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The Principal Projects Underpinning This Work

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Abstract

This chapter describes the set of projects that we have concentrated upon to help map out the landscape and to draw out the potential benefits that can arise through combining a citizen's personal data with existing available data. It also draws attention as to why the European Commission decided to fund these projects, a major one being to support the emergence of data markets and the data economy, and, specifically, to set up and operate platforms for secure and controlled sharing of "closed data" (proprietary and/or personal data). These projects were also funded to address the necessary technical, organisational, legal, and commercial aspects of data sharing/brokerage/trading, whilst building on existing computing platforms.

2.1 Project Overviews

Below, we briefly describe the set of projects that we have concentrated upon to help map out the landscape and draw out the potential benefits that can arise through combining a citizen's personal data with existing available data. But it is worthwhile also drawing attention to the background for these projects in relation to the policies and the objectives that the European Commission have based their decision to fund these projects.

The focus for this book is around those projects that addressed the topic of “Supporting the emergence of data markets and the data economy”.¹

More specifically, the majority of the projects referred to, and from which the examples of the emerging technologies and the practices that the various demonstration cities have adopted to demonstrate these emerging technologies have come from, are the “innovation actions” for setting up and operating platforms for secure and controlled sharing of “closed data” (proprietary and/or personal data).

These projects were funded to address the necessary technical, organisational, legal, and commercial aspects of data sharing/brokerage/trading, whilst building on existing computing platforms.

With specific regard to the future use of citizen’s personal data, the intention was that the emerging personal data platforms should be created to ensure compliance with a set of policy goals which included that:

- The personal data platforms shall ensure respect of prevailing legislation and allow data subjects and data owners to remain in control of their data and its subsequent use.
- Solutions should preserve utility for data analysis and allow for the management of privacy/utility trade-offs, metadata privacy, including query privacy.
- Solutions should also develop 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 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.

Other aims, if achieved, will also impact upon the growth of these personal data platforms.

- The call for proposals also addressed the fact that the lack of trusted and secure platforms and privacy-aware analytics methods for secure sharing of personal data and proprietary/commercial/industrial data

¹ “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. 22, 2022).

hampers the creation of a data market and data economy by limiting data sharing mostly to open data.

- It further intended to address the lack of ICT and data skills which were regarded as seriously limiting the capacity of Europe to respond to the digitisation challenge of industry.
- Specific attention needs to be put in involving SMEs and give them access to data and technology. IT standardisation faces new challenges as technologies converge and federated systems arise, creating new gaps in interoperability.

Collectively, they will stimulate the European data economy,² and of significance for this work, will in doing so, also stimulate the local data economy of a smart city, giving a stimulus in the form of releasing more valuable data for their use.

In addition to the core focus on personal data and the evolving data economy, we have drawn from other projects that have succeeded in bringing forward good examples of the use of data in a smart city. These have been drawn from a variety of sources including from the 18 smart cities and communities funded Lighthouse projects, which embrace 48 Lighthouse cities augmented by 72 “fellow cities” collaborating with them, to speed up replication. These Lighthouse cities are cities that are piloting and deploying the most advanced and innovative solutions.

Further projects highlighted have been funded to meet the identified societal challenges at a European level such as in health, demographic change, and wellbeing, where improved understanding of health and disease is demanding close linkage between fundamental, clinical, epidemiological, and socio-economic research. Effective sharing of data, standardised data processing, and the linkage of these data with large-scale cohort studies are also essential as are improving health information and better collection and use of health cohort and administrative data, with standardised data analysis and techniques.³

Other examples have come from the use of the European cloud infrastructure by public administrations in order to provide an infrastructure with data and analytical power for the public administration.⁴

² “Building a data economy - Shaping Europe’s digital future.” <https://digital-strategy.ec.europa.eu/en/library/building-data-economy-brochure> (accessed Jul. 22, 2022).

³ “SOCIAL CHALLENGES - Health, demographic change and well-being” *Programme H2020 - CORDIS European Commission*. <https://cordis.europa.eu/programme/id/H2020-EU.3.1>. (Accessed Jul. 22, 2022).

⁴ “Pilot on using the European cloud infrastructure for public administrations - Programme,” *H2020 - CORDIS European Commission*. <https://cordis.europa.eu/programme/id/H2020-DT-GOVERNANCE-12-2019-2020> (accessed Jul. 22, 2022).

2.2 DataVaults

DataVaults⁵ aims to deliver a framework and a platform that has personal data, coming from diverse sources in its centre and that defines secure, trusted, and privacy-preserving mechanisms allowing individuals to take ownership and control of their data and share them at will, through flexible data sharing and fair compensation schemes with other entities or for simply altruistic purposes.

In order to let the data providers decide what, how much, and in which manner they would like to share their data, we are using technologies that enable data asset control and management, trusted and secure sharing, and risk exposure awareness.

In order to guarantee the privacy and security of personal data during collection, sharing, and utilisation, the technologies embraced include TPM attestation/crypto, private and public ledgers, ABAC +ABE, layered anonymisation, and searchable encryption.

In order to attribute a fair share of the value data generated and to allow data seekers to extract intelligence, novel compensation schemes were developed along with blockchain-based data access and sharing accompanied by data analytics and intelligence generation.

The actors are the data owners (providers) on one hand and the data seekers (consumers) on the other.

Owners are the individuals who extract, collect in one place and securely store their personal data, share them, and take control of their usage. Seekers are the economic operators who explore extracts or metadata, request access, and perform analyses.

The outcome will be citizens getting back the control of personal data and an ever-growing eco-system for personal data sharing, thus having the potential to improve service delivery, increase citizen participation, and stimulate the local data economy.

2.3 KRAKEN

Based upon the self-sovereign identity paradigm, the project is providing:

- A decentralised user-centric approach on personal data sharing.
- A data marketplace, which will allow the sharing of personal data and its corresponding artificial intelligence/machine learning analysis, all while preserving privacy.

⁵ “DataVaults - Empowering Secure Data Storage, Sharing and Monetisation.” <https://www.datavaults.eu/> (accessed Jul. 22, 2022).

- A set of different analytic techniques based on advanced crypto tools that will permit privacy-preserving data analysis.

KRAKEN (BroKeRage and MArKet platform for pErsoNal data)⁶ is developing a trusted and secure personal data platform with state-of-the-art privacy aware analytics methods (with guarantees on metadata privacy, including query privacy).

Returning the control of personal data back to users:

The KRAKEN project aims to enable the sharing, brokerage, and trading of potentially sensitive personal data, by returning the control of this data to citizens (data providers) throughout the entire data lifecycle. In all the developments of KRAKEN, GDPR has been followed and assessment provided by the legal partner.

KRAKEN will standardise different IT solutions, thanks to featuring the (privacy-preserving) integration of independently obtained data sources from subjects consenting to different analyses. The project combines, interoperates, and extends the best results from two existing mature computing platforms developed within two H2020 actions: CREDENTIAL and MyHealthMyData.

In this context, the KRAKEN solution is piloting in two high-impact domains, health and education, and contributes to data spaces by providing tools and solutions that can preserve the privacy and assuring security, trustability, data integrity, and confidentiality, when data are shared between different stakeholders in a data space, and even between different data spaces.

2.4 Safe-DEED

Safe-DEED's vision⁷ is a competitive Europe where individuals and companies are fully aware of the value of the data they possess and can feel safe to use it.

As privacy and trust remain key in the data sharing debate, privacy enhancing technologies will play a prominent role by 2025. Safe-DEED takes a highly interdisciplinary approach, bringing together partners from cryptography, data science, business model innovation, and the legal domain to focus on improving security technologies, improving trust, as well as diffusion of privacy enhancing technologies to keep up pace with global macro trends and the data economy, to enable the fastest possible growth.

Furthermore, as many companies have no data valuation process in place, Safe-DEED provides a set of tools to facilitate the assessment of

⁶ "KRAKEN - broKeRage And marKEt platform for persoNal data." <https://krakenh2020.eu/> (accessed Jul. 22, 2022).

⁷ "Safe-DEED ." <https://safe-deed.eu/> (accessed Jul. 22, 2022).

data value, thus incentivising data owners to make use of the scalable cryptographic protocols developed in Safe-DEED to create value for their companies and their clients.

The contribution that Safe-DEED has made has been related to how value is put on data and how business models in the data economy are evolving and in indicating what work needs to be done in the next phase. Chapter 13 elaborates on this and starts relating to the valuation of data within the context of the “story of data” in a smart city.

The general concept of Safe-DEED is a virtuous cycle of establishing value, providing the enabling technologies and creating the value thus promised, all within a solid legal and ethical framework.

1. Develop new methods addressing the problems of private set intersection for large datasets, and secure multiparty computation (MPC), reducing both communication (Mb/s) and runtime (s) by at least 50% against the existing state-of-the-art, while improving the expressiveness of the class of functions evaluated on the data.
2. Develop the first of its kind software as a service (SaaS) component for evaluating the potential of a company’s data if collected and processed at scale.
3. Show the scalability of the methods in real-world scenarios involving personal data (from Telecom provider ForthNet) and confidential industry data (from semiconductor manufacturer Infineon).
4. Show the general applicability and sustainability of the methods for MPC and data valuation.
5. Develop pricing models and business models to exploit both the MPC services as well as the data valuation services.
6. Generate trust in data markets through sound legal and ethical foundations in the use-cases, project output, and the development of an educational module; cross-sectoral guidance on ethical/normative valuation and how to better align technology and economic incentives with the law and ethics.

2.5 DUET Project

DUET⁸ advances an area’s transformation through utilising a new innovative public sector digital twin which is a continuously learning digital copy of real-world assets, systems, and processes.

⁸ “DUET Digital Twins.” <https://www.digitalurbantwins.com/about-1> (accessed Jul. 22, 2022).

DUET enables decision-makers from multiple sectors to co-create innovative solutions to complex urban challenges by drilling down into data through a shared, easy-to-use interface. Although DUET's solution is designed primarily for cities and public administrations, there is no reason why the application cannot be used by other industries. The underlying architecture is built with interoperability in mind. Users can upload any model so long as it complies with the framework requirements, after which they will be able to run simulations, analyse data, visualise insights, and much more.

Built to handle large datasets, both historic and real-time, the solution enables interrogation of anomalies and deviations before a disaster strikes. Thanks to the IoT connection, investigations can be done remotely from any place within a city and beyond; all that is needed is access to the DUET dashboard. Other benefits come from embedded machine learning and artificial intelligence functions, which allow the system to make predictions concerning, e.g., depreciation of road infrastructure or environmental footprint. We start by testing DUET in the smart city environment, with local administrations as main users (Flanders, Athens, and Pilsen). However, a fully developed solution has no restrictions when it comes to potential adopters. City halls, companies (big and small), universities, and emergency services all are using DUET because it is cheaper, more advanced, and user-friendly than competitor solutions. It helps organisations become more responsive, reacting rapidly to real-time events; policy decisions are faster and more effective, and relationships with citizens are improved.

In looking at advantages of a digital twin to a city, it is estimated that only 12% of a city's data is actually used in decision-making. It can change the way in which we see a city. It is valuable for experimentation to find policy solutions that work. It consumes data from across the city and uses high-powered computing to distil enormous amounts of data in order to deliver insights. 3D interfaces contribute to making policy implications easier to be understood by everyone.

2.6 InteropEHRate

The project sets out to put EHR in people's hands across Europe, having the slogan "Electronic health records made easy for patients to manage".⁹

The electronic health record (EHR) collects, systematises, and stores patient data in a digital format in order to improve healthcare systems. However, there is a low level of systems interoperability in Europe since

⁹ "InteropEHRate." <https://www.interopehrate.eu/> (accessed Jul. 22, 2022).

data are collected in different silos and managed under converging security and safety conditions. This creates legal hurdles in the availability of data. The EU-funded InteropEHRate project will reverse trends by ensuring that health data are available when and where needed. It will provide patients with full control in usage and routes of their medical information through device-to-device and peer-to-peer protocol standards. It will also outline a set of new protocols for secure and cross-border exchange of medical evidence.

Today, citizens moving across Europe have very limited control on their own health data, spread out in different silos. Legal constraints may prevent controllers of these silos from exchanging the managed data, even in an anonymised way, without the intervention of higher authorities. As a consequence, health data cannot be fully exploited for healthcare and research.

InteropEHRate aims to empower the citizen and unlock health data from local silos, using a bottom-up approach for EHR interoperability.

1. Mediated by the citizen: through the adoption of a D2D (device to device) standard, it, by exploiting edge computing and short-range wireless technologies, allows the citizens to import their own health data on personal smart devices, and exchange them, in a confidential way, also without the internet, with healthcare professionals and researchers, without the intervention of other authorities.
2. Authorised by the citizen: through peer-to-peer protocols for cross-border interoperability among EHRs and research apps, using decentralised authorisation mechanisms based on citizens' consent, to guarantee data accountability and provenance traceability, in compliance with patients' rights and GDPR.
3. Open and incremental: based on open specifications, connecting for-profit and non-profit data providers with different levels of interoperability, starting from a low level for secure exchange of unconverted data to a high level combining knowledge extraction and adaptive data integration, to translate data to a common HL7 FHIR¹⁰ profile and into the natural language of the consumer.
4. A co-design approach and a specific governance model will manage human aspects related to ethics, laws, and technology evolution.

¹⁰ <https://www.hl7.org.uk/standards/hl7-standards/fhir/>

User scenarios, presenting different security and interoperability requirements, will be validated by citizens and institutions belonging to six European countries.

Existing interoperability infrastructures will be exploited, including Connecting Europe Facility building blocks such as eIdentity.

2.7 RUGGEDISED

RUGGEDISED¹¹ is a smart city project funded under the European Union's Horizon 2020 research and innovation programme. It brings together three lighthouse cities, Rotterdam, Glasgow, and Umeå, and three follower cities, Brno, Gdansk, and Parma, to test, implement, and accelerate the smart city model across Europe in partnership with businesses and research centres. The three overall aims of RUGGEDISED are as follows:

1. improving the quality of life of the citizens, by offering the citizens a clean, safe, attractive, inclusive, and affordable living environment;
2. reducing the environmental impacts of activities, amongst others by achieving a significant reduction of CO₂ emissions, a major increase in the investment and usage of renewable energy sources and an increase in the deployment of electric vehicles;
3. creating a stimulating environment for sustainable economic development, by generating more sustainable jobs, stimulating community involvement in smart solutions (as consumers and as producers), and boosting start-ups and existing companies to exploit the opportunities of the green digital economy and Internet of Things.

With RUGGEDISED, there is no simple application or topic under scrutiny. Instead, in addition to the focus for our interest in this project, the progress in deploying urban data platforms, there is a wide array of areas where work is progressing. RUGGEDISED will demonstrate in total 32 innovative and integrated smart solutions in the cross-section of energy, transport, and ICT.

These include the following:

- smart open data decision-making platforms;
- 3D city operations model;

¹¹ "RUGGEDISED - Smart city lighthouse project." <https://ruggedised.eu/smart-solutions/smart-solutions-overview/> (accessed Jul. 22, 2022).

- smart waste management;
- smart thermal grids;
- thermal energy storage;
- smart electricity grids and eMobility;
- energy data management;
- end-user involvement in intelligent building controls;
- long-range wireless networks.

2.8 DataPorts

It is a data platform for the connection of cognitive ports.

DataPorts¹² will provide a data platform in which transportation and logistics companies around a seaport will be able to manage data like any other company asset, in order to create the basis to offer cognitive services.

Nowadays, only 3% of container terminals are automatised. However, the future of the port industry points towards smart ports since it is the only way to overcome the challenges and demands that arise in the sector, optimising port operations, enhancing the supply chain of operators and carriers, and reducing the emissions and waste.

Nevertheless, the maritime port infrastructure is quite complex. On a site, a large number of agents interfere in each port operation (retailer, freight forwarder, carrier, consignee, port authority, etc.); thus, stagnant silos of information are produced and the real potential of the data cannot be obtained. From this need appears the DataPorts project, a data platform for the cognitive ports of the future.

Valencia and Thessaloniki are the pilot sites, and in relation to the smart cities agenda, there is interest in dealing with the logistics in the port city both for freight and tourists arriving by sea.

2.9 EUHubs4Data

Most of Europe's SMEs lag behind in data-driven innovation. To tackle this problem, the EU-funded EUHubs4Data project¹³ will build a European fed-

¹² "DataPorts - A Data Platform for the Connection of Cognitive Ports." <https://www.dataports-project.eu/> (accessed Jul. 22, 2022).

¹³ "EUHubs4Data - European Federation Of Data Driven Innovation Hubs." <https://euhubs4data.eu/> (accessed Jul. 22, 2022).

eration of data innovation hubs based on existing key players in this area and connecting with data incubators and platforms, SME networks, artificial intelligence communities, skills and training organisations, and open data repositories.

A European catalogue of data sources and federated data-driven services and solutions will be made accessible to European SMEs, start-ups, and web entrepreneurs through the data innovation hubs. Cross-border and cross-sector data-driven experimentation will be facilitated through data-sharing, as well as data and service interoperability, becoming a reference instrument for growth in a global data economy and contributing to the creation of common European data spaces.

EUHubs4Data provides an integrated ecosystem aimed to stimulate greater participation of European SMEs and start-ups in the data economy. By providing easy, cross-border access to datasets, facilitating data sharing and assisting them with the skills, tools, and support, new innovative data-driven solutions and business models that are aligned with users' needs will be developed, thereby improving their digital competitiveness as well as the satisfaction of end-users.

2.10 i3-MARKET

The i3-MARKET project¹⁴ addresses the growing demand for a single European data market economy by innovating marketplace platforms, demonstrating with industrial implementations that the data economy growth is possible. The i3-MARKET aims at providing technologies for trustworthy (secure and reliable), data-driven collaboration and federation of existing and new future marketplace platforms. Special attention is given to industrial data, particularly sensitive commercial data assets from both SMEs and large industrial corporations.

The i3-MARKET aims to overcome current data marketplace integration obstacles by developing the lacking building blocks (in the form of a software framework or toolkit) for data providers and consumers. By doing so, it enables the creation of a more trusted European data market economy.

The i3-MARKET v2 Backplane software is now publicly available to the community. The v2 Release is built based on industrial stakeholder's feedback, consultation events with SMEs, developers, industry stakeholders,

¹⁴ "i3-Market." <https://www.i3-market.eu/about/#project> (accessed Jul. 22, 2022).

and collecting requirements and demands from developer communities and entrepreneurs.

The i3-MARKET project contributes towards the growth of a single European data market economy by enabling secure and privacy-preserving data sharing across data spaces and marketplaces.

It is well known that despite various research and innovation attempts working on big data management and sharing, there is no broadly accepted trusted and secure solution for federation of data marketplaces. The i3-MARKET is addressing this gap by developing lacking technologies and solutions for a trusted (secure, self-governing, consensus-based, and auditable), interoperable (semantic-driven) and decentralised (scalable) infrastructure, the i3-MARKET Backplane, that enables federation via interoperability of the existing and future emerging data spaces and marketplaces.

2.11 AURORAL

It is an architecture for unified regional and open digital ecosystems for smart communities and wider rural areas large-scale application.

AURORAL¹⁵ focuses on increasing connectivity and delivering a digital environment of smart object interoperable service platforms able to trigger dynamic rural ecosystems of innovation chains, applications, and services. Thus, AURORAL contributes to increase economic growth and create jobs in rural areas and to tackle significant societal challenges and contributes to overcoming digital divide between rural and urban areas and to developing the potential offered by increased connectivity and digitisation of rural areas. AURORAL digital environment is demonstrated by cost-efficient and flexible cross-domain applications through large-scale pilots in five European regions. 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 in rural areas.

H2020-AURORAL was launched in January 2021 aiming to contribute to increase economic growth in rural areas and to tackle significant societal challenges.

¹⁵ "AURORAL." <https://www.auroral.eu/#/> (accessed Jul. 22, 2022).

H2020-AURORAL is building a new concept, the smart communities, a new European paradigm for sustainable development.

Those are areas based on the use of innovative solutions to improve their resilience, building on local strengths and opportunities.

The main objectives are as follows:

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

Vertical services and tools:

AURORAL reference architecture aims to facilitate the integration of different vertical tools and service from a variety of rural domains. Some indicative areas are:

- digitalised energy;
- digitalised mobility;
- digitalised farming;
- digitalised tourism;
- digitalised health services.

2.12 REPLICATE

REPLICATE – RENaissance of PLaces with Innovative Citizenship And TEchnologies,¹⁶ is a European research and development project that aims to deploy energy efficiency, mobility, and ICT solutions in city districts.

“Our vision is to increase the quality of life for citizens across Europe by demonstrating the impact of innovative technologies used to co-create

¹⁶ “REPLICATE Project EU - RENaissance of PLaces with Innovative Citizenship And TEchnology.” <https://replicate-project.eu/> (accessed Jul. 22, 2022).

smart city services with citizens, and prove the optimal process for replicating successes within and across cities”.

There are three lead cities (called smart city “Lighthouses”), which include San Sebastian in Spain, Florence in Italy, and Bristol in Great Britain. There are also a number of other “follower” cities that will look into replicating interventions in their cities including Essen (Germany), Nilüfer (Turkey), and Lausanne (Switzerland). In addition to this, there are also a number of “observer” cities, such as Guangzhou (China) and Bogota (Colombia), as well as international networks who will take part in learning and dissemination of results.

The REPLICATE team is working to accelerate the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport, and drastically reduce greenhouse gas emissions in urban areas. Therefore, the project aims to enhance the transition process to a smart city in three areas: energy efficiency, sustainable mobility, and ICT infrastructures.

Energy efficiency – saving energy consumption:

- up to 56% in relation to existing situation in building retrofitting;
- up to 35% in district heating.

Sustainable mobility – integrating sustainable EVs, recharging systems, and information mobility system.

Integrated ICT infrastructures:

Developing new sustainable and cost-effective services to citizens providing integrated infrastructures that improve efficiencies in the use of local public resources and the delivery of public services:

- new ICT model based on FI-WARE and open data management;
- new intelligent lighting system based on new LED technology;
- high-speed mobile wireless network based on post WIMAX technology.

2.13 PIMCity

Personal information management systems (PIMS) ¹⁷ aim to give back users control over their data, while creating transparency in the market. PIMCity

¹⁷ “PIMCity - Building the Next Generation Personal Data Platforms.” <https://www.pimcity-h2020.eu/> (accessed Jul. 22, 2022).

offers tools to enable businesses to mature and reach sizeable user bases. The PIMCity approach is both ambitious and revolutionary.

Personal data are increasingly necessary for the development of products and services that must combine their use with respect to the privacy and intimacy of citizens. For there to be confidence in the personal data ecosystem, it is necessary, in addition to an adequate regulatory framework, to have tools that allow citizens and companies to make an ethical use of them without renouncing the development of new business opportunities. The EU-funded PIMCity project aims to increase transparency and provide users with control over their data.

Mission: Our mission is to ensure that citizens, companies, and organisations are informed and can make respectful and ethical use of personal data. The human-centric paradigm is aimed at a fair, sustainable, and prosperous digital society, where the sharing of personal data is based on trust as well as balanced and fair relationship between individuals, business, and organisations. We need, besides being informed, that all the multi-stake holders are proactive and that they get involved in this process that is in continuous evolution.

What we do: We select, classify, and assess information of interest, in terms of privacy and personal data management, for citizens, companies, and organisations. We search and test tools and novel mechanisms to increase users' awareness. We are looking for materials that facilitate the work of evangelisation in order to achieve a well-informed society, whilst promoting the use of the tools developed in the PIMCITY project.

2.14 **smashHIT**

The smashHIT project¹⁸ is designed to solve the problem of consumer consent and data security in the connected car and in the smart cities environments. SmashHIT is formed by a consortium of nine organisations drawn from analytics, data security, car manufacturing, smart city infrastructure, and academia working collaboratively to deliver the benefits of shared connectivity to millions of consumers.

Enabling millions of EU consumers to benefit:

- The objective of smashHIT is to assure trusted and secure sharing of data streams from both personal and industrial platforms, needed to

¹⁸ “Smash Hit - Solving Consumer Consent & Data Security for Connected Car and Smart City.” <https://smashHIT.eu/> (accessed Jul. 22, 2022).

build sectorial and cross-sectorial services, by establishing a framework for processing of data owner consent and legal rules and effective contracting, as well as joint security and privacy-preserving mechanisms.

- smashHIT aims to overcome obstacles in the rapidly growing data economy which is characterised by heterogeneous technical designs and proprietary implementations, locking business opportunities due to the inconsistent consent and legal rules among different data-sharing platforms actors and operators.
- A vision, strategy, and future ready framework.
- Diversity and inclusion are integral to smashHIT's vision, strategy, and business success. We recognise that leadership in today's global marketplace requires that we create environments where the best and brightest diverse minds – employees with varied perspectives, skills, and experiences – work together to meet consumer demands. The collaboration of cultures, ideas, and different perspectives is an organisational asset and brings forth greater creativity and innovation.
- The framework will provide methods and tools, such as smart data dispatcher, to assure common consent over data shared using semantic models of consent and legal rules.
- The new tools include traceability of use of data, data fingerprinting, and automatic contracting among the data owners, data providers, service providers, and volumes on data streaming from the usage of mass products with cyber-physical features (e.g., vehicles).

These data streams offer new opportunities to build innovative services, but their combination with other personal and industrial data is subject to complex ownership and consent aspects, as the data streaming from these products belong to persons or organisations who are owners or users of the products.

The overall concept can be found on the project website.¹⁹

2.15 PolicyCloud

PolicyCloud aims to make data-driven policy management a reality across Europe.

¹⁹ “Smart Dispatcher for Secure and Controlled sharing of Distributed Personal and Industrial Data,” 2021. Accessed: Jul. 22, 2022. [Online]. Available: https://www.smashHIT.eu/wp-content/uploads/2021/03/smashHIT_D1.3_Public_Innovation_Concept_v100.pdf (accessed Jul. 22, 2022).

The PolicyCloud project²⁰ will harness the potential of digitisation, big data, and cloud technologies to improve the modelling, creation, and implementation of public and business policy. PolicyCloud will deliver a unique, integrated environment of curated datasets, and data management, manipulation, and analysis tools. The project will address the full lifecycle of policy management using the data analysis capabilities of the European Cloud Initiative.

During the course of the project, our expertise will be practically demonstrated in four thematically distinct pilot use-cases to be run in diverse European cities, positively impacting both economic growth and the lives of the citizens concerned.

The solutions and tools developed by PolicyCloud will eventually become available from the European Open Science Cloud (EOSC), as public cloud services. As explained by the EC President von der Leyen at the 50th annual meeting of the World Economic Forum in Davos, the EOSC is a core element of the European Commission’s vision to make Europe a global leader in data management.²¹

By 2023, PolicyCloud will roll out a series of novel data-driven policy management solutions set to drastically advance policy-making and benefit a wide variety of stakeholders.

Policy-makers at European, national, and regional levels, public administrations, non-governmental organisations, and standardisation bodies will be provided with the ability to make efficient and effective policy decisions through access to:

- cleaned, refined, structured, and trustworthy datasets emerging from the pilot use cases;
- analytical tools to enhance the predictive power of data;
- scenario simulations to model and evaluate policy impacts.

Academic institutions, research centres, individual researchers, and big data experts will be able to achieve better quality research outcomes through access to:

- solutions and policy-making services available through EOSC;
- previous project results upon which to build further.

²⁰ “Policy Cloud.” <https://policycloud.eu/> (accessed Jul. 22, 2022).

²¹ “Keynote by President von der Leyen at World Economic Forum.” https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_20_102 (accessed Jul. 22, 2022).

In industry, big data, cloud, and solutions, providers will experience improved efficiencies and attract new business opportunities through access to:

- novel data management and analysis solutions;
- tools for cleaning and refining data;
- via, pilots, improvements in the quality of certain governmental datasets;
- the data marketplace as a shop window via which to offer new datasets.

Citizens resident in range of the pilot use-cases or impacted by future PolicyCloud adoption will enjoy improved quality of life through:

- opportunities to participate in policy creation through the iterative design and implementation methodology adopted;
- continuous improvement in policies through an iterative design approach which leverages newly available data on an ongoing basis and optimises policies simultaneously across multiple sectors.

Increasingly relevant and useful policies designed around homogeneous segments rather than entire populations.

2.16 IRIS: Co-creating Smart and Sustainable Cities

IRIS Smart Cities²² is a collective of seven European cities working to meet the challenge of making the transition to smart and sustainable and has been developed around three lighthouse cities – Utrecht (Netherlands), Nice (France), and Gothenburg (Sweden), with follower cities. In a rapidly changing environment, they are tackling the need for new strategies that help cities to smartly integrate technological solutions, accompanied by the fact that cities can act as large-scale demonstrators of integrated solutions, whilst wanting to contribute to the socially inclusive energy and mobility transition.

The overall concept of IRIS is the transition strategy comprising five “tracks” that together provide a universal yet versatile framework to address both common and district-specific challenges. Within these five tracks, IRIS demonstrates a set of integrated solutions built on top of both mature and innovative technologies. The integrated solutions are defined on the basis of a common-shared know-how interchange among the lighthouse and follower cities, with a planned replication from the outset of the project.

²² <https://irismartcities.eu/> NOTE, not to confuse, we later refer to a more technical project, also named IRIS, with Barcelona, Helsinki, and Tallinn as the cities involved.

The tracks under scrutiny are:

1. renewable and energy positive districts;
2. flexible energy management and storage;
3. intelligent mobility solutions;
4. digital transformation and services;
5. citizen engagement and co-creation.

Track 4 is of particular interest with its city innovation platform with open, standards-based application program interfaces (APIs) provides meaningful data and information services for households, municipality, and other stakeholders, allowing for a data market with new business models. It embraces:

- urban monitoring;
- city management and planning;
- mobility services;
- energy management.

For the purpose of this book, the interest also lies in the business models under consideration. For mainstream sustainability, developing and delivering green infrastructure and services needs to make financial sense. With this in mind, IRIS has aimed to put bankable business models for proposed integrated solutions into practice – helping European cities and regions reduce technical and financial risks and attract investors.

2.17 SmartEnCity

Cities play a key role in fighting climate change. Energy demand and CO₂ emissions are particularly high in urban areas. At the same time, urban density allows more alternatives for energy-efficient housing, eco-friendly transport, and service provision. SmartEnCity's²³ vision is to create smart zero carbon cities that are more sustainable and inclusive, improve citizens' quality of life, create jobs and wealth, and offer equal growth opportunities.

SmartEnCity aims to develop a systemic approach for transforming European cities into sustainable, smart, and resource-efficient urban

²³ "SmartEnCity.eu." <https://smartencity.eu/> (accessed Jul. 22, 2022).

environments in Europe. We aim to develop strategies that can be replicated throughout Europe in order to:

- reduce energy demand;
- maximise renewable energy supply.

Activities include retrofitting in buildings, integrating infrastructures, developing sustainable mobility, and the intelligent use of information and communication technologies.

The SmartEnCity concept was defined, planned, and implemented in the three Lighthouse demonstrators Vitoria-Gasteiz (Spain), Tartu (Estonia), and Sonderborg (Denmark). The process will be replicated in the two follower cities of Lecce (Italy) and Asenovgrad (Bulgaria). We will encourage a SmartEnCity network of further cities interested replicating the approach elsewhere in Europe.

In addition to the core set of projects, we also need to refer to two wider initiatives contributing to the evolution of the European data economy: MyData and Solid.

2.18 The MyData Global Initiative

MyData Global²⁴ believes that the future belongs to companies that provide human-centric solutions to privacy and control of data. “The human-centric approach to data is aimed at a fair, sustainable, and prosperous digital society. In such a society, people get value from their data and set the agenda on how it is used. And for organisations, the ethical use of data is always the most attractive option”.

MyData Global is an award-winning, international non-profit organisation which has over 100 organisation members and close to 400 individual members from over 40 countries on six continents. It helps organisations to build human-centric solutions and services and collaborates with local, national, and international stakeholders to advance ethical use of personal data.

The MyData community includes thousands of experts who meet regularly at the flagship event, which is the international MyData Conference, which has been taking place annually since 2016.

MyData Global’s purpose is to empower individuals by improving their right to self-determination regarding their personal data. We bring together professionals and organisations from business, legal, technology, and society

²⁴ “MyData.” <https://www.mydata.org/> (accessed Jul. 22, 2022).

perspectives to accelerate transformation for ethical and human-centric data sharing and use. The mission and values are described in the MyData Declaration which entrepreneurs, activists, academics, listed corporations, public agencies, and developers are encouraged to sign in order to help make the use of human-centric data a reality.

The MyData Declaration provides a common goal: to empower individuals with their personal data and acts as a basis for restoring trust in data-based business and for establishing a balanced and fair relationship between individuals and organisations.

2.19 The SOLID Initiative

Solid²⁵ is a specification that lets people store their data securely in decentralised data stores called Pods. Pods are like secure personal web servers for data.

- Any kind of information can be stored in a Solid Pod.
- Access to the data can be controlled in the Pod. Deciding what data to share and with whom (be it individuals, organisations, and/or applications) is down to the individual.
- Access can be revoked at any time.
- To store and access data in the Pod, applications use standard, open, and interoperable data formats and protocols.

A Solid server hosts one or more Solid Pods. Pods are where you store your data:

- each Pod is fully controlled by the Pod owner;
- each Pod's data and access rules are fully distinct from those of other Pods.

Pods come from a Pod Provider or can be self-hosted.

It is possible to have multiple Pods. They can be hosted by the same Pod Provider or by different providers or be self-hosted or any combination thereof. The number of Pods possessed as well as which Solid server or servers you use is effectively transparent to the applications and services that you use. This is because, in the Solid ecosystem, data is linked through your

²⁵ “Solid: Your data, your choice.” <https://solidproject.org/> (accessed Jul. 22, 2022).

identity and not through the specifics of your Pod. This is true for your own data as well as for data that others have shared with you.

Solid has the ability to store data in a way that promotes interoperability. Specifically, Solid supports storing Linked Data. Structuring data as Linked Data means that different applications can work with the same data.

With Solid's authentication and authorisation systems, the individual determines which people and applications can access their data. They grant or revoke access to any slice of your data as needed. Consequently, the individual can do more with their data, because the applications used can be granted access to a wider and more diverse set of information.

Share data with others and others sharing data with you is possible. This creates rich and collaborative experiences across a combination of both personal and shared data.

Solid applications store and access data in Pods using the Solid protocol.

Within the interoperable Solid ecosystem, different applications can access the same data instead of requiring separate data silos specifically for the applications.