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The Local Data Economy

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Abstract

In this chapter, we will very briefly raise the topic of how the local data economy which exists in a smart city can benefit from having access to a citizen's personal data, as part of the wider ecosystem, which, if successfully created in a city, should produce data at a scale of real value to local companies and to SMEs in particular, thus enhancing operations already being carried out in the local data economy and stimulating new ones.

An underlying objective of this book has been to try to indicate which developments are in the pipeline and so should be taken into account when planning the evolution of urban data platforms and growing the local data economy, enhanced with personal data. This chapter will provide examples of ongoing work to stimulate the data economy – and hence from a smart city perspective, the local data economy.

5.1 Introduction

Chapter 4 has covered how by making personal data from the citizens available in a trusted way, it can augment the smart city applications which were highlighted in Chapter 3, as well as generally improving service delivery, whilst engaging citizens in the decision-making process towards the goal of achieving climate – neutral cities by 2030.

The following chapters will cover a range of topics tackling other issues faced, before personal data can be fully utilised. Here we will very briefly raise the topic of how the local data economy, which exists in a smart city, can benefit from having access to a citizen's personal data,

as part of the wider ecosystem, which, if successfully created in a city, should produce data at a scale of real value to local companies and to small and medium enterprises (SMEs) in particular, thus enhancing operations already being carried out in the local data economy and stimulating new ones.

It has been said that an SME operating in the data economy finds it easier to raise finance than it does to access the data it requires. Creating an ecosystem to access personal data should encourage wider sharing of data and, therefore, provide a stimulus to SMEs.

If the EU's ambition of increasing its share of the global data economy commensurate with the size of its economy is to be reached, here is a driver. And the required shift of power from the huge non-European corporations in the direction of a European model of the data economy will rely considerably on SMEs meeting the challenge, aided in part by the EU funded projects which are working in this field.

The EU data market is forecasted to reach 85 billion euro with accumulative growth of 7% between 2020 and 2025 as European enterprises accelerate their digital transformation.[1]

Data sharing and data interoperability are still at their infancy; few data markets for sharing industrial data exist. In a recent survey, more than 40% of the SMEs interviewed claim that they had problems in acquiring data from other companies. The diffusion of platforms for data sharing and the availability of interoperable datasets is one of the key success factors which may help to drive the European data economy and industrial transformation.[2]

The smashHit project sums up the potential value of data to a local economy:

"This enormous amount of data offered by various data sharing platforms represent:

• A massive information resource to create new value, allowing the improvement of existing services or the establishment of diverse new innovative services, by combining data streams from various sources.

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[1] "The European data market study update - Shaping Europe's digital future." https://digital-strategy.ec.europa.eu/en/library/european-data-market-study-update (accessed Jul. 25, 2022).

[2] "SME panel consultation - B2B Data Sharing - Shaping Europe's digital future." https://digital-strategy.ec.europa.eu/en/library/sme-panel-consultation-b2b-data-sharing   (accessed Jul. 25, 2022).

- A major big data-driven business potential, not only for the manufacturers of Cyber Physical Products (CPP), but in particular also for cross-sectorial industries and various organisations with interdisciplinary applications".[3]

An underlying objective of this book has been to try to indicate which developments are in the pipeline and so should be taken into account when planning the evolution of urban data platforms and growing the local data economy, enhanced with personal data. This chapter will provide examples of ongoing work to stimulate the data economy and, hence, from a smart city perspective, the local data economy.

Chapter 2 covered a range of projects that are contributing to moving forward this agenda, as "Innovation Actions for setting up and operating platforms for secure and controlled sharing of "closed data" (proprietary and/or personal data)".[4]

Whilst the focus has been on projects working towards making personal data more accessible, other sister projects have been facing the challenge of helping the local data economy by providing:

- privacy metrics that are easy to understand for data subjects and contribute to the economic value of data by allowing privacy-preserving integration of independently developed data sources;

- industrial data platforms that shall enable and facilitate trusted and secure sharing and trading of proprietary/commercial data assets with automated and robust controls on compliance (including automated contracting) of legal rights and fair remuneration of data owners;

- the need to link to and bring in industrial data providers that will populate the platforms, with conditions of use and practical arrangements of data sharing being regulated.

We will look in more detail at what the projects i3-MARKET, AURORAL, and smashHIT are achieving as they have focused more on the economic aspects, but we should also point to other projects contributing to improving the local data economy.

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[3] https://www.smashhit.eu/wp-content/uploads/2021/03/smashHit_D1.3_Public_Innovation_Concept_v100.pdf

[4] "Supporting the emergence of data markets and the data economy - Programme H2020," *CORDIS - European Commission.* https://cordis.europa.eu/programme/id/H2020_ICT-13-2018-2019 (accessed Jul. 25, 2022).

These include:

- MOSAICrOWN[5] which is providing "effective and deployable solutions allowing data owners to maintain control on the data sharing process, enabling selective and sanitised disclosure providing for efficient and scalable privacy-aware collaborative computations".

- OpertusMundi[6] which is delivering "a trusted, secure, and highly scalable pan-European industrial geospatial data market, which will act as a single-point for the streamlined and trusted discovery, sharing, trading, remuneration, and use of proprietary and commercial geospatial data assets".

- SmashHit[7] which, in addition to assuring trusted and secure sharing of data streams incorporating personal data within a smart city context, also considers the industrial platforms that are needed to build sectorial and cross-sectorial services.

There are a variety of other projects which are contributing more at the European and specific sectorial levels.

Two projects highlighted in Chapter 2, AURORAL[8] and EUHubs4Data,[9] have emerged from the industrial leadership programme – leadership in enabling and industrial technologies – information and communication technologies (ICT).[10]

The programme has the aim of mastering increasingly complex and multidisciplinary technology and business chains in ICT, with partnering, risk-sharing, and mobilisation of critical mass across the union being needed.

The European DIGITAL SME Alliance plays a leading role in both the i3-MARKET and AURORAL projects, in order to assist in the development of its members and provide more opportunities for them, such as those which should materialise with the availability of more personal data to the existing

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[5] "MOSAICrOWN – Multi-Owner data Sharing for Analytics and Integration respecting Confidentiality and OWNer control." https://mosaicrown.eu/ (accessed Jul. 25, 2022).

[6] "Opertus Mundi." https://www.opertusmundi.eu/ (accessed Jul. 25, 2022).

[7] "Smash Hit." https://smashhit.eu/ (accessed Jul. 25, 2022).

[8] "AURORAL." https://www.auroral.eu/#/ (accessed Jul. 22, 2022).

[9] "EUHubs4Data - European Federation Of Data Driven Innovation Hubs." https://euhubs4data.eu/ (accessed Jul. 25, 2022).

[10] "INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT) - Programme H2020 ," *CORDIS - European Commission*. https://cordis.europa.eu/programme/id/H2020-EU.2.1.1. (accessed Jul. 25, 2022).

and evolving ecosystems within the data economy. The Alliance, the largest in Europe with more than 45,000 digital SMEs represented, is the joint effort of 30 national and regional SME associations from EU member states and neighbouring countries to put digital SMEs at the centre of the EU agenda.[11]

We will look in turn at the contribution these two projects are making towards growing the local data economy.

5.2 i3-MARKET

The main objective of the i3-MARKET project[12] was to develop the missing building blocks standing in the way of having an "Intelligent, Interoperable, Integrative and deployable open source MARKETplace backplane with trusted and secure software tools for incentivising the industry data economy".

This is in the form of a software framework called the "i3-MARKET backplane" for data providers and consumers, and, thus, it incentivises and enables the creation of a more trusted European data market economy. It addresses the interoperability and integration challenges for trading data assets across independent stakeholders by means of secured transactions based on data annotation (semantics), as well as a trusted data trading platform, and will provide a network of decentralised and economy-driven and scalable data repositories that can be extensible for enabling the deployment of intelligent industrial data services fostering innovation and business opportunities.

This backplane is now live and can be accessed at their webpage.[13]

It represents the culmination of the first phase of the project: the backplane is the results of the reference architecture, the mapping of the security, privacy and trust requirements, and will now be tested in three different industrial settings. It is providing the support tools to promote a joint ecosystem for unified European data marketplaces and data spaces, which can address the diverse needs that the demand side for data markets and spaces creates, and as a service provides a one-size-fits-all solution. It is based on open source technology and architecture and exists to provide secure services to the expanding data market and data economy. The backplane will fill a gap in the current data economy, as digital services are suffering from a lack

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[11] "European DIGITAL SME Alliance." https://www.digitalsme.eu/ (accessed Jul. 25, 2022).

[12] "i3-Market." https://www.i3-market.eu/about/#project (accessed Jul. 22, 2022).

[13] "i3-MARKET Backplane Goes Live - i3 Market." https://www.i3-market.eu/2021/05/27/i3-market-backplane-goes-live/ (accessed Jul. 25, 2022).

of support to ensure reliability and robustness, which it can offer through a federated, fully distributed environment, and thus providing an incentive for local data economies to grow and for future platforms to evolve.

It will allow local SMEs (as well as other stakeholders) to share, trade (monetise) their data assets, as well as to use and buy it from the others. Thus, it will incentivise and enable the creation of a more trusted European data market.

The piloting has taken place focusing on three sectors[14]:

- the automotive sector, bringing data supply and demand together and providing the possibility of efficient matchmaking through an open and brand-independent platform;

- the intelligent manufacturing sector, with SIEMENS offering their data on their products, manufacturing and supply processes through a single dataspace or marketplace;

- the healthcare and wellbeing sector, with IBM providing various elderly care solutions and products, which will allow this pilot to leverage IoT technologies to address patients' and relatives' needs.

5.3 AURORAL

We will now turn to AURORAL[15] which stands for "Architecture for Unified Regional and Open digital ecosystems for Smart Communities and Rural Areas Large scale application".

Whilst the AURORAL project is focusing on smaller communities, its overall ambitions and focus will also be of benefit to all communities, regardless of size. As well as the technology being produced, lessons learned in governance of such evolving eco-systems will be of value.

AURORAL focuses on increasing connectivity and delivering a digital environment of smart objects, interoperable services platforms able to trigger dynamic rural ecosystems of innovation chains, applications, and services. Thus, AURORAL contributes to increasing economic growth and creating jobs and to tackling significant societal challenges and contributes to overcoming the digital divide between rural and urban areas and to developing the potential offered by increased connectivity and digitisation of rural areas.

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[14] "i3-MARKET – The missing link between Europe's data marketplaces." http://opensource.i3-market.eu/ (accessed Jul. 25, 2022).

[15] "AURORAL." https://www.auroral.eu/#/ (accessed Jul. 25, 2022).

AURORAL digital environment is demonstrated by cost-efficient and flexible cross-domain applications through large-scale pilots.

Piloting is taking place in: Alentejo (Portugal), Southern Burgenland (Austria), Hålogaland (Norway), Västerbotten (Sweden), Lapland (Finland), Piedmont (Italy), and Penedès (Catalonia, Spain).

The project is focusing on five topics – tourism, mobility, energy, health, and agriculture.

It builds on an open, API-based, interoperable and federated Internet of Things (IoT) architecture and includes a reference implementation supporting flexible integration of heterogeneous services, bridging the interoperability gap of the smart object platforms and creating markets for services.

The AURORAL reference architecture is devised to provide the means to several different diverse local communities from different domains, in order to be part of a dynamic rural ecosystem to:

- connect and share data collected locally through a secure and privacy-preserving framework;

- engage external technology and application providers in exploiting their data by offering advanced horizontal services to process and create value out of these data;

- participate in new dynamic online marketplaces as commodities services and online platform operators;

- implement easily in an interoperable way and based on open application interfaces based on open standards.

AURORAL is built on top of a previous H2020 project, VICINITY.[16] It is extending VICINITY's core functionalities, in order to promote and facilitate a smooth integration of different entities and services, by the extension of the core platform to a data brokerage middleware, enabling flexible integration of heterogeneous vertical and horizontal tools and services from cross-domain applications.

Thus:

- providing enhanced semantic discovery and interoperability features;

- featuring advanced access control management and end-to-end security, privacy, and trust, preserving data sovereignty;

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[16] "Vicinity - Open virtual neighbourhood network to connect IoT infrastructures and smart objects." https://vicinity2020.eu/ (accessed Jul. 25, 2022).

- shifting from a centralised storage to a distributed storage component based on DLT smart contract management, facilitating scalable data access and sharing;

- integrating Elliot Cloud middleware to further facilitate the use of core FIWARE components;

- enabling easy middleware integration of external tools/devices/services by open APIs based on open standards.

The AURORAL reference architecture aims to facilitate the integration of different vertical tools and services from the targeted domains of energy, mobility, tourism, health, and agriculture.

Examples of solutions being produced, whilst aimed at improving rural and smaller community life, but equally appropriate to cities in most cases, include the following.

Tourism: AURORAL bundles all the touristic activities and services from a rural region. The platform connects and integrates many existing data bases and services from different sectors. For example, the connection of the mobility sector to the tourism sector by integrating shuttle services and taxi services with touristic activities. By using a provided single sign on technique, guests can either book just the tour or can book the tour in combination with different transportation options. Big data analysis in the tourism domain, for example, can bring in the whole guest journey from all event logs for digital touristic systems (e.g., oHA,[17] sensors, or web pages from local companies). For example, processes can be discovered which show the common user behaviour for tourists before booking a massage. This involves use of personal data.

Digitalised health services: Digital care and eHealth solutions for elderly or people with multiple chronic conditions, especially those living in rural areas, provide the following benefits: (a) improving access to health care services in areas with low (or no) availability of relevant services as eHealth tools can enable remote consultations, therapies, and rehabilitation; (b) enhancing care coordination and integration as eHealth solutions can help with collecting, storing, and reporting health data to professionals and to patients via electronic health records (EHRs) and personal health records (PHRs); (c) supporting decision-making by clinicians as decision support systems (DSSs) can link available clinical evidence on appropriate treatments and best practice for the patients profile improving the quality of care

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[17] This is a platform developed by LuxActive https://www.luxactive.com/en/

provided; (d) enabling monitoring, risk analysis, and proactive intervention since an information system for risk stratification can monitor and predict health risks in a population as well as indicating recommended strategies for prevention, monitoring, and treatment.

Digitalised energy: Nowadays, the provision of energy in a rural context is not about bringing electricity to consumers but to empower them by providing the means for combining consumption with production of electricity through renewable sources, local temporary storage, and demand management. All of these just require a single communication channel and a managing platform which can be common to other sectors. It is based on an open source platform[18] that enables the integration of devices at the edge by fully exploiting data available from local and distributed energy resources to build added value services for energy stakeholders. Now, its continuous improvements have led first to develop tools and services to enable transaction management for local energy markets as for the decentralised management of energy supply and demand and, as a consequence, the management of any kind of goods or services that can be provided by members of a community using a multi-carries and multi-commodities approach (energy, mobility, health or education, agricultural, livestock production, etc.).

The AURORAL project will be enabling the integration of several different marketplace application areas and commodities services, ranging from:

• assisted living as a platform;

• intelligent healthcare and social assistance operations;

• digital transportation services;

• intelligent logistics hub;

• mobility-as-a-service;

• energy trade flexibility service;

• online markets with rural products and services

5.4 The smashHIT Project

The smashHIT project is based on the need to overcome the obstacles caused by wide variety in technical designs and proprietary implementations and

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[18] "FUSE - Research & Innovation." https://booklet.atosresearch.eu/fuse (accessed Jul. 25, 2022).

locks down various business opportunities due to all the inconsistent consent
and legal rules among all the different existing data-sharing platforms, oper-
ators, and bodies involved. In turn, this restricts innovation and results in lost
opportunities.

The project will offer a new framework for effective sharing and bro-
kerage of data streaming over diverse platforms, both personal and industrial,
and allowing for efficient generation of services by combining the data. The
main focus in smashHIT will be on platforms with data streams coming from
the usage of products embedded within systems in combination with data
from personal and industrial platforms covering smart city data, as well as
insurance data platforms. They too point to the fact that providing access for
the entire local economic community will become a powerful resource for
further innovations. Tools they provide on their "3D city operations plat-
form" – an open data platform – will help every third party to use data and
visualisation tools to create their own business. "This will influence society
and lead to additional economic benefits for companies and more wellbeing
for citizens".[19]

5.5 The smashHIT Methodology

We will return to the fact that all the projects referred to seek to make their
results available and with the necessary support tools to encourage take-up. It
is worthwhile to draw attention to the approach taken by smashHIT to do this.

Besides the specification and implementation of the smashHit platform
solution (smashHit platform, consent certification, data use traceability, etc.)
which will be described in Chapter 6, the project has foreseen to develop and
provide a set of support material, which serve the different stakeholders of
the smashHit value chain (data owners, data providers, data consumers, and
data processors) as basic guidelines for participating in the overall smashHit
workflow.

A key challenge of the project's methodology is to address a privacy-aware
consent and contract management for secure sharing of data from and between
diverse platforms, including agreed consent and legal rules among stakehold-
ers (data providers, data owners, and data users).

Therefore, the methodology will provide guidelines on how to use
the smashHit platform and the privacy- and security-preserving services to

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[19] "What is the smashHit Project? - Smash Hit." https://smashhit.eu/smashhit-press-release/
(accessed Jul. 25, 2022).

integrate and assure data owner and service users consent and compliance with legal rules of all involved stakeholders over diverse platforms. The methodology will provide the method to translate the legal rules of the stakeholders in the semantic model which will be used by smashHit solution to achieve a platform overlapping consent certification.

In this context, one of the key objectives of the support material is to empower smashHit platform stakeholders to:

- easily implement specified and developed procedures and tools;

- to understand offered functions and tools.

The developed support materials will also address organisational, administrative, and contractual measures concerning the interaction of the various stakeholders with the smashHit platform.

To achieve such envisaged methodology concept and to identify required tailored support material to be developed, the specific view and needs for each of the smashHit platform solution stakeholders was taken into account, which results in the following four types of support materials.

Developer guidelines: This type represents specific developer guidelines for industrial smashHit platform users (data providers, data consumers, and data processors), aiming to give these user groups all necessary knowledge on how to connect their systems with the heart of the smashHit platform (smashHit platform).

User guidelines: This type represents specific user guidelines for all types of smashHit solution end-users (data owners, data providers, data consumers, data processors, and smashHit platform administrator), aiming to help users on how to use the platform (e.g., the specific functionalities provided by the platform, such as user authentication, consent/contract certification, data use traceability, automatic contracting, etc.) and gives knowledge about the different functionalities available.

Concept papers: These documents provide easy understandable general descriptions of the key innovative project outcome, like the overall smashHit platform solution.

smashHit platform policy guidelines: As a complementary support material, this document covers legal, privacy, and consent regulations for key processes/activities with respect to the actions/roles of the various stakeholders and their interaction required for the operation of the smashHit platform solution.[20]

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[20] https://www.smashhit.eu/wp-content/uploads/2021/03/smashHit_D1.3_Public_ Innovation_Concept_v100.pdf

The final set of smashHit support material will be presented in the scope of Deliverable 2.2 and will be made publicly available.

5.6 Conclusion

We saw an example in the previous chapter of how Piraeus is attempting to utilise a citizen's personal data to help support the local economy. In this instance, the personal data for the platform is that of the very large number of travellers, embarking on the ferries and cruise ships which make tourism a significant factor for the local economy. Additional personal data was exchanged for "offers" which motivated travellers to experience the city and engage them in the local attractions and facilities. This approach provides a dual benefit on the local economy, as, on one hand, it helps gather the necessary information, otherwise unavailable, and, on the other, it initiates through the compensation mechanism and engagement between the visitors and the local market. Stakeholders are encouraged to join the platform as data seekers and data providers in their own right, to test aspects of value generation and sharing with entities not directly using personal data but that access the derivatives of the latter. This fits with the overall economic development strategy for improving the local economy through restructuring of the market infrastructures and the deployment of smart applications.

In this chapter, we have touched on a plethora of obstructions to the growth of a local data economy, but also with many solutions being suggested.

Chapter 6, "Technical Solutions", aims to give a simplified overview of the technology currently becoming available.

In this context, the RUGGEDISED project also concluded that[21]:

> "from a technical perspective, a platform should also provide business model support tools to enhance the economies of scope by encouraging new communities (e.g., data-driven start-ups, developers, and established firms) to join the platform ecosystem in order to explore new business opportunities, or to enhance their existing business models".

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[21] "RUGGEDISED D6.6 Governance, Trust and Smart City Business Models: the Path to Maturity for Urban Data Platforms," *RUGGEDISED Consortium*, Accessed: Jul. 25, 2022. [Online]. Available: https://ruggedised.eu/fileadmin/repository/Publications/RUGGEDISED-D6.6-Governance-Trust-SmartCity_business_Models-EUR-FINAL-2020.11.13.pdf

And that: "Within the RUGGEDISED platform architecture are some key technical capabilities that will enhance the trust in the Urban Data Platform. These are security, privacy, analytics and business model support tools. Security and Privacy are a *sine-qua-non*. Analytics and Business model support tools are a matter of platform maturity. The better the business model support tools, the easier it is for innovators to enhance their existing business models or to create new business models by using the Urban Data Platform. Software Development Kits, APIs, and data marketplaces are all enablers of new business models. The better these tools, the more likely it is to succeed. Such technical tools allow access and interaction with the platform and mediate between the platform and its users. Hence, they play an important role in opening up new business opportunities within a platform ecosystem".

Chapter 11 will continue this economic theme, looking at the emerging business models within the interlinked smart cities, data, and personal data economies. And subsequent chapters will look at how to overcome those other obstacles that have been identified, including interoperability and standardisations issues and financial, governance, and legal issues.