views with the City Council. The Citizen Panel is open

⁷⁵⁶ [Information provision and automation | Budget Rotterdam 2021](#)

⁷⁵⁷ [The Digital City | Rotterdam.nl](#)

⁷⁵⁸ [Dataplatform Rotterdam \(rotterdamopendata.nl\)](#)

⁷⁵⁹ [Home - Urban Big Data Rotterdam](#)

⁷⁶⁰ [UDPs - Urban Big Data Rotterdam](#)

⁷⁶¹ [Thesis market and mediation - Urban Big Data Rotterdam](#)

⁷⁶² [Rotterdam Urban Big Data Thesis Award - Urban Big Data Rotterdam](#)

⁷⁶³ [Borderless South Holland data landscape | iAdministration \(ibestuur.nl\)](#)

⁷⁶⁴ [Citizen Panel Rotterdam – Involved in the city \(burgerpanelrotterdam.nl\)](#)

⁷⁶⁵ [Members – Citizen Panel Rotterdam \(burgerpanelrotterdam.nl\)](#)

to any citizen, and it is organized under different working groups considering the topics of interest in each moment (this can cover topics of: waste management, child poverty or mobility)⁷⁶⁶. The group is financed by the Municipality itself and it promotes surveys to residents to derive recommendations to the Municipality. In 2020, the group provided several recommendations to the City⁷⁶⁷ on the measures to cope with the pandemic. The recommendations were based on the results of a survey conducted with 500 Rotterdammers and consider, for example, the need for more vigilance on large gatherings in public places like parks or schools entrances.

The City has also created the opportunity for citizens to share their ideas of plans and projects to be discussed by the City Council. This can be done through citizens' initiatives that require a representative and at least 25 signatures from Rotterdammers. From this concept, the city created the Youth Citizens Initiative⁷⁶⁸, for citizens aged 12-17 years old, and the Citizens' Initiative⁷⁶⁹, open to the population above 18 years old. In the same line, the City developed a grant for residents, to finance citizen-driven projects with impact on the neighbourhood upon approval by the Municipality⁷⁷⁰.

The City uses the mobile application Municipal pollster⁷⁷¹ to directly collect views and opinions by sending polls on different topics. From here, the City can better understand citizens' needs and find more adequate solutions. The City has also developed *Mijn Rotterdam* ('My Rotterdam')⁷⁷², a new platform grouping several of the previously mentioned initiatives within the organisation so as to become the key point of interaction and communication with citizens. The platform will give the chance for citizens to have an individual profile, define their areas of interest and co-design projects and plans for their neighbourhood, e.g., by filling surveys. In 2021, the Municipality conducted several tests with both city employees and residents⁷⁷³, and the first version of the platform is planned for the beginning of 2022.

With respect to communication with citizens, the City also has different initiatives in place. The WijkServicebalie010 (**Neighbourhood service desk010**)⁷⁷⁴ is one of those examples, with city employees moving through different neighbourhoods in the city to talk to citizens, allowing them to report local problems. This communication channel of reporting problems is digitally complemented by a mobile application, MeldR⁷⁷⁵. The app allows users to report problems in the city by sending the precise location photos with a detailed description. The issue reported is then forwarded to the responsible entity within the Municipality. Additionally, to encourage the transparency of the Municipality, there is a dedicated **portal to provide insights on the policy decisions, budget and activities implemented throughout the year**⁷⁷⁶.

The City has also organized language courses to promote citizen participation and to address illiteracy, as estimates suggest that 90,000 Rotterdammers between 16 to 65 have difficulties on reading, writing and with digital skills⁷⁷⁷. The City counts with several partners to provide free courses, that can be

⁷⁶⁶ [Advices – Citizen Panel Rotterdam \(burgerpanelrotterdam.nl\)](https://www.rotterdam.nl/burgerpanelrotterdam.nl)

⁷⁶⁷ [jaarverslag 2018 \(burgerpanelrotterdam.nl\)](https://www.rotterdam.nl/jaarverslag-2018)

⁷⁶⁸ [Submitting a citizens' initiative | Rotterdam.nl](https://www.rotterdam.nl/submitting-a-citizens-initiative)

⁷⁶⁹ [Submitting a citizens' initiative | Rotterdam.nl](https://www.rotterdam.nl/submitting-a-citizens-initiative)

⁷⁷⁰ [Subsidy for residents' initiatives | Rotterdam.nl](https://www.rotterdam.nl/subsidy-for-residents-initiatives)

⁷⁷¹ [The Municipal Pollster | Rotterdam.nl](https://www.rotterdam.nl/the-municipal-pollster)

⁷⁷² [Mijn Rotterdam - Home](https://www.rotterdam.nl/mijn-rotterdam)

⁷⁷³ <https://www.magazines.rotterdam.nl/betrokkenstad21-22/ambitie-2-leren-innoveren-en-experimenteren/>

⁷⁷⁴ [DistrictService desk010 | Rotterdam.nl](https://www.rotterdam.nl/districtservice-desk010)

⁷⁷⁵ [MeldR | Rotterdam.nl](https://www.rotterdam.nl/meldr)

⁷⁷⁶ [What does the municipality do? | Municipality of Rotterdam](https://www.rotterdam.nl/what-does-the-municipality-do)

⁷⁷⁷ [Get better at language - Beterintaal.nu](https://www.beterintaal.nl)

on learning a language or more specifically focused on health⁷⁷⁸ or to better prepare citizens for the job market⁷⁷⁹. With this social and cultural perspective, the City has developed the **Rotterdam Pass**⁷⁸⁰, the city card for citizens with several discounts in cultural and sport activities. The card has approximately 200,000 citizens subscribers annually, which corresponds to 1/3 of the population. The Rotterdam Pass also gives the possibility for low-income people to acquire certain basic products through the card, which encompasses for example education material for children. The project, initiated in 2008, moved from a physical to a more digitalised service, where citizens can create and consult their cards entirely online. As the project is entirely digitalised, it provides flexibility to rearrange the amount of money or to introduce new conditions for a specific group. The City is also participating in the **Citizen Card working group of the Living-in.EU initiative**.⁷⁸¹ In this context, the City intends to exchange knowledge and address some limitations identified in its current version (for instance on the creation of a more efficient system that relies on the data available from users while complying with data privacy regulations).

In terms of co-design projects and services with citizens, there is not yet a harmonised approach, with some departments having better practices than others. In reality, there are some Departments with projects that by law require citizen participation (e.g., in the spatial planning domain), while other departments are more pro-active in looking for citizen participants. Overall, according to the City, some progress has been made to more frequently involve citizens. For instance, the municipality notes that there are significant differences on the feedback collected according to the different phases of the process design. From the City's experience, the involvement of citizens at earlier stages of the process and without any restrictions may lead for suggestions that cannot be accommodated. Following that, there is an ongoing process to better understand at which phase citizens should be involved.

To create conditions for better citizen participation, the City is now working on a new application, which through several digital tools the City presents complex urban issues in a more user-friendly manner. In the first phase, the plan requires the involvement of citizens to re-design a public square. The project will rely on the Digital Twin and will combine 3D plans, with augmented reality technology and gamification principles to simplify complex urban issues, and to make it as close as possible to a real environment. For example, in a situation where citizens decide to plant a tree in a public square, they will have to take into account several restrictions, from the underground infrastructure that limits the tree location up to the total budget considering their other ideas. From this initial phase, citizens are invited to think about the design process of the square and will be given the chance to see their proposals coming to life in the square itself through technology. Then, they will vote on the proposals to decide the one that pleases the majority. **The project will allow the City to see how people react to the tool, and to reflect on the best phase(s) of the design process to include citizens.**

The Living Lab Sensor⁷⁸² is another example of an engagement initiative with both citizens and the innovation ecosystem. The project began in 2019 with the implementation of several smart sensors around the Reyeroord district of Rotterdam. The sensors were placed at the entrance and exit of parks to measure

⁷⁷⁸ <https://www.rotterdam.nl/wonen-leven/taal-en-gezondheid/>

⁷⁷⁹ [Working & learning | Rotterdam.nl/](https://www.rotterdam.nl/working-learning/)

⁷⁸⁰ [Acties - Rotterdampas](https://www.rotterdam.nl/acties/)

⁷⁸¹ [Actions - Rotterdam pass \(living-in.eu\)](https://www.rotterdam.nl/living-in-eu/)

⁷⁸² [Plan of action Living Lab Sensible Sensor Reyeroord - PDF Free Download \(docplayer.nl\)](https://www.rotterdam.nl/plan-of-action-living-lab-sensible-sensor-reyeroord/)

crowds, on waste containers⁷⁸³ and on public lights⁷⁸⁴. The infrastructure of the lab also included a pilot smart mast, CENT-R⁷⁸⁵, an infrastructure placed on the streets of the Reyoortd with 5G internet, electric charging for cars, street lighting and sensors for air quality and noise.

The lab is aiming for the setup of the city as a laboratory, in order to understand the role of municipalities on this process and how citizens interact with this technology. This first phase also organized several online sessions with citizens and experts to discuss the design of sensors and to understand what residents want to know about it⁷⁸⁶. The project was financed by the Municipality of Rotterdam with € 250,000 and by the regional authority MRDH with € 100,000. The project also had the collaboration from other municipalities of the region, as well as the Erasmus University of Rotterdam, the national metrological institute Nederlands Meet Instituut (NMI), Intermax, a cloud sourcing company and other private partners⁷⁸⁷.

The City also relies significantly on its “knowledge network”, that integrates several universities, institutes and high schools, having work developed on different “knowledge tracks”. In some cases, the collaborations are long-standing and well structured. For instance, with the Erasmus University, the City has almost 6 years of cooperation on several fronts. In the digital field, this cooperation includes receiving annually around 35 master students to conduct their research in the digital city surroundings, which is also beneficial for the City’s evolution and projects.

With the Technical University of Delft⁷⁸⁸, there are collaborations on the research field of BIMM Geo (Building Information Management Models Geosystems). The BIMM geosystems are very detailed on the individual and objects in the city. This is useful to develop public services related with the automation of the permit process, for instance when someone wants to put solar panels on the top of the roof through this technology could get a faster approval from the Municipality. There are also collaborations with the University of Stuttgart *Informatik, Elektrotechnik und Informationstechnik*⁷⁸⁹ to create smart data sources. From the partnership on this knowledge track in which the University is specialized, the City already is able through a 3D infrastructure, to calculate and conduct research on the energy savings of the city buildings, being now working on the solar potential of the roofs of individual buildings. In the future, it is planned to extend the research for the heating and geothermal potential of all city buildings.

To promote entrepreneurship and simultaneously engage with the citizens, the City founded in 2015 the CityLab010.⁷⁹⁰ The CityLab010 partners with several social stakeholders, (Rabobank, Ploum, Mazars and Rotterdam University of Applied Science) to support the ideas of citizens for the city. The process starts with the citizen registering the idea, which counts with the support from the lab to be translated into a more solid plan. The plan should be innovative and benefit the city. From here, the citizen can request a starting budget to implement the initiative that needs to be approved by the subsidy desk of the municipality. The lab has an annual budget of EUR 3 million that comes entirely from the Municipality, where each project can

⁷⁸³ [Smart neighborhood containers | Rotterdam.nl](#)

⁷⁸⁴ [LED transition 2020-2025 | Rotterdam.nl](#)

⁷⁸⁵ [CENT-R – We create future-proof sustainable cities.](#)

⁷⁸⁶ [Webinar Living Lab Sensible Sensor Reveroord \(invite only\) — V2 Lab for the Unstable Media](#)

⁷⁸⁷ [Plan of action Living Lab Sensible Sensor Reveroord - PDF Free Download \(docplayer.nl\)](#)

⁷⁸⁸ [TU Delft](#)

⁷⁸⁹ [Fakultät 5: Informatik, Elektrotechnik und Informationstechnik | Universität Stuttgart \(uni-stuttgart.de\)](#)

⁷⁹⁰ [CityLab010 - Green light for free energy](#)

receive a maximum starting budget of 100,000 euros. This project has been important to create and strengthen the city's social entrepreneur's network.

In respect to the promotion of innovation ecosystem, the City and the national government has been supporting the development of the Innovation District.⁷⁹¹ The Innovation District, located at west of Rotterdam's city centre and close to Rotterdam's Port, is a city area that concentrates mix of innovative of entrepreneurs from different areas (technological, financial services, maritime). These entrepreneurs are attracted by the good conditions to perform their work, from a simplified legislation to several innovative platforms for their scaling-up.⁷⁹² In this area is also promoted a direct connection with educational institutions with programs science-based and technology oriented, such as the Erasmus University of Rotterdam, Rotterdam University of Applied Sciences or the Albeda College and Zadkine.

Also, the Municipality of Rotterdam and the Ministry of Economic Affairs are two public shareholders of the Innovation Quarter,⁷⁹³ a regional economic development agency for the greater Rotterdam, locally known as Zuid-Holland region. This agency has the competencies of financing innovative and fast-growing companies, supporting the process of integration of foreign companies in the region and promoting the engagement between the entrepreneurs, academia and the City. In fact, the City and the Innovation Quarter, together with several other partners (CityLab010, the Erasmus University, the Port, etc)⁷⁹⁴, launched the initiative the Ondernemen010⁷⁹⁵, to support city entrepreneurs in a "better a more targeted way". This initiative relies on a website that presents several key and constantly updated information for entrepreneurs (from funding opportunities, hubs, events, business parks, regulations, etc). In this initiative it is also provided a business contact officer, as a contact channel to centralize and link the Municipality with entrepreneurs.⁷⁹⁶

10.2.1.4 Procurement

Traditional and innovative public procurement

The Netherlands innovative procurement practices are well advanced at both national and local level. According to the European Commission assessment report⁷⁹⁷, The Netherlands is **placed as a good performer in the adoption of innovative procurement practices in the digital economy**. The country is also characterized by most of the public procurement happening at the local level. There is a National Competence Centre for Innovation Procurement, the PIANOo (*Professioneel en Innovatief Aanbesteden, Netwerk voor Overheidsopdrachtgevers* - Professional and Innovative Tendering, Network for Government Contracting Authorities)⁷⁹⁸ which works with a network of 3,500 public procurement professionals and is responsible for "professionalise procurement and tendering in all government departments". This organisation is also a promoter of innovative procurement practices in the country.⁷⁹⁹

⁷⁹¹ [Factsheet Rotterdam Innovation District by Stadshavens Rotterdam - Issuu](#)

⁷⁹² [Position paper Rotterdam Innovation District by Stadshavens Rotterdam - Issuu](#)

⁷⁹³ [InnovationQuarter - InnovationQuarter](#)

⁷⁹⁴ [Partners - Entrepreneurship010 \(ondernemen010.nl\)](#)

⁷⁹⁵ [The platform for entrepreneurial Rotterdam - Ondernemen010](#)

⁷⁹⁶ <https://www.ondernemen010.nl/contact/bedrijfscontacten/>

⁷⁹⁷ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=55205

⁷⁹⁸ [About PIANOo | PIANOo - Dutch Public Procurement Expertise Centre](#)

⁷⁹⁹ [About PIANOo | PIANOo - Dutch Public Procurement Expertise Centre](#)

Moreover, in 2015, the country implemented the Action Plan for Responsible and Sustainable Procurement (RSP),⁸⁰⁰ an instrument to introduce and contribute to uniformize procurement requirements on sustainability, to be taken into account by the different public authorities.

At the local level, the procurement in Rotterdam is organized around two specialized teams that support the budget holders of each department to identify the most adequate procurement process to adopt in each situation.⁸⁰¹ **The City recognizes that the traditional procurement processes are not fitted to more innovative projects.** Since most of the traditional procurement processes demand upfront a level of certainty on the results to expect that is not compatible with projects involving innovation.

In order to find alternative practices and exchange knowledge with peers from other cities, the City of Rotterdam joined several networks and participated in different European projects. In 2013, the City joined the Procura+ Network,⁸⁰² a network founded in 2005 by the ICLEI – Local Governments for Sustainability,⁸⁰³ and is composed of several European public authorities and regions, to “connect, exchange and act on sustainable and innovation procurement”⁸⁰⁴.

Rotterdam also joined in 2012 the TRAN-SFORM (Towards sustainable zero carbon transport through innovation procurement) project⁸⁰⁵, a network of procurers on public procurement of innovative solutions (PPI) for sustainable transport. Through the definition of PPI methodologies and guidance from procurement experts from the UK and the Netherlands, each of the three participant cities, Rotterdam, Birmingham and Barcelona, implemented PPI pilot projects and assessed the results derived from it. The project was funded through the FP7, Seventh Framework Programme⁸⁰⁶, and counted with two procurement foresight workshops, to address information gaps and promote the knowledge exchange among the network partners. In the same line, the City joined another project, WaterPiPP (Water Public Innovation Procurement Policies)⁸⁰⁷, to explore new innovative procurement processes, specifically on the water sector. The consortium of the project counted with 12 partners from public organisations, academia and other organisations from the water sector (non-profit organisations or other networks) and was partially supported by the FP7.

More recently, in 2018, the City launched its own Socially Responsible Procurement Action Plan,⁸⁰⁸ where it promoted the integration of social objectives, such as employment and clean environment, in the procurement process. For instance, the City demands from their suppliers an environmental management system certification such as, the ISO 14 001⁸⁰⁹, or other equivalent.⁸¹⁰

Also at the regional level, the MRTH, has been participating on European projects, such as the SPP Regions,⁸¹¹ dedicated to expanding the European regional networks of municipalities on the topic of sustainable public procurement (SPP) and public procurement of innovation (PPI). From this project, the seven

⁸⁰⁰ [netherlandsactionplanresponsibleandsustainableprocurement20152020.pdf \(pianoo.nl\)](#)

⁸⁰¹ [Procura+ | Rotterdam \(procuraplus.org\)](#)

⁸⁰² [Procura+ | Rotterdam \(procuraplus.org\)](#)

⁸⁰³ [Procura+ | Rotterdam \(iclei.org\)](#)

⁸⁰⁴ [Procura+ | Rotterdam \(procuraplus.org\)](#)

⁸⁰⁵ [Towards Sustainable Zero Carbon Transport through Innovation Procurement | TRANS-FORM Project | Fact Sheet | FP7 | CORDIS | European Commission \(europa.eu\)](#)

⁸⁰⁶ https://ec.europa.eu/defence-industry-space/eu-space-policy/space-research-and-innovation/seventh-framework-programme-fp7_en

⁸⁰⁷ [Public procurement and water specificities | Waterpipp](#)

⁸⁰⁸ [manifest-mvi-actieplan-gemeente-rotterdam.pdf \(pianoo.nl\)](#)

⁸⁰⁹ [ISO - ISO 14000 family — Environmental management](#)

⁸¹⁰ [Procura+ | Rotterdam \(procuraplus.org\)](#)

⁸¹¹ [SPP Regions :: Home](#)

regional authorities of the consortium, promoted several SPP and PPI activities, which resulted in 40 eco-innovative tenders published.⁸¹² For instance, within this project, the City of Rotterdam followed its policy that requires all new vehicles of the municipality to be electric and established a framework agreement that led to the acquisition in 2017 of 40 battery electric cars.⁸¹³ Overall, the MRTH shared within the SPP Regions, eco-innovative tender models on energy efficiency, buildings and transport.⁸¹⁴ The project, went from 2015 up to 2018, and was entirely supported by European funding from the Horizon 2020.⁸¹⁵

In the national city networks, innovative procurement is also a discussed topic, where it has also been promoted the concept of City Deals to procure joint solutions. The City Deals are also supported by the national government, that can also be involved in the agreement, as well as, companies, and other social organisations. There are already some examples of City Deals, in which, Rotterdam was involved, mostly on urban transformation, circular economy and climate adaption.⁸¹⁶ According to the City, among the city network G40, it is being currently studied, how they could procure an Urban Platform and Digital Twin through possible joint procurement.

The City has becoming a reference on innovative procurement practices in the country, with its efforts being recognized as the winner Procura+ Award of innovation procurement of the year 2018.⁸¹⁷

Financing digital solutions

The financing of digital projects is mainly derived from the budget of the department or departments that will collect the benefits from it. The departments involved are the ones responsible for finding the funding needed on those situations, in which there are not enough internal resources. In the case of programs, such as the Digital City Program or the Data-driven Program, there are specific budgets allocated to it, with the possibility of existing additional contributions from national or European sources. Also here, **the internal entity or team responsible for coordinating the program has responsibility to find the alternative sources when needed.**

The City considers the Horizon2020 and national funding as the most relevant external sources to finance digital innovation. However, it acknowledges, that project-based methodology of EU funding, can consist of a limitation on innovative long-term projects that are composed by several phases. This is particularly an issue, on more innovative projects, in which the City ensures funding for the first stages of development through European programs, but to more advanced ones, it is not guaranteed an adequate one. According to the City, instead of being project-based, the creation of an European cycle project, that focus on the different phases of each project, would be more beneficial to reach the final results and also monetize past investments. For instance, this is the case on the development of Digital Twin, in which two European programs (Espresso project⁸¹⁸ and Ruggedised⁸¹⁹) contributed for the first two moments of developing the prototype, but for the implementation phase, the City had to rely on its own means.

⁸¹² [SPP Regions :: ABOUT SPP REGIONS](#)

⁸¹³ [Acquisto di energia elettrica per almeno il 50% proveniente da fonti rinnovabili per la Regione Piemonte \(sppregions.eu\)](#)

⁸¹⁴ [SPP Regions :: Tender Models](#)

⁸¹⁵ [SPP Regions | SPP Regions Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](#)

⁸¹⁶ [City Deals - Agenda city \(agendastad.nl\)](#)

⁸¹⁷ [Procura+ | AWARDS 2018 \(procuraplus.org\)](#)

⁸¹⁸ [The ESPRESSO Project – ESPRESSO Project \(espresso-project.eu\)](#)

⁸¹⁹ [RUGGEDISED - Smart city lighthouse project | SMART THERMAL GRID](#)

10.2.2 Change Management

For a long time, the City of Rotterdam has recognized the importance of being an active player on city networks and projects at both local, national and European level. The advanced stage of digital transformation has put the City on important positions within some of those networks and organisations, where it has been significantly contributing to the digital evolution of other partners. Nevertheless, the City has also been leveraging them to also exchange knowledge and further develop its own projects. According to a recent assessment, it was identified the participation and collaboration on more than 300 smart city initiatives from the City of Rotterdam on the different related domains (mobility, sustainability, water, administrative services, etc)⁸²⁰.

The City is a member of Eurocities⁸²¹, a large European cities network dedicated to promote cooperation on a variety of topics among cities and other partners.⁸²² In fact, the origins this network rely on 1986 on a conference organized in Rotterdam with representants from 10 other big European Cities.⁸²³ The City became one of its six founders and currently the Mayor of Rotterdam is a member of the Executive Committee.⁸²⁴ Within Eurocities, in 2020, Rotterdam and other large European cities joined to sign the letter “The Way out of the Covid-19 Crisis is digital and local”⁸²⁵ for the European Commission. The letter was submitted while the 2021-2027 EU Budget is discussed, to call attention for the role of local governments in society and the need for investment to better prepare cities for the challenges of a post-COVID period.

The City is also vice-coordinator of the OASC Council of Cities, a relevant organisation on the City data management and in the development of interoperable solutions, particularly with the adoption of the OASC Minimal Interoperability Mechanisms (MIMs)⁸²⁶.

In 2016, the City joined the Like! Project that is part of the Interreg North Sea Region Program.⁸²⁷ The project was designed with the aim of “enhance the capacity of the public sector”, through innovative methodologies and solutions, and counted with ten partners (municipalities and universities) from five different countries of the North Sea Region. According to the city, this was a relevant project that influenced the city service design process and where the partners involved still interact with each other in the present time.

This project included experimenting with innovative service design methodologies (such as, design thinking and gamification) to better understand and assess the needs of stakeholders and integrate those insights on projects. From this process, the city was involved in the smart senior work package⁸²⁸ where it started by organizing a training and design session with senior citizens, local government officials and experts to collect useful insights to understand how to make the support desk more accessible for people with needs. This project did not end up in a concrete new service but provided insights and practices that are still embedded in the City design process.

⁸²⁰https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiB2pK9vu30AhUiQvEDHVtOA Z0QFnoECAIQAQ&url=https%3A%2F%2Fwww.mrdh.nl%2Ffile-download%2Fdownload%2Fpublic%2F2349&usg=AOvVaw2UD-BAoiwYVYTuzVikNK_Bw

⁸²¹ [about EUROCITIES](#)

⁸²² [about EUROCITIES](#)

⁸²³ [history \(eurocities.eu\)](https://eurocities.eu/history)

⁸²⁴ [Team - Eurocities](#)

⁸²⁵ [DIGITALISERING IS EEN NUTSVOORZIENING EN EEN MENSENRECHT \(rotterdam.nl\)](#)

⁸²⁶ [MIMs - Open & Agile Smart Cities \(oascities.org\)](#)

⁸²⁷ [Like, Interreg VB North Sea Region Programme](#)

⁸²⁸ [Smart Senior, Interreg VB North Sea Region Programme](#)

For instance, since the beginning of the pandemic the municipality has been working on a project that provides public services for citizens through video calls. This project relies on a digital counter and would also allow citizens to submit and access documents. This solution has already been tested, for example with citizens that gave birth and can register their child even at the hospital. However, the City recognized that not all citizens would interact in the same way with this tool. So, to better understand how, for instance, the elderly would interact, the City partnered with university students that worked together with the elderly. From here, they realized that the current version of the solution was not fit-for-purpose to this group's needs which led to an adapted version of the service. This new version will include a joystick that proved to be more familiar and user-friendly for them.

European programs have also been important to stimulate the city's innovation ecosystem and to introduce internal changes in the organisation. The City of Rotterdam joined in 2018 the third edition of the Urbact programme that since 2000 has been "fostering sustainable integrated urban development in cities across Europe"⁸²⁹. In this edition the City participated in Innovator-R Transfer Network (INT)⁸³⁰. The INT was designed for engagement of City employees with peers from other cities. From here, the participants were challenged to develop innovative projects that would improve the performance of their administrations.

The journey started in 2018, with a kick-off meeting in Turin. Rotterdam was represented by an Urban Act Local Group (ULG) composed of 30 civil servants from several areas of the City. This included members of CityLab010, the Digital Experimentation Centre and design specialists. Other meetings were organized to provide more insights on efficient design processes and to promote the interaction with the partners from other cities.

From here, in March 2019, the City ULG started designing the digital platform for the City innovation community. The idea was to create a platform of interaction and knowledge exchange for the city civil servants and its innovation ecosystem. The platform was mostly dedicated for social entrepreneurship, in order to find solutions for the city problems⁸³¹. The platform is currently being developed, and the process included additional INT sessions to receive feedback from partners. The current plans also include a mobile application version to make it more accessible and interactive⁸³².

Also at the national level, the City belongs to several city networks, such as the G5⁸³³ and G40⁸³⁴, that collaborate in several domains, including digital. This network and its collaborations have also been important to promote knowledge exchange and to stimulate cooperation among cities in the Netherlands. For instance, among the G-5, the partner cities are currently working in partnership with the Dutch Ministry of Infrastructure and Water to develop the City Data Standard – Mobility (CDS-M). The CDS-M⁸³⁵ will be relevant to manage and interconnect the data from the different mobility providers more efficiently. This will provide the municipalities and remaining public authorities with more information to plan the use of public

⁸²⁹ [URBACT at glance | URBACT](#)

⁸³⁰ [Innovato-R | URBACT](#)

⁸³¹ [Layout 3 \(fondazionebrodolini.it\)](#)

⁸³² [Innovato-R - Transfer Story from Rotterdam | URBACT](#)

⁸³³ [G40 City Network | Joint advocacy and knowledge sharing for 40 major cities \(g40stedennetwerk.nl\)](#)

⁸³⁴ [G40 City Network | Joint advocacy and knowledge sharing for 40 major cities \(g40stedennetwerk.nl\)](#)

⁸³⁵ [Microsoft Word - City Data Standard - Mobility Two Pager .docx \(polisnetwork.eu\)](#)

space and to design more data-driven mobility policies. A first version of the CDS-M was already developed, being now in the testing phase⁸³⁶.

Finally, there is an important national development on Digital Twinning, called '**Nationale Digital Twin Fysieke Leefomgeving**' (nDTFL). The Rotterdam DT development is now a field lab within this national development.

10.3 Digital Service Innovation Maturity

The City of Rotterdam is part of the country that ranked 4th out of the 27 Member States of the EU in the Digital Economy and Society Index (DESI) for 2021.⁸³⁷ Its top performance is particularly evident in terms of connectivity, where the country is the second best.⁸³⁸ In Rotterdam, the City Council has increased its efforts to improve its digital infrastructure, through supporting the expansion of the city fiber network⁸³⁹ and with the development of data centres.⁸⁴⁰

From its digital infrastructure, the City has been promoting the digitalisation of its services in several sectors, from mobility, waste management, urban planning, environment and education. For instance, in waste management, the City is an example in the Netherlands and Europe with a large-scale implementation of more than 6500 sensors in containers⁸⁴¹. The sensors monitor how full containers are and if they are clogged. From this information, the best routes are automatically settled, and the waste management entity can more efficiently perform their tasks. The implementation of this project was preceded by a two-year trial in South Rotterdam, where the sensors allowed for a reduction of collection days and the containers were emptied only when they were at least three quarters full⁸⁴².

In mobility, as part of the projects to improve bicycle adoption⁸⁴³, the City invested in the development of a special car with a laser that maps bumps and other aspects in the 600 km of the cycle paths. This laser technique can capture the comfort measure of a cyclist while cycling. It is part of the smart management practices, as it provides an overall picture on the quality of the cycling network allows the public authorities to more efficiently address the problems detected.⁸⁴⁴ The City is also using sensors to keep track on the occupancy of parking space, information than then is displayed to the residents through a pilot app⁸⁴⁵.

The fact that the City has a Rapid Application Development program⁸⁴⁶ leads to a greater capacity to adapt and develop its own digital solutions more easily. For instance, during the pandemic the City developed an application to share with citizens information on the density of people in parks in real-time and in this way they could avoid crowded areas. **In the future, the City has plans to rely on artificial intelligence and**

⁸³⁶ [Dutch cities develop new mobility data standard - POLIS Network](#)

⁸³⁷ [Countries' digitisation performance | Shaping Europe's digital future \(europa.eu\)](#)

⁸³⁸ [Countries' digitisation performance | Shaping Europe's digital future \(europa.eu\)](#)

⁸³⁹ [Fiberglass | Rotterdam.nl](#)

⁸⁴⁰ [Rotterdam Innovation City | Digital](#)

⁸⁴¹ [Smart neighborhood containers | Rotterdam.nl](#)

⁸⁴² [Smart neighborhood containers | Rotterdam.nl](#)

⁸⁴³ [Cycling city | Rotterdam.nl](#)

⁸⁴⁴ [Innovation | Rotterdam.nl](#)

⁸⁴⁵ [ParkeerSlim - Snel een Parkeerplaats - Apps on Google Play](#)

⁸⁴⁶ [Data-driven working within municipalities: In conversation with Jos Maessen - Morgens](#)

robotics process automation technology to further automate routine processes within the municipality⁸⁴⁷.

Below we zoom-in on a City service that illustrates one of the most technologically advanced projects in the City, the Digital Twin (Box 9). This project will be a central point of the City's future digital transformation process.

Box 9 - Zoom-in: Digital Twin

○ Overview

The City of Rotterdam started the Digital Twin project by acknowledging that developing numerous smart city projects does not make Rotterdam a Smart City if those projects are not interconnected.⁸⁴⁸ From here the city derived from its Digital Agenda⁸⁴⁹, the Digital City Program (DCP).

The DCP has in its core the development of the city Digital Twin. The digital twin is a smart 3D model of the city (with representations of its buildings, streets and public spaces), which then can be complemented with real-time information, through networks of sensors and data-streams.⁸⁵⁰ According to the City, the essence of a digitally twin is to horizontally connect different silos based on a common picture of reality. The digital twin will not be part of a smart solution; instead it is the basis for smart solutions.

From here, **the City expects to have an open urban platform from which new applications and digital services can be derived. This will improve the efficiency of urban planning and management of the city.** The project is still under development, but the City participation in two European Programs, the RUGGEDISED⁸⁵¹ and the ESPRESSO project⁸⁵², already contributed to its evolution. Currently, the City is running a competitive dialog to find private stakeholders to move forward the project.

○ Relevance and uniqueness

The potential of the City's Digital Twin makes it an important component of the digital transformation process of the city. The combination of the digital twin with other cutting-edge technologies, like artificial intelligence or the predictive power of big data, can contribute to significantly **improving several city operations**- from rescue operations by providing detailed information on the building occupancy to firefighters, to the monitoring of road traffic and the water in the canals to optimise the operations of opening and closing the city's bridges⁸⁵³. The City is already working on some of pilots that can improve the city's operations, for instance on the permit process, where the city is developing an application with 3D models that will reduce the time of approval of an environmental permit.

The fact that it is being built focusing around the mindset change from software-driven towards data-driven, with open data standards and following the MIM approach, makes it a reference in the area of data management. The City is relying on several existent data collection infrastructures, such as sensor networks, to develop the infrastructure. However, the distinctive aspect is that the Digital

⁸⁴⁷ [Information provision and automation | Budget Rotterdam 2020](#)

⁸⁴⁸ [GIM - November/December 2019 | GIM International \(gim-international.com\)](#)

⁸⁴⁹ [De-digitale-organisatie.pdf \(rotterdam.nl\)](#)

⁸⁵⁰ [gim-international-november-december-2019.pdf](#)

⁸⁵¹ [RUGGEDISED - Smart city lighthouse project | Home](#)

⁸⁵² [ESPRESSO Project – systEmic Standardisation apProach to Empower Smart cities and cOmmunities \(espresso-project.eu\)](#)

⁸⁵³ [Rotterdam Innovation City | Can Rotterdam be even more beautiful? The answer is yes, as a Digital City.](#)

Twin aggregates all these sources of information and systems, together under the same structure. This provides an updated and more complete overview of the city which increases the efficiency of its management and the possibilities of applications.

Moreover, the current procurement process, through a **competitive dialog** to find private partners to collaborate in the further development of the platform, also constitutes an innovative practice within the municipality.

○ **Challenges & Drivers**

The difficulty of this innovative project lays on the uncertainty of the results. According to the City, one of the first steps was to determine the maximum level of uncertainty acceptable considering the unpredictability of the results and the interests of all the stakeholders involved.

In the same line, another challenge identified was on the **equilibrium between the time needed to test and the communication / reporting within the organisation and external stakeholders to keep the credibility of the project and ensure the necessary resources.**

The conversion of the information collected from different systems and sources of information already implemented in the city to open data standards was another difficulty found. In order to address it, the City started specifying in the contracts signed with external service providers, that the data provided had to comply with specifically determined open data standards.

An important driver of this process was the **strategic positioning of this project in the City vision for its digital transformation journey** and the internal capacity of the City to develop it. The participation in European programs and the involvement of the ecosystem has also been a relevant factor of the success so far.

○ **Implementation and Monitoring**

An important aspect regarding the development of our Open Urban Platform with Digital Twin is the **governance** aspect. The City strives for an OUP that is commercially exploited by private partners, but with regard/respect to the public interests. So the future governance model should give an answer to the potential tension between commercial exploitation and maintaining the public values. In other words, the City believes it is also about the different roles to play and who should play which role.

The Digital Twin is composed of two main components: geodata in the form of a 3D model of the city, and IoT sensor data provided by several sources. In respect to the geodata, the City leveraged from the already developed Rotterdam 3D city⁸⁵⁴ model and combined it with a new operations platform. “The data collected from these sources were integrated into CAD/ BIM software, and artificial intelligence was used to process the data and depict the current reality of the city to improve the urban planning process radically”⁸⁵⁵.

In 2016, the City of Rotterdam was **involved in two European projects** financed by Horizon 2020 programme that **significantly contributed to the development of both the sensor infrastructure and the new operations platform.**

⁸⁵⁴ [Rotterdam 3D \(3drotterdam.nl\)](https://3drotterdam.nl)

⁸⁵⁵ [GEOBIM 2020 Awards Recognize Exemplary Construction 4.0 Practices - Geospatial World](#)

The systEmic standardisation apPRoach to Empower Smart cities and cOmmunities (ESPRESSO)⁸⁵⁶ was a project focused on the “development of a conceptual Smart Cities Information Framework”. The project counted with the coordination of the Open Geospatial Construction⁸⁵⁷ and Rotterdam was one of the two cities in which pilots were implemented⁸⁵⁸. The two pilots of the City **improved the sensor network**, specifically the ones used to measure groundwater levels⁸⁵⁹ and to read how full containers are⁸⁶⁰. The information collected was then sent to the city 3D Model.

The ESPRESSO project also provided an important contribution to the project due to its strong focus on the pivotal points of interoperability (PPI). The PPIs consists of using open standards and common interfaces to achieve interoperability between the various datasets. This principle has also been followed in the Digital Twin when integrating the sensor data into its system.

The City has also been leveraging significantly from the ongoing RUGGEDISED project⁸⁶¹. The RUGGEDISED project counted with three lighthouse cities, Rotterdam (also project coordinator), Glasgow and Umea to test and implement 32 smart solutions in their cities. After its implementation the project, which finishes in 2022, aims to replicate the successful pilots in the group of three fellow cities, Brno Gdansk and Parma. Each city partnered with different private stakeholders and academia to implement its pilots⁸⁶².

For Rotterdam it was allocated 13 smart solutions⁸⁶³, which encompassed the needed **3D city operations model**⁸⁶⁴ to further develop the digital twin⁸⁶⁵. As part of the 3D city operations model, the City executed two proofs of concept (PoC). The first consisted in integrating real parking lot data into the city 3D model, which demonstrated that the plans of the City to its Digital Twin were technically feasible. The second PoC tried to assess up to what extent the digital twin would provide useful information to answer the city real problems. From here, several open data standards were tested and real time data on traffic mobility, public transport and opened bridges was integrated. The remaining smart solutions (on mobility and energy) are contributing to the development of the City sensor network and are also planned to be integrated into the city digital twin platform.

The City is currently running, for the first time, an **innovative competitive dialog procurement process** to find private partners to collaborate in the further development of the platform.

○ Impacts

The City digital twin project is still under development. Although the city has not yet implemented KPIs to monitor its evolution, there are some indicators of its potential impacts in the future.

⁸⁵⁶ [ESPRESSO Project – systEmic Standardisation apProach to Empower Smart cities and cOmmunities \(espresso-project.eu\)](https://espresso-project.eu)

⁸⁵⁷ [The Home of Location Technology Innovation and Collaboration | OGC](https://ogc-project.eu)

⁸⁵⁸ [ESPRESSO Pilots – ESPRESSO Project \(espresso-project.eu\)](https://espresso-project.eu)

⁸⁵⁹ [Use Case 2: Ground Water Level – ESPRESSO Project \(espresso-project.eu\)](https://espresso-project.eu)

⁸⁶⁰ [Systemic standardisation approach to empower smart cities and communities | ESPRESSO Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](https://cordis.europa.eu/project/id/101019444)

⁸⁶¹ [RUGGEDISED - Smart city lighthouse project | Home](https://ruggedised.eu)

⁸⁶² [RUGGEDISED - Smart city lighthouse project | PARTNERS](https://ruggedised.eu)

⁸⁶³ [RUGGEDISED - Smart city lighthouse project | ROTTERDAM](https://ruggedised.eu)

⁸⁶⁴ [Ruggedised-factsheet-R9-Rotterdam.pdf](https://ruggedised.eu)

⁸⁶⁵ [Ruggedised-factsheet-R9-Rotterdam.pdf](https://ruggedised.eu)

The platform enhances the possibilities of co-creation with citizens. For instance, the city is currently relying on the present version of the digital twin to develop an app that allows citizen participation in the spatial planning process at any time or place⁸⁶⁶.

The fact that it is an open data platform designed for any third participate and develop its own applications, opens new businesses opportunities that can influence the efficiency of the City⁸⁶⁷. For instance, a city pilot test on efficient and intelligent streetlights in buildings, that will be also monitored through the Digital Twin, estimates a potential “city-wide reduction in the use of energy of around 30%”⁸⁶⁸.

10.4 Conclusions and lessons learned

The City designed its new Digital Agenda acknowledging that the digital transformation has been changing the way the city dimensions interact with each other and to understand more clearly what its role in this process should be. From here, it appointed a new Chief Digital Officer and developed its digital projects by relying on collaborations with external stakeholders and leveraging the participation on different European programs and cities networks. The Digital Twin is an example of this approach and will become a central point on the digital transformation journey of the City.

Below we explore in more detail some potential lessons learned from the experience of Rotterdam in transforming its public service provision through digitalisation:

i) *Rotterdam’s digital priorities are aligned with the digital transformation occurring “outside its doors”.*

In 2021, through the Mayor’s decision, the city appointed the first Chief Digital Officer and created the Chief Digital Office team. The CDO is a digital expert that was positioned across all departments to bring an “out-side-inside” perspective to the City organisation. Its main responsibility is to shed light on what should be the positioning of the Municipality to accommodate the digital transformation and guarantee that all the organisation is aligned with it. This decision clearly shows the relevance that the City recognizes on being aligned with the overall digital trends to be synchronized and updated on its digital priorities.

ii) *The City acknowledges the importance and benefits of actively participating in national and European initiatives and networks to foster its digital transformation.*

The City has been an active agent in several national networks, such as G5 and G40. From here, the City has been leveraging benefits for itself but has also been supporting the digital development of other cities. These networks contributed to the design of the national Smart City Strategy, being the entities responsible for its implementation. Also, through the G5 the City is also partnering to develop the City Data Standard on Mobility, which will be relevant to create a common data standard that opens new possibilities for the municipalities in the country to design more data driven policies. At more local level, there are also similar examples, with the project “Borderless Data Landscape” that joined the City of Rotterdam, the province of Zuid-Holland and The Hague to create a single data landscape to jointly test and shape policies, or with the

⁸⁶⁶ [The Digital City | Rotterdam.nl](#)

⁸⁶⁷ [Ruggedised-factsheet-R9-Rotterdam.pdf](#)

⁸⁶⁸ [Ruggedised-factsheet-R11-Rotterdam.pdf](#)

Urban Big Data Rotterdam project where the City partner with the local universities to conduct research projects on big data.

The European projects and initiatives have also been relevant to the City's innovative projects. The Digital Twin is the clear illustration of that, where two European projects were fundamental to move forward the first stages of this key digital project.

iii) *There are clear efforts by the City to introduce innovative procurement practices and overcome the limitations of traditional procurement processes.*

The City is becoming a reference on innovative procurement practices. In part this is justified by the favourable national support and advanced stage of the country on this domain. Nevertheless, the active city participation on several European procurement networks and projects (Procura+ Network, TRANS-FORM, WaterPiPP) has also been fundamental to introducing and learning new innovative practices in the Municipality. The City adopted Socially Responsible Procurement Action Plan and is currently running an innovative competitive dialog to move forward the Digital Twin.

iv) *The City of Rotterdam has developed several channels of interaction with citizens to create a stronger community and collect the benefits of a more active participation.*

The City created the citizen panel, open to all citizens and from which a group of 25 people represent citizens' interests and allow them to have a direct voice in the City decision making. The City has also been looking for the right balance between digital and physical channels to ensure a closer communication with citizens. Thus, the City created the Neighbourhood service desk010 to allow for open and close reports of problems by the citizens, which is complemented by the digital apps MeldR to be more flexible and attractive for the participation of other citizens groups. The citizens are also invited to share and implement their ideas of how to improve the City through the CityLab010 and the citizens initiatives.

In terms of co-design practices with citizens, there is not an harmonized approach, but there is a City effort to promote a more active collaboration, particularly with new applications that will start by allowing citizens to directly participate in the design and planning of new public spaces. The digital twin in which this application will be tested, will also open new opportunities of co-creation initiatives.

v) *The City has been creating an innovative culture of experimentation which also boosts its internal capacity.*

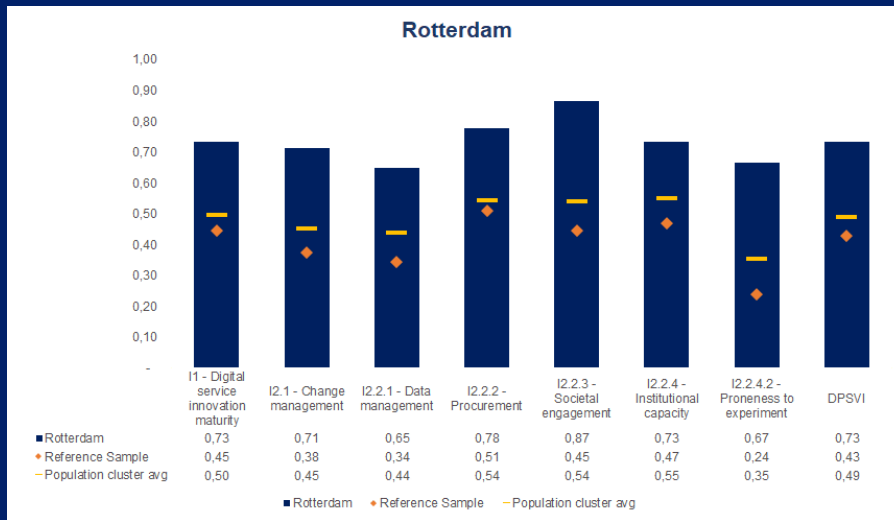
The City created an internal Digital Experimentation Centre, a space for experiments and to share knowledge, where employees can try IT solutions and digital developments to experience the added value of each and understand which ones improve the City internal work processes.

The participation on the European Innovator-R Transfer Network project also contributed to stimulate the City internal innovation culture. In this project a group of city employees from different departments were challenged and started developing a digital platform for interaction and knowledge exchange of the city civil servants with the city innovation ecosystem.

Rotterdam

Performance according to the Digital Public Service Value Index (DPSVI) based on Digisurvey

DPSVI performance significantly above the reference sample and above the same population cluster average



Strengths (above average): Societal engagement; Procurement; Institutional capacity; Digital service innovation maturity; Change management; Proneness to experiment; Data management

Figure 15 - Performance of the city of Rotterdam in the DPSVI relative to the reference sample and the population cluster average

11 Case Study: Thessaloniki (Greece)

11.1 Overview and approach to digital innovation

Thessaloniki, located in Northern Greece, is the second largest city in Greece with an economic and political influence on the whole region of Central Macedonia. The city has a population of 326,766 inhabitants⁸⁶⁹, while the metropolitan area hosts approximately 1.12 million⁸⁷⁰, facing **urban pressure and demographic challenges**, due to population ageing⁸⁷¹. The city is also characterized by its well-reputed universities, being the largest university town in Greece, which helps to counteract the demographic pressure. Moreover, the city hosts the **second most important port of Greece**, and **tourism from abroad has seen its importance rise** over the years peaking at over 2.3 million international air arrivals in 2019⁸⁷². These are two sectors that are already in a digital transformation path⁸⁷³.

In this context, the City developed a comprehensive Resilience Strategy to address the city challenges, which was the foundation to derive its digital plans. The City's internal capacity is conditioned to some extent by financing, human capital and infrastructure limitations that impact the implementation of the digital transformation process. Nevertheless, the active role of the City to promote a dynamic innovation ecosystem through e.g., community meetups, open events and hackathons, has been helping to overcome these obstacles. This is particularly evident in the mobility domain with several projects developed by city stakeholders that led to concrete services to address citizens' needs. The procurement of innovation is also at an early stage, with initiatives at national level being promoted to support further local capacity-building on this domain. The fiscal consolidation measures in the aftermath of the global financial crisis have slowed down the implementation phase of the City's strategic priorities for digital transformation due to shrinking public budgets.

Overall, the City has also been prioritizing an active and more transparent relationship with citizens through its Citizen Service Centres, and the 'Improve My City' platform, just to name a few. However, there is still room for improvement to fully integrate co-creation in the City's decision-making process and in the design of new services.

11.2 Proneness to Change

Thessaloniki has made some progress towards having internal departments to support the digital transformation of the City, particularly in the geospatial domain, with consistent investments since 2007. However, the municipality has been **lacking an horizontal institution** responsible for the implementation and monitoring of its digital strategy. In practice, as the strategy covers actions involving several city departments and **with financing not always secured, spontaneous and not fully coordinated projects start moving forward, without a clear alignment** between them. However, recently this year, the City promoted a re-shape of its internal organisation, with the creation of an entity, directly under Mayor's supervision, dedicated to coordinating all the digital actions.

⁸⁶⁹ 2011 Census

⁸⁷⁰ 2011 Census

⁸⁷¹ [Thessaloniki Resilience Strategy - Arup](#)

⁸⁷² [International air arrivals in Thessaloniki 2021 | Statista](#)

⁸⁷³ [Assesment Report_THESSALONIKI.pdf \(intelligentcitieschallenge.eu\)](#)

In terms of data management, the City has been following a consistent path to be a reference in the geospatial information management, which has provided accurate information and supported the development of new services. In respect to data covering other domains, the City has been implementing some initiatives to collect and provide the data, however, some limitations persist on the re-use of data to further develop new services.

The City of Thessaloniki does not yet fully integrate in its service design processes a co-creation methodology of engagement with citizens that would allow to take into account their perspectives and needs. On the other hand, the city ecosystem has partnered with the Municipality in several projects, which helped overcome some of the limitations on the internal capacity of the City. **The City involvement in European networks was relevant on the development of its strategic plans.** However, there is still room for improvement to include more regular practices of knowledge exchange at national or international level to support the digital transformation of the city and in the creation of new digital solutions that address the citizen's needs.

11.2.1 Innovation governance

11.2.1.1 Institutional Capacity

Governance

To fully analyse the institutional capacity of the city of Thessaloniki and its internal governance, it is essential to consider the two main levels of governance at subnational level in Greece. Following a process of decentralization, Greece introduced directly-elected regional authorities responsible for the implementation of regional development policies. The City of Thessaloniki and its 10 municipalities integrate the Region of Central Macedonia.

The decentralisation reform came with its own challenges for the governance of municipalities, notably not entirely clear jurisdictional boundaries, no adequate institutional capacity to deal with new responsibilities, and low autonomy due to the economic dependence from higher regional and national authorities (OECD, 2020)⁸⁷⁴. This governance challenge has been impacting the implementation of projects and strategies designed at city level, including in the digital domain, with some initiatives not continuing further. Indeed, the reform happened at the same time as the global financial crisis in 2008 and local governments saw their budgets reduced by 60% due to a contraction in the budget of the central government and many only managed to run their basic infrastructure and operations⁸⁷⁵.

The City of Thessaloniki did not concentrate, until recently, in one single city department or institution the responsibility for the digital transformation of the City. In practice, **the initiatives that the City has been implementing on this domain came from a top-down approach, where several departments of the Municipality were involved.** The lack of such a horizontal institution created several challenges and led to disconnected projects and initiatives which hamper a coordinated effort for large-scale projects or structural reforms on this domain.

However, in January 2021, the city recognized this and announced a **re-shape of its internal organisational structure with the creation of a new Internal Service Organisation, directly under Mayor's**

⁸⁷⁴ [Regional Policy for Greece Post-2020 | OECD Territorial Reviews | OECD iLibrary \(oecd-ilibrary.org\)](#)

⁸⁷⁵ [Assessment of the Development Potential of Greek Local Government \(coe.int\)](#)

supervision to improve the efficiency of public services. This organisation incorporates a Directorate for Recycling and Circular Economy (to accelerate efforts on circular business model practices), a Directorate for Education, a Department for Business Planning (to facilitate funding opportunities), and a Department to better position the city internationally.

Strategy and priority-setting

The key foundations of the Smart City strategic plans of Thessaloniki were laid down in 2009 as a result of a collaboration between the Regional Government of Central Macedonia and the Urban and Regional Innovation Research Centre (URENIO) from Aristotle University of Thessaloniki. The strategy- “**Intelligent Thessaloniki**”⁸⁷⁶- focused both on the deployment of open public broadband networks and the development of web applications and “smart environments”. Moreover, the strategy considered six main areas of the city, namely: the port area, the commercial city centre, the university campus, the Technopolis business park, the museum of science and technology, and the airport. Each area was then matched with an assessment of their characteristics and needs, in order to define tailor-made solutions that would strengthen their innovation capabilities.

The Municipality of Thessaloniki became the entity responsible for the coordination and implementation of this strategy. However, the negative effects from the financial crisis, combined with political uncertainty, put a halt to the implementation phase of the strategy by the Municipality. On the other hand, some bottom-up initiatives from several different city stakeholders kept arising throughout this period (Komninos et al., 2019).

Later, in 2014, the City was selected out of 1,000 city candidates as one of the 100 Resilient Cities⁸⁷⁷ **(100RC), an initiative led by The Rockefeller Foundation.** The 100RC was created with the mission of helping cities to “build reliance to the physical, social and economic challenges that are a growing part of the 21st century”. As a result of this initiative, Thessaloniki received financial, expert, and logistical guidance support for the establishment of a **Chief Resilience Officer** in the city government structure and for the development of the strategy “**Resilient Thessaloniki – A strategy for 2030**”⁸⁷⁸. This comprehensive strategy was preceded by a preliminary assessment of the state-of-play and the needs of the city⁸⁷⁹. In this first stage, between March and June 2016, different initiatives were organized with the involvement of a wide range of stakeholders. This was the first strategy developed in collaboration with the city ecosystem, including residents, entrepreneurs, small business owners, asset managers, institutions, etc. For example, this participatory process included an online questionnaire with more than 850 respondents, as well as a Resilience MiniLab workshop to evaluate, together with experts, the current and forthcoming challenges that the city may face. At the end, all the information collected was compiled in the Preliminary Resilience Assessment Report⁸⁸⁰, identifying five discovery areas of focus for the final Resilience Strategy of the city.

The Strategy identifies four main goals accompanied by concrete actions for the implementation phase: 1) shape a thriving and sustainable city, 2) co-create an inclusive city, 3) build a dynamic urban economy and response city, and 4) re-discover the city’s relationship with the sea. The development of

⁸⁷⁶ [Assessment of the Development Potential of Greek Local Government \(urenio.org\)](#)

⁸⁷⁷ [100 Resilient Cities - The Rockefeller Foundation](#)

⁸⁷⁸ https://resilientcitiesnetwork.org/downloadable_resources/Network/Thessaloniki-Resilience-Strategy-English.pdf

⁸⁷⁹ [Preliminary Resilience Assessment , Municipality of Thessaloniki \(sustainablegreece2020.com\)](#)

⁸⁸⁰ [Preliminary Resilience Assessment - Thessaloniki by Resilience Thessaloniki - Issuu](#)

'smart systems' is cross-cutting, i.e. it is seen as an enabler across these dimensions. For instance, in the mobility domain, the smart system refers to the creation of an integrated mobility system that monitors and enables a better understanding of the sources of pollution and its consequences in the Thermaikos Bay.

In fact, the long-term planning vision of 'Thessaloniki 2030' paved the way for the subsequent development of the City's Digital Strategy⁸⁸¹ for the period 2017-2030. The main goal was to establish a guiding framework that would help in the selection of specific actions, projects and policies in the digital domain. The document was designed with contributions from several city stakeholders, such as the Open Knowledge Greece Foundation⁸⁸² and the University of Macedonia, the Organisation of Open Technologies (EELLAK) and The Things Network.

The strategy defines five key dimensions: 1) **an interconnected city**, reliant upon infrastructure capable of providing an accessible internet connection for its citizens and in a network of interoperable smart devices and systems, 2) **an inclusive digital city**, that strengthens citizens' digital skills and promotes digital inclusion, 3) **data-driven policies**, through open data that informs citizens, promotes transparency and encourages the creation of new services, 4) **a participatory city**, that embeds collaborative and co-creation principles in the service design including channels of communication and participation between the City and its citizens, and 5) **a city that supports entrepreneurship and innovation**, by cooperating with academic and research institutions, engaging in European and city networks, and supporting the creation of new business models in the context of the Digital Economy. These different pillars were composed of concrete and measurable objectives, alongside a roadmap of specific actions to achieve them, including links with the Thessaloniki 2030 strategy.

The strategy will be updated every five years (2020, 2025 and 2030). However, the implementation phase has been delayed as, until the recently created Internal Service Organisation, there was no clear organisational structure dedicated to this phase and the necessary budget has yet to be secured.

Capacity to develop digital solutions

The development of services is currently done by outsourcing ICT technical support, considering the limited resources available- the city ICT department is composed by ten members. The City also **lacks a common and concrete strategy for internal capacity-building**; currently, capacity-building activities are ad-hoc, i.e., they take place only when higher authorities (e.g. Ministries) enforce the use of new digital platforms and tools. Nevertheless, the city recognizes the training of the staff as a challenge to be tackled, including some internal resistance and limited competences as well from the staff to fully embrace digital endeavours.

Furthermore, local governments in Greece also believe that with the administrative reform and the austerity rules that were imposed in the past, there is a **lack of autonomy/flexibility to employ skilled staff** that could then lead the implementation of ambitious programs and initiatives of the municipality⁸⁸³.

11.2.1.2 Data Management

The City of Thessaloniki has been implementing some initiatives to better leverage data to improve its decision-making and transparency. In fact, the City was one of the first cities in Greece to open its

⁸⁸¹ [Ψηφιακή Στρατηγική 2017-2030 \(thessaloniki.gr\)](http://www.thessaloniki.gr)

⁸⁸² Open Knowledge Greece, a chapter of Open Knowledge Foundation since 2013.

⁸⁸³ [Assessment of the Development Potential of Greek Local Government \(coe.int\)](http://www.coe.int)

data in an open data platform⁸⁸⁴. However, the data management of the City is still a work in progress as some bottlenecks persist.

Previous assessments of the city status⁸⁸⁵ in this domain pointed out the lack of a central entity for data management, and the inefficient coordination between city divisions due to the lack a common data management framework and vision. Consequently, this generated a situation of fragmented and disconnected data management actions. Therefore, there are untapped opportunities for creating new data-driven applications that could be derived from the re-use of data.

The City started its data management efforts in 2007, by using geographic information system (GIS) for base mapping purposes in its Building and Planning Division. The City rapidly realized the benefits of this system to better support decision-making for spatial planning. So, one year later, the City created a **GIS Office**, integrated in the Building and Planning Division. The GIS office centralized all the city's work on GIS, having the responsibility not only to collect, handle and display GIS data, but also to develop applications and explore new potential use cases in the city context.

To further develop the GIS potential, the city collaborated with a local private firm, GET⁸⁸⁶, to create an integrated spatial data infrastructure platform, using customized free and open software. From this collaboration, the **GeoPortal⁸⁸⁷** was created, with the Municipality's geospatial data shared in the form of maps. The portal followed the international interoperability standards (open geospatial consortium standards (OGC)⁸⁸⁸, the standards from the International Organisation for Standardization (ISO⁸⁸⁹) and the European Commission Directive INSPIRE⁸⁹⁰. The GeoPortal has two versions available- the free access version to the public, and the other for city administrators to improve and update the service.

The project of developing the Web GIS of the Municipality of Thessaloniki is ongoing and has already led to a series of services that include a city guide, geo-referenced building codes and regulations, optimized routes for waste collection, electrical distribution modelling, business permit access, and land-use planning. Such GIS applications have been relevant to improve internal monitoring and decision-making capabilities across city divisions, and to provide better services for citizens. For example, the **Digital Planning app** monitors the urban land use of the city and gives to citizens the possibility of submitting land plan permissions, hence reducing the time-consuming bureaucratic procedures concerning this process. Regarding the monitoring of the service, the municipality shares information on a daily basis on the number of digital land plan permissions submitted⁸⁹¹. However, there is no further data on how this process improved the efficiency of the service provided.

For this reason, the GIS office has become an important element to provide information for other City departments, businesses, and citizens. However, it is only one of the entities that is in charge of the management of data in the City. In fact, the **Directorate of Operational Planning and Information & Communication Technologies** also incorporates in its structure some departments with data-related

⁸⁸⁴ [Thessaloniki OpenData Portal](#)

⁸⁸⁵ IBM study⁸⁸⁵ and in the Intelligent Cities Challenge Assessment Report for the city of Thessaloniki conducted by the European Commission

⁸⁸⁶ [Company | Geospatial Enabling Technologies \(getmap.eu\)](#)

⁸⁸⁷ [Παρατηρητήριο χωροθέτησης αστικού προσίμου \(getmap.gr\)](#)

⁸⁸⁸ [OGC Standards | OGC](#)

⁸⁸⁹ [ISO - ISO 19115:2003 - Geographic information — Metadata](#)

⁸⁹⁰ [About INSPIRE | INSPIRE \(europa.eu\)](#)

⁸⁹¹ [Municipality of Thessaloniki - e-Government Portal - Planning permits](#)

competencies. For instance, the **e-government division** has the responsibility to manage the open government portal. **The portal⁸⁹², launched in 2015, is set to be host platform for the e-Services created by the city** and other future ICT projects of the Municipality. The portal incorporates the Open Data Platform⁸⁹³, to which several city divisions contribute by producing, collecting and managing datasets. The portal currently gathers 140 datasets in a wide variety of topics, from health, tourism, education, environment up to public administration and culture.

Additionally, under the participation of the City in the 100 Resilient Cities Challenge, the city collaborated with the World Bank and local stakeholders (Open Knowledge Greece and EOFarm P.C.) to develop the **Risk Data Portal⁸⁹⁴**. The Risk Data Portal is an open data collaborative platform that gathers geospatial data to better understand the city's risk of disaster and its vulnerability to natural hazards.

Although most of the information was already being collected, there were two pending issues that the portal intended to address. On the one hand, the information collected was spread given that it was produced separately by different types of organisations, such as research institutes or utilities companies; and, on the other hand, it was not properly used to identify the risks associated with disasters nor to plan preventive actions. Thus, **with the creation of the portal, the information was centralized in one single repository**, to which the different stakeholders could contribute to, and where any user can preview and download geospatial data, metadata and related documents. The Risk Data Portal nowadays counts with more than 100 geospatial datasets from 13 different organisations.

This initiative was also interesting because of the way it was designed and co-created. Citizens collaborated by providing crucial information on the at-risk zones. The home-school mapping exercise is one example of those engagement initiatives, where students and parents provided details on their routes to schools and modes of transportation. The information collected was later digitalized, aggregated and used to produce digital and anonymized “heatmaps” of the main routes that were used to school. The involvement of citizens and local organisations was also relevant for raising awareness on the importance of this topic for the city. The governance of this Portal falls under the remit of the GIS office, Resilience office and the e-government department.

11.2.1.3 Societal Engagement

In the societal engagement domain, the City of Thessaloniki aims to strength its relationship with citizens, with co-creation initiatives and new channels of interaction. Nevertheless, the city recognises that these initiatives are mostly experimental and are not yet widely integrated into the City decision-making process.

The City has in its structure a Directorate of Citizen Service Centres (CSCs) designed to manage the Citizen Service Centres and to make the bridge between citizens and the city departments. The CSCs were founded in 2002, under the initiative of the central government of Greece, namely the Hellenic Ministry of Interior, counting also with the support of a private firm, Kapa Research, to design and implement the first pilot. The main objective of these centres was to decentralize the delivery of public services and to create a front-gate through which citizens could efficiently be served and interact with local administrations.

⁸⁹² [Municipality of Thessaloniki - e-Government Portal - Home](#)

⁸⁹³ [Open Data Portal of the Municipality of Thessaloniki](#)

⁸⁹⁴ [About the Portal - riskdata.thessaloniki.gr](#)

Additionally, these centres were also relevant to create national standards in terms of public processes and hence to harmonize practices among different parts of the country. Despite being a central government initiative, the local administrations are the entities responsible for building, supervising and managing the centres.

At the beginning, due to the limited internet availability in Greece, the CSCs prioritized face-to-face services. At the time, Greece was one of the EU-25 Member States with the lowest performance on internet usage⁸⁹⁵. However, over time, a more complex multi-channel system was developed to better address citizen needs and to narrow the gap between citizens and municipalities. Throughout this process, the creation of a web-based IT platform, based on a service-oriented architecture (SOA) and with interoperability guidelines, has enabled further developments and the transformation towards more e-CSCs.

Additionally, the City of Thessaloniki has been promoting its own initiatives to promote societal engagement. The **Improve My City (IMC) platform**⁸⁹⁶ created in 2017 is an illustration of such efforts. The platform is available on a web-format at the open government portal and as a smartphone application. Hence it allows citizens to directly communicate to the City on issues they have come across by posting them on an interactive city web map. The platform covers requests that go from discarded trash bins, broken tiles on sidewalks up to illegal advertising boards. After submitting a request, the service provides personalized information and feedback about the progress made on each reported issue. At the same time, it can be used as a monitoring instrument for effective internal decision-making. In this way, citizens can actively solve city problems which reinforces the participatory governance of the City. The platform also counts with back-end infrastructure responsible for linking a citizen's request to the respective municipality department, allowing the assignment of the same request across more than one employee if needed be. Additionally, it is also capable of producing statistically aggregated information to assess the performance of each department in this regard. However, there have been some limitations to fully exploit the capabilities of this tool. In particular, city departments sometimes do not communicate the resolution of problems in proper time, which impacts the feedback from users and biases the information on performance.

The IMC is the result of memorandum of understanding between the City of Thessaloniki, URENIO Research and a private firm. The platform has as distinctive feature the fact that it was developed on open source thus allowing future interested parties to build on top of the existing infrastructure (Kominos et al., 2013). More recently, the City has signed a new contract with the same partners to ensure further support and enhancement.

In 2015, the city participated in OpenBudgets.eu⁸⁹⁷, a European project supported by EU's Horizon 2020 program and coordinated by Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V.. The goal was to "provide an open-source software framework and accompanying Software-As-A-Service (SAAS) platform for supporting financial transparency, thus enhancing accountability within public sectors, and as a result preventing corruption". Thessaloniki's participation, powered by Open Knowledge Greece,

⁸⁹⁵ [Digital divides in Greece: The role of society's culture and decision-making from a top-down and bottom-up perspective. Implications for the European information society. - LSE Theses Online](#)

⁸⁹⁶ [Digital divides in Greece: The role of society's culture and decision-making from a top-down and bottom-up perspective. Implications for the European information society. - LSE Theses Online \(thessaloniki.gr\)](#)

⁸⁹⁷ [Financial Transparency Platform for the Public Sector | OpenBudgets.eu Project | Fact Sheet | H2020 | CORDIS | European Commission \(europa.eu\)](#)

resulted in the creation of the **Open Budget web portal**⁸⁹⁸, which provides real-time data on how the Municipality's budget is managed, and the **Participatory Budget**⁸⁹⁹, that allows citizens to submit and vote on proposals of investment in the City. These initiatives are relevant to increase transparency and trust in the municipality.

Overall, even with these initiatives of engagement and points of interaction created, most of the projects come from a top-down approach, i.e., they are not being driven by citizen's needs. Thus, the City still lacks a clear and common framework for service design based on co-creation and citizen engagement.

11.2.1.4 Procurement

Traditional and innovative procurement

The City of Thessaloniki follows mostly traditional procurement processes – although there is a critical challenge to innovate, mostly due to rules, requirements, procedures and the duration of the process. In this domain, **the city is somehow limited by the dependence and centralization of competencies at national and regional level.**

The city's reality is influenced by the fact that at the national level, alternative or innovative procurement processes are still at an early stage of development⁹⁰⁰. Nevertheless, the national government in Greece has been implementing initiatives to improve local and national performance. In 2017, it adopted the National Procurement Strategy⁹⁰¹ and the National Digital Strategy for 2016-2021⁹⁰², with concrete actions to promote innovation procurement, such as the implementation of a framework of pre-commercial procurement for the supply of innovative services and products at the pre-commercial stage. However, so far there is no structure monitoring and evaluating the progress on innovation procurement.

Additionally, under the EU Horizon 2020-funded project Procure2Innovate⁹⁰³, **Greece committed to developing the National Competence Centre on Innovation Procurement**⁹⁰⁴ with the mission of “increasing the number of Greek authorities participating in pre-commercial procurement and innovation procurement”. As a result, it received in 2016 the annual event of European Assistance for Innovation Procurement, dedicated to promoting knowledge exchange on best practices in innovative procurement and funding opportunities from relevant programs for Greek institutions.

In 2018, Greece integrated the Procure2Innovate Network of Competence Centres⁹⁰⁵ and signed a joint declaration on innovation procurement that “aims to strengthen political commitment to innovation procurement at a European, national and regional level, and strengthen cooperation between Member States and the European Commission”. As a result, in the Conference of the Vice Rectors of Greek Universities, the Greek and the Irish National Competence Centres, shared principles and benefits from innovation procurement. Regarding **capacity-building**, apart from the initiatives under the Procure2Innovate network, **there**

⁸⁹⁸ [Financial Data \(c-gaia.gr\)](http://c-gaia.gr)

⁸⁹⁹ [OpenBudgets \(okfn.gr\)](http://okfn.gr)

⁹⁰⁰ [The strategic use of public procurement for innovation in the digital economy - Publications Office of the EU \(europa.eu\)](http://publications.europa.eu)

⁹⁰¹ www.opengov.gr/aads/wp-content/uploads/downloads/2016/02/02_STRATEGY_partB.pdf

⁹⁰² www.opengov.gr/digitalandbrief/wp-content/uploads/downloads/2016/11/digital_strategy.pdf

⁹⁰³ [P2I | The Project \(procure2innovate.eu\)](http://procure2innovate.eu)

⁹⁰⁴ [Θεσμική Αρμοδιότητα του Κέντρου Αριστείας για τις Δημόσιες Συμβάσεις Καινοτομίας \(promitheus.gov.gr\)](http://promitheus.gov.gr)

⁹⁰⁵ [P2I | P2I network \(procure2innovate.eu\)](http://procure2innovate.eu)

are only sporadic events with no targeted strategy on capacity-building to enhance the adoption of innovation procurement, at local or national level. For example, one of those initiatives in Thessaloniki is a one-day event on Innovation Procurement in the Regional Policy, organized in 2014, by the Region of Central Macedonia in cooperation with DG CNECT and the Smart Specialization (S3) Platform.

Greek cities continue to rely predominantly on big procurement contracts rather than engaging with smaller innovative actors within a given ecosystem to develop new digital services or solutions. In part, this situation persists because the national legal framework of the information and communication technology projects consider, as basic award criteria, previous experience and financial credibility which plays in favour of large and well-established firms as prime contractors.

Financing digital solutions

According to the City, national and regional funds are the main sources to support city projects. This is partly because these funds are derived from the centralization of European funds by national and regional authorities. Over time, **European programs, such as the Horizon 2020, became increasingly relevant to support the city projects on the digital domain.**

For the coming years, the City expects that part of the funding needs will be tackled through the Greek Recovery and Resilience Plan, where 23,3% of the funds are dedicated to support the digital transition in the country, from which, the largest share, of EUR 1.3 billion, will be allocated to the digitalisation of public services⁹⁰⁶. In addition, the City plans to get more involved in European and national programs around smart cities and digitalisation.

11.2.2 Change Management

The City of Thessaloniki, through its Resilience Office, has been gradually joining city networks and participating in European programs. These participations, together with the contribution of city stakeholders, have promoted the creation of new services and supported the digital transformation in the city.

The Municipality of Thessaloniki was one of the 41 European cities selected to join the Digital Cities Challenge⁹⁰⁷ (DCC) promoted by the European Commission. The DCC is a tailored programme of coaching and facilitation to assist cities in the development and implementation of digital policies. The DCC categorized the cities in three groups: i) a group of **six were mentor cities** that shared their good practices; ii) a group of **fifteen cities**, including Thessaloniki, that had access to a budget of 9.2 billion euros and to free-of-charge high-quality policy advice on topics of smart policy design and implementation, coaching and also support in the implementation of digital transformation strategy; and iii) the remaining **twenty were a group of fellow cities** that engaged in the program with their own resources. **The initiative promoted synergies between existing policies related to digital priorities** (e.g., the city's digital strategy and the strategy for Resilient Thessaloniki) and other planned policy actions to support the digital transformation. In the field of advisory services, Thessaloniki received an assessment report⁹⁰⁸ developed by a group of high-level experts, with concrete key performance indicators and a detailed characterization of the state-of-play in the digital

⁹⁰⁶ [Greece's recovery and resilience plan | European Commission \(europa.eu\)](https://europeancommission.europa.eu)

⁹⁰⁷ [DCC Conference | Digital Cities Challenge \(digitallytransformyourregion.eu\)](https://digitallytransformyourregion.eu)

⁹⁰⁸ [Assesment Report_THESSALONIKI.pdf \(intelligentcitieschallenge.eu\)](https://intelligentcitieschallenge.eu)

domain in the city. This assessment report was relevant to further develop the city's strategic vision and the roadmap on the digital transformation journey.

Following the work developed under this DCC, in 2020, Thessaloniki joined the Intelligent Cities Challenge⁹⁰⁹ (ICC)- a European Commission initiative that brings together 136 cities “to achieve intelligent, socially responsible and sustainable growth through advanced technologies”. Within the ICC, the city of Thessaloniki seeks support in “the creation of an interconnected city for everyone through data, enhancing citizen participation and increasing digital innovation”. This support comes from the knowledge exchange between ICC cities, and the insights provided by thematic experts and mentor cities, ultimately contributing to the development of new pilot projects.

With respect to its innovation ecosystem, the city hosts a “vibrant digital community”⁹¹⁰ though some obstacles remain, such as the lack of connection with non-digital companies, that limits its full potential. In the city of Thessaloniki there are higher education institutions capable of providing a “steady flow of well-educated ICT graduates”⁹¹¹ and a representative group of ICT companies able to support the development of new digital services. The city of Thessaloniki and the national government have been putting forward concrete initiatives and projects, with the goal of fostering the city innovation ecosystem and leverage from that to generate public value.

For instance, the Greek government selected the city of Thessaloniki to become the international hub of the country. To this end, it established in 2020 the Thessaloniki Innovation Zone (TIZ)⁹¹². The goal is to concentrate in this area “a critical mass of companies based on new technologies and innovation”. The TIZ management and implementation is under the responsibility of Alexander Innovation Zone SA (AIZ), that also accumulates the competencies related to the management of the city incubator hub Ok!Thess⁹¹³, and the promotion of foreign direct investment (FDI). The board members of AIZ are representatives from key organisations, such as the Hellenic Institute of Transport (HIT), the Rector of Aristotle University of Thessaloniki, the Hellenic Industries Association and the Greek Exporters Association (GEA). The COVID-19 pandemic has slowed down the development and implementation phase of TIZ.

The Municipality created in 2015 the Ok!Thess with the ambition of making it an active agent in the promotion and support of the innovation ecosystem through community meetups and open events. The incubator also has an acceleration program that includes training, coaching, and support for access to capital. In 2020, Thessaloniki was also chosen by Pfizer to develop its second digital innovation hub⁹¹⁴ and in the same year, Cisco inaugurated its Centre for Digital Transformation and Digital Skills.

The municipality of Thessaloniki has also been engaging with its ecosystem to promote events and initiatives. The **Technology Forum** is a clear illustration of that, where twenty organisations from industry, academia, governmental sectors came together to organize this technological conference⁹¹⁵. The event counts with a matchmaking session dedicated to promoting business, technological and research partnerships among participants.

⁹⁰⁹ [About Intelligent Cities Challenge | Intelligent Cities Challenge](#)

⁹¹⁰ [Assesment_Report_THESSALONIKI.pdf \(intelligentcitieschallenge.eu\)](#)

⁹¹¹ [Assesment_Report_THESSALONIKI.pdf \(intelligentcitieschallenge.eu\)](#)

⁹¹² [Αλεξάνδρεια Ζώνη Καινοτομίας Α.Ε. - Thessinnozone](#)

⁹¹³ [arxiki-geniki-idea.pdf \(okthess.gr\)](#)

⁹¹⁴ [Digital hub | Digitalhub \(pfizer.com\)](#)

⁹¹⁵ [TF-Home - \(technology-forum.eu\)](#)

The Municipality of Thessaloniki organized, in 2014, the first Hackathon in the City- Apps4Thessaloniki⁹¹⁶. The competition resulted from the collaboration between the city departments (e-government and European Direct Information Centre) with the Open Knowledge Foundation of Greece and URENIO's Research Unit. This was an initiative that involved the entire city, with citizens, organisations, institutions and businesses of Thessaloniki being asked to register their needs regarding digital services and to vote in the best solutions, counting with more than 200 ideas on how to improve the quality of life in the city. The winning teams received a financial prize to develop their applications. One year later, the city promoted a new edition, focused on digital solutions for the tourism sector. Nevertheless, these solutions are yet to be materialized into real services in the city.

11.3 Digital Service Innovation Maturity

Sectors experiencing considerable digital innovation maturity

Mobility is one of the most mature city areas in terms of digital innovation for service provision. Thessaloniki's Urban Mobility Center⁹¹⁷ (TUMC) has been one of the key entities driving innovation in this sector. TUMC results from the collaboration between key players of the city responsible for urban mobility, transport and environment, namely the Region of Central Macedonia, the Municipality of Thessaloniki, the Hellenic Institute of Transport – Center for Research and Technology Hellas and the Thessaloniki's Integrated Transport Authority. The center also counts with the support of the National Observatory of Athens and the Institute of Transport Economics – Norwegian Centre for Transport Research. Thessaloniki's Urban Mobility Center then developed the Intelligent Urban Mobility Management System (Mobithess)⁹¹⁸ which provides several services to support travellers in moving around the city. The system's incident management capacity relies on real-time information to provide routing services for both private and public transport modes. The infrastructure that supports Mobithess consists of an extensive network of Bluetooth device detectors that have been installed around the city, providing great coverage and high accuracy. From the €2,916,854 needed to finance the development the Intelligent Urban Mobility Center, half was supported by Iceland, Liechtenstein and Norway through the financial mechanism 'European Economic Association', and the other half by national funds. Mobithess' main challenge is the need of continuous resources to maintain, update and improve its activities, in order to ensure that the service keeps providing accurate results. On the other hand, by collecting traffic data, this system also provides guidance to local authorities on how to better improve current traffic-related models.

Over time, Thessaloniki's Urban Mobility Center has evolved and transformed into the Thessaloniki Smart Mobility Living Lab (ThSMML)⁹¹⁹, one of the largest labs in Europe. The ThSMML was co-founded by the Hellenic Institute of Transport and the Centre for Research Technology Hellas (CERTH) and counts with partners from different fields of the ecosystem (industry and technology providers, public administration, transport network operators, etc). Additionally, ThSMML is also a member of the European Network of Living Labs (ENoLL) that "promotes and enhances user-driven innovation ecosystems"⁹²⁰. The ThSMML has been developing several projects and mobility services, apart from Mobithess. An example of those is the iBike

⁹¹⁶ [Δήμος Θεσσαλονίκης - Πύλη Ηλεκτρονικής Διακυβέρνησης - Apps4Thessaloniki- 2014](#)

⁹¹⁷ [Κέντρο Αστικής Κινητικότητας Θεσσαλονίκης \(mobithess.gr\)](#)

⁹¹⁸ [Κέντρο Αστικής Κινητικότητας Θεσσαλονίκης \(mobithess.gr\)](#)

⁹¹⁹ [Thessaloniki Smart Mobility Living Lab - HIT/CERTH \(imet.gr\)](#)

⁹²⁰ [About us - European Network of Living Labs European Network of Living Labs \(enoll.org\)](#)

Share⁹²¹ with the development of an integrated electronic service to support the operation of public bicycle systems in the City. Another example is the CommINSAFE⁹²², where Thessaloniki was a pilot city to test a car-pooling solution and ride-sharing service adapted to COVID-19 circumstances.

Additionally, on the mobility and urban space management domains, the City has developed THESi⁹²³, a new controlled parking system of the municipality to assist residents, visitors and the internal decision-making of the city. The system aims to be a governance tool to enhance the parking policy, and to reduce illegal parking and traffic congestion, based on the continuous dynamic flow of information. The Municipality provided the data needed for the controlling parking system, namely the details on the location, conditions and area of each parking spot, being the system and application developed by two technological firms, Intrasoft International⁹²⁴ and Intrakat⁹²⁵. The system is under the supervision and management of the Municipal Police that is also equipped with devices with access to the payments database, thus allowing for the reading of the licence plate of each parked vehicle and whether all is according to legal requirements. The project was financed by an innovative procurement scheme that ensured the resources needed without relying on any public funds. The process consisted in a “bid to entrust the development and operation of the system, which was funded by the actual revenues derived from its market exploitation”. The first six months of the project revealed some positive indicators on the performance of this solution - an increase of 231% of app users, 61% increase in the payments through the application, more than 6,000 vehicles daily checked and approximately 8,000 fines issued.

In the urban space management domain, the City has also developed the urban green management application, Green Tree⁹²⁶, to create an integrated model system to manage the urban forestry of the city. The Green Tree program provides to the competent services of the Municipality an accurate map and records of the objects under their responsibility. As a result, this tool allows for better internal planning on all the related actions to the sustainable management the urban greenery of the city. The information collected is made available also for the overall community, with transparency and research purposes. The project was developed in close collaboration with two local firms specialized in this domain, YLORIKI⁹²⁷ and HOMEOTECH⁹²⁸ and the School of Agriculture, Forestry and Natural Environment Department from Aristotle University of Thessaloniki. The project had a duration of 34 months, from 2012 to 2015, and was funded by the General Secretariat for Research and Technology within the framework of the Cooperation 2011 Program with a budget of approximately half million euros⁹²⁹.

This was a project that later contributed to development Urban Resilience Observatory⁹³⁰ of the Municipality, [*tbc with the municipality*] created in the context of the Resilience Strategy of the City and with the contribution of resources provided by Earth Observation Toolkit for Sustainable Cities and Human

⁹²¹ [iBikeShare](#)

⁹²² [CommINSAFE Project \(imet.gr\)](#)

⁹²³ [THESi – by ParkPa](#)

⁹²⁴ [Home Page | Netcompany-Intrasoft](#)

⁹²⁵ [Intrakat |](#)

⁹²⁶ <https://greentree.gr/greentreemanager/index.php>

⁹²⁷ [Υλωρική Ε.Ε. | Εταιρεία Μελετών – Εταιρεία Μελετών \(yloriki.gr\)](#)

⁹²⁸ [Η σελίδα δεν βρέθηκε - Homeotech](#)

⁹²⁹ <https://greentree.gr/greentreemanager/index.php?r=site/aboutProgramme>

⁹³⁰ [Thessaloniki Use Case \(arcgis.com\)](#)

Settlements⁹³¹ from the UN HABITAT⁹³². **This Observatory collects data to measure the environmental footprint on a GIS environment**, and its framework is aligned with the UN's Sustainable Development Goals (SDGs). For example, in order to **monitor air pollution**, Thessaloniki uses *Copernicus* - the European Union's Earth observation programme - to upgrade the existing spatial data infrastructure (SDI) of the city in order to provide end users in the Region of Central Macedonia with advanced searching, viewing, and downloading services to satellite data. From the dataset made available through this programme, the city has the capacity to in near real-time and following standardized web services, provide air pollution information with detail on the concentration of pollutant gases. The Copernicus program was also useful to improve the SDI capacity in terms of environmental data on the distribution of urban green spaces.

All in all, the Observatory is responsible by the monitoring, conducting analyses and drafting reports on the performance of the city on the SDGs and to support decision-making. In respect to funding, the Observatory counted with regional support⁹³³.

Overall, on other domains, the City also has some digital initiatives but without significant advanced technological components incorporated in them. According to the City, AI technologies and solutions are not yet planned. However, the city is planning to deploy IoT for safety and security purposes mainly. It is also important to note, that a big share of Thessaloniki's citizens is not yet choosing digital services when there are other options available, which presents an obstacle to further digitalisation of city services. This is a situation also verified at national level, where the overall use of internet services in Greece remains below the EU average, with a country ranking 25th in the EU.⁹³⁴

ICT Infrastructure

To some extent the development of more advanced and mature technologies has been constrained by the “lack of adequate IT infrastructure”, identified by the City as one of its key obstacles. In fact, this has been a constant limitation, also at the national level. In terms of connectivity, Greece ranks last among the 28 EU Member States⁹³⁵, with poor performance on very high-capacity networks coverage and in fixed broadband take-up of speeds of at least 100Mbps⁹³⁶.

However, at the national level, some progress has been made, with an increase on ICT investment as share of total investments⁹³⁷ and an improvement of the country overall performance in several dimensions of the Digital Economy and Society Index (DESI)⁹³⁸. Additionally, the Greek government presented in 2021 its “Digital Transformation Bible 2020-2025”⁹³⁹, in which connectivity is a strategic axis. In the National Recovery and Resilience Plan⁹⁴⁰, the Greek government also foresees connectivity investments of EUR 321.6 million to improve performance on this domain and also to support the digitalisation of the public sector at the local level.

⁹³¹ [About Toolkit \(unhabitat.org\)](https://unhabitat.org/about-toolkit)

⁹³² [UN-Habitat - A Better Urban Future | UN-Habitat \(unhabitat.org\)](https://unhabitat.org/un-habitat-a-better-urban-future)

⁹³³ [Thessaloniki 2030 Resilience Strategy as a roadmap for Sustainable Tourism Mobility | Interreg Europe - Sharing solutions for better policy](https://interreg.europa.eu/interreg/2021/04/thessaloniki-2030-resilience-strategy-as-a-roadmap-for-sustainable-tourism-mobility)

⁹³⁴ Indicator of the Digital Economy and Society Index.

⁹³⁵ Indicator of the Digital Economy and Society Index.

⁹³⁶ [DESI - Greece | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/digital-strategy/en/desi-greece-shaping-europes-digital-future)

⁹³⁷ [DESI - Greece | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/digital-strategy/en/desi-greece-shaping-europes-digital-future)

⁹³⁸ <https://ec.europa.eu/newsroom/dae/redirection/document/80479>

⁹³⁹ [Βιβλίο Ψηφιακού Μετασχηματισμού 2020-2025 \(digitalstrategy.gov.gr\)](https://digitalstrategy.gov.gr/)

⁹⁴⁰ [Greece's recovery and resilience plan | European Commission \(europa.eu\)](https://ec.europa.eu/economic-recovery-plan/en/greece-recovery-and-resilience-plan)

At the local level, Thessaloniki technological infrastructure has been assessed as “obsolete”⁹⁴¹ with a lack of free city-wide wireless network identified as one of the most significant “deficit in the digital infrastructure of the city”⁹⁴². As a result, the penetration of digital technologies in the physical infrastructure has been slow.

Nevertheless, in the metropolitan area of Thessaloniki there are good examples of public investments in digital infrastructure. For instance, the municipality of Thessaloniki installed 13 Wi-Fi spots that covered areas with large number of visitors and with a lack of broadband infrastructures. Hence, this led to free internet for its citizens and supported the development of new services and applications⁹⁴³. In Thessaloniki, the City plans to address its needs of connectivity with the development of wireless network of free internet access in the metropolitan area and investment on a network of sensors for data collection that support the creation of new services.

Box 10 - Zoom-in: E-Services - Digital Services Portal

○ Overview

Developed as a result of the COVID-19 pandemic, **e-services is a digital portal** for citizens to request a specific document, such as birth certificates, park permits or business licenses. It represents an effort of the city to keep a good quality level of service delivery even during the pandemic. **This service has been developed in-house and has received good feedback from citizens.** It represents a good starting point to what the city is preparing to launch soon: a new city portal building upon the learnings from this initiative.

○ Relevance and uniqueness

Based in an open-source platform, it is a one of a kind in Greek public service provision. It has a user-friendly interface, ensuring data protection and can accommodate additional services in future developments. The service has strong capabilities to scale up internally by adding new features or domains – and a potential to expand and replicate to other Greek cities.

It marks the introduction of the digitalisation of public services which are usually delivered on-site. As Thessaloniki is a research and innovation hub and is one of the driving cities for digital transformation in Greece, the service can be replicated in other local communities. Likewise, it has also accommodated new types of services: according with the city report, the types of services included increased from 9 in 2020 to 30 different services in June 2021. This marks an important starting point to the city’s plans of fully implemented automated public services by end of 2022 – i.e., the new “city portal”.

○ Challenges & Drivers

When the pandemic started, citizens had to be in lockdown, but public services needed to remain operational. Considering that back in March 2020 the city’s digital maturity was low, the city had to quickly adapt to a new reality, and to continue to address citizens’ requests, demands and needs of public service provision. The City Registry and the IT Department understood these needs and worked together

⁹⁴¹ [thessalonki-greece-full-report-2017.pdf \(smartercitieschallenge.org\)](#)

⁹⁴² [Assesment_Report_THESALONIKI.pdf \(intelligentcitieschallenge.eu\)](#)

⁹⁴³ [\(PDF\) Toward Intelligent Thessaloniki: From an Agglomeration of Apps to Smart Districts \(researchgate.net\)](#)

to ensure a quick deployment of a digital platform. To avoid public procurement processes, limitations and time constraints, Thessaloniki managed to find the internal resources based on existing open-source technology. A key bottleneck to launch the solution was the **low level of digital literacy of both City Hall employees and citizens**. As a result, initially, public civil servants and citizens offered some resistance to this change. However, younger generations with a strong smartphone penetration triggered the e-services solution – paving the way for a new city platform, which is planned to be launched in 2022, as part of the city's overall effort to digital transformation.

○ Implementation and Monitoring

The City involved both the City Registry Department and the Software Department to develop the solution. However, neither citizens nor actors from the innovation ecosystem were involved in designing and creating the solution. The City followed a top-down approach to innovation, in which the solution was developed according to the City's perception of citizens' needs. Civil servants were to some extent opposed to digitalisation of the documentation of processes and no further capacity-building initiatives were undertaken (indeed, trainings are only planned for 2022). According to the City, only half of the civil servants is digitally literate – similarly to the Thessaloniki population. The City embraced the organisational model in place to carry out these new initiatives and no network of cities was leveraged to create the service. The e-services platform was communicated through social media and awareness campaigns in schools. These communication activities are aligned with the Municipality effort to communicate the new city portal that will become available next year. The Municipality keeps track of the usage and coverage level of the service but no KPIs were defined in the beginning of the service.

○ Impacts

Statistics show that around 13,000 requests have already been answered through the platform, with 4,900 certificates being emitted in 2020. In July 2020, when the platform was launched, only 131 monthly requests were registered – while the number of requests increased to 1,983 by June 2021. The service has paved the way for additional improvements in digital services, namely the plan to create the new city portal by 2022. The City has the perception that both public civil servants and citizens are satisfied with the new service and intends to launch surveys to assess more effectively the impact of the solution, the level of satisfaction, and to collect ideas as well for the next steps.

11.4 Conclusions and lessons learned

The digital transformation journey of the city of Thessaloniki has to some extent been limited by exogenous factors, such as the global financial crisis, which has brought economic uncertainty and funding constraints in its aftermath, **and by some underlying country-specific conditions relevant for digital innovation**, which include for instance the poorly developed national digital infrastructure⁹⁴⁴ and the low digital literacy of the Greek population⁹⁴⁵. However, over time, the City has been boosting its efforts to

⁹⁴⁴ In the *Connectivity* dimension of the European Commission *Digital Economy and Society Index (DESI) 2021*, Greece registered the lowest performance of the 27 EU Member States. This dimension included as sub-dimensions fixed broadband take-up, fixed broadband coverage, mobile broadband and broadband prices <https://digital-strategy.ec.europa.eu/en/policies/desi-connectivity>

⁹⁴⁵ In the *Human capital* dimension of the DESI 2021, Greece ranked 21st in the EU. This dimension includes Internet user skills and Advanced skills and development <https://digital-strategy.ec.europa.eu/en/policies/desi-human-capital>

overcome these obstacles and to ensure better public service provision. On the one hand, the City has been promoting and engaging with its ecosystem to better leverage from its expertise on the development of solutions for its citizens. On the other hand, the City has been putting forward investments on the city ICT infrastructure that support the digital transformation.

Below we explore in more detail some potential lessons learned from the experience of Thessaloniki in transforming its public service provision through digitalisation:

i) *The City leveraged on European and international initiatives to develop its strategic priorities for a more sustainable and digital Thessaloniki.*

The participation in the 100 Resilient Cities program and in European initiatives- Digital Challenge and the Intelligent Cities-, has provided access to independent external assessments and support essential to identify the city struggles, define priorities and prioritize concrete actions. As a result, the City achieved an independent strategic framework, designed in collaboration with the ecosystem, to guide and support decision-making in the city. Importantly, sustainability and digital goals were aligned as to maximize the socio-economic and environmental impact from these strategies.

ii) *The lack of structural components linked to the governance of the digital portfolio and to the development of digital infrastructure has slowed down the city's efforts to promote the digital transformation.*

At the governance level, the City has been lacking a centralized institution, horizontal to the city structure, to coordinate, implement and monitor the progress on the digital strategy. In 2021, the City recognized this challenge and announced the creation of the Internal Service Organisation to assume this role.

The ICT infrastructure is not yet ready to accommodate a quick digital transformation of the city's service provision. In particular, the lack of free city-wide wireless access and the insufficient average broadband access speed for bandwidth demanding applications such as IoT⁹⁴⁶ limits the development of new digitally innovative services.

iii) *The city's active innovation ecosystem has enabled the development of new digital projects and services.*

The interaction of the Municipality with its active city innovation ecosystem has been supporting the digital transformation of the city. In the mobility domain, this is particularly evident with the creation of Thessaloniki's Urban Mobility Center and the projects and services that derived from there, such as the iBike Share and Mobithess. Also, the city stakeholders have been a driving force in promoting technological initiatives, such as the Technology Forum and the Apps4Thessaloniki competition.

iv) *National policies and country-specific conditions often impact the speed and effectiveness of the digital transformation at the local level.*

The global financial crisis of 2008 hit Greece particularly hard⁹⁴⁷ and led to a debt crisis⁹⁴⁸ followed by austerity measures and political uncertainty. The administrative decentralization reform coincided with the crisis, so local governments saw the funds transferred from the central budget reduced thus impacting public

⁹⁴⁶ [Assesment Report THESSALONIKI.pdf \(intelligentcitieschallenge.eu\)](#)

⁹⁴⁷ [The IMF and the Greek Crisis: Myths and Realities](#)

⁹⁴⁸ [Greece's Debt Crisis Timeline | Council on Foreign Relations \(cfr.org\)](#)

service provision and the successful implementation of strategic priorities (i.e., there have been delays and some initiatives were even discontinued). Moreover, this reform has brought “limited freedom for local governments to shape their own human resources policies” and they often lack the right staff to implement more ambitious programmes⁹⁴⁹.

At the national level, there is also room to improve on digital connectivity, digital competencies and overall digital literacy. Although Greece has been improving its performance in almost all dimensions of the Digital Economy and Society Index (DESI) of the European Commission, in most indicators it still scores below the EU average⁹⁵⁰. For example, only 51% of the population has at least basic digital skills, below the EU-average of 56%. The 2019 World Internet Project – Greece (WIP-GR), a part of the international World Internet Project, founded by the USC Annenberg School Center for the Digital Future, also concluded that Greece is a laggard in internet penetration and the use of e-services, and that demand is weak for internet services⁹⁵¹. Moreover, the study also highlighted that strong idiosyncratic cultural factors (defined accordingly as “defensive attitudes toward innovation and anti-reformist values”) are a bottleneck to the digitalisation of the country.

All these factors together (funding, infrastructure, human capital and sociocultural characteristics) translate into barriers also at the local level for better public service provision and call for a higher prioritisation of the digital transition and further coordination of the national level with the local level to make this happen. COVID-19 has to some extent boosted these efforts as citizens had to access public services online in situations of lockdown and quarantines. Moreover, Greece’s Recovery and Resilience Plan⁹⁵² puts digitalisation high in the national agenda and will include enhanced connectivity actions, further efforts for the digitalisation of public administrations, measures to tackle the digital divide, among others.

⁹⁴⁹ [Assessment of the Development Potential of Greek Local Government \(coe.int\)](#)

⁹⁵⁰ [Countries' digitisation performance | Shaping Europe's digital future \(europa.eu\)](#)

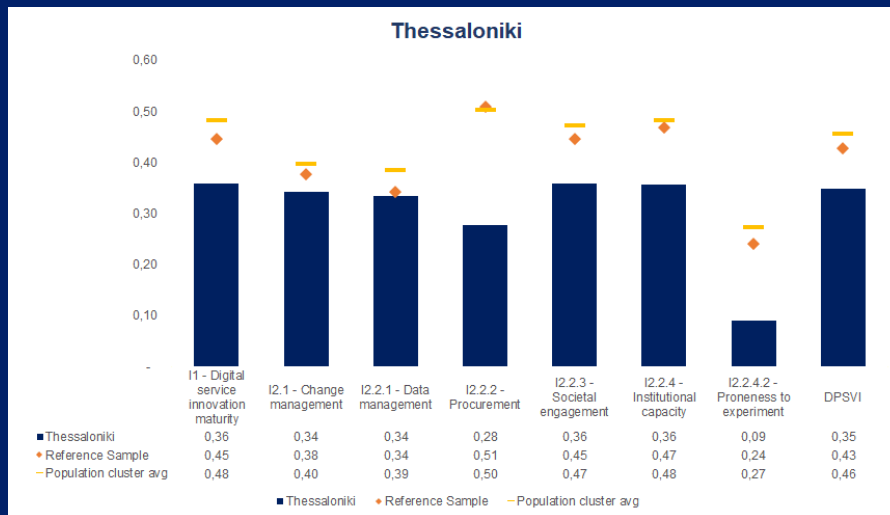
⁹⁵¹ [Greece's Digital Challenges: what is to be done? | Greece@LSE](#)

⁹⁵² [Greece's recovery and resilience plan | European Commission \(europa.eu\)](#)

Thessaloniki

Performance according to the Digital Public Service Value Index (DPSVI) based on Digisurvey

DPSVI performance is below the sample average and below the same population cluster average



Room for improvement (below average): Procurement; Proneness to experiment; Digital service innovation maturity; Institutional capacity; Societal engagement; Change management; Data management

Figure 16 - Performance of the city of Thessaloniki in the DPSVI relative to the reference sample and the population cluster average



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