Enabling a data-informed public sector:

From hype to action using
*the **Big Data Test Infrastructure (BDTI)***

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Business Owner:
DG CNECT
Directorate-General for Communications Networks, Content and Technology

Service Provider:
DG DIGIT
Directorate-General for Informatics

Road Map

1 **Policy context**

2 **BDTI in a nutshell**

- Its context and why use it

3 **BDTI in practice**

- Access and overview of the BDTI portal
- Concrete application of the BDTI

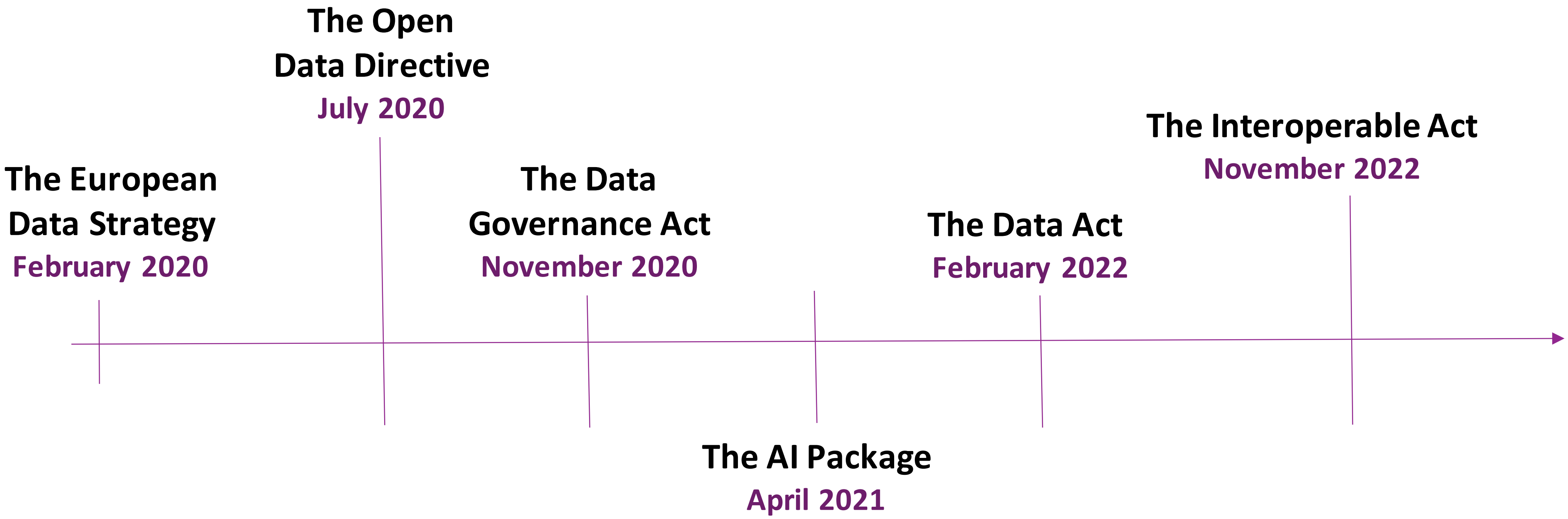
4 **BDTI's community**

- Developing the BDTI community and how can you help us

1 Policy context

1

Policy timeline



The European Data Strategy
February 2020

The Open Data Directive
July 2020

The Data Governance Act
November 2020

The AI Package
April 2021

The Data Act
February 2022

The Interoperable Act
November 2022

Data Spaces

Policy vision

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en

2

BDTI in a nutshell

- Its context and why use it

Big Data Test Infrastructure (BDTI) in a nutshell: its context

The BDTI is funded by the the Digital Europe Program (DEP), an **EU funding programme** (€7.5 bn) focused on **bringing digital technology** to businesses, citizens and **public administrations**.

The DEP provides strategic funding in **five crucial areas**:

- **High performance computing**
- **Cybersecurity**
- **Artificial intelligence** *(Cloud, data and AI)*
- **Advanced digital skills**
- **Deployment and wide use of digital technologies**

Learn more about the Digital Europe Programme: https://digital-strategy.ec.europa.eu/en/activities/digital-programme

What is the Big Data Test Infrastructure (BDTI) ?

Six months free of charge service
for EU public administrations *

Ready-to-use
data analytics stack and support

Cloud platform based on
open-source tools

To help the public sector **to derive insights from data**
and accelerate transition towards **data- informed decision making.**

Not **only** for big data, for **public sector in general (i.e. open data)**

* The cost of the pilot project must fit within the funding boundaries of the BDTI pilot budget

2

Who is the Big Data Test Infrastructure (BDTI) for?

European Public Administrations

All European Public Administrations at **local, regional and national level** can independently apply for a BDTI pilot project

Ecosystem with academia and private sector

Academia, spin-off, startups can apply for pilot projects as long as there there is a **clear collaboration** with a Public Administration which will be the main point of contact for the project (**Master/PhD, GovTech startups**)

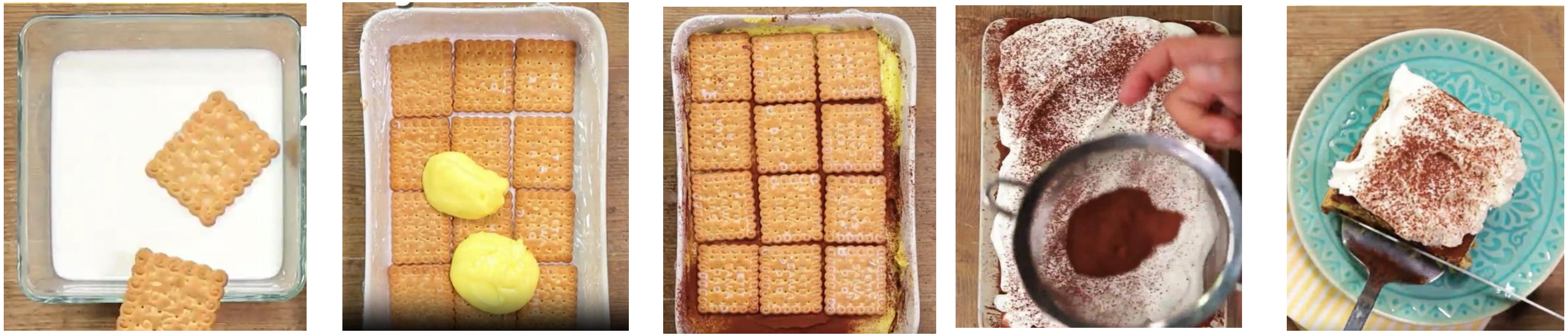
Are you working for a public administration in need of infrastructure for data analytics?

Contact us:

EC-BDTI-PILOTS@ec.europa.eu

Why use the BDTI ?

Data → Information → Presentation → Knowledge



You have the key ingredients (datasets),
we provide you the best tool to generate amazing recipes.

https://funtip.giallozafferano.it/Torta-mattonella.html

Challenges

Legal, technological, organisational, cultural, ethical, behavioural and institutional challenges.

To mention some of them:

- Lack of **data skills** – limited understanding of data's potential and its value proposition
- Data sharing and **SILOS**
    - **PPP – smart cities…**
- Lack of high-**quality data –poor quality**
- Lack of effective **data governance**
    - Data stewards
- Data discovery and re-use for human and **machines**
    - **FAIR principles**
        - Findable
        - Accessible
        - **Interoperable –** Cross border and cross domain dimensions
        - Reusable - Licenses

2

Why use the BDTI ?

Benefit of six months free of charge service, including **advisory and technical** support during the duration of the pilot

Experiment with data analytics using high **performance infrastructure** that leverages the power of the **elastic cloud**

Receive guidance to move from a pilot to a **production-ready** process – **EXIT package**

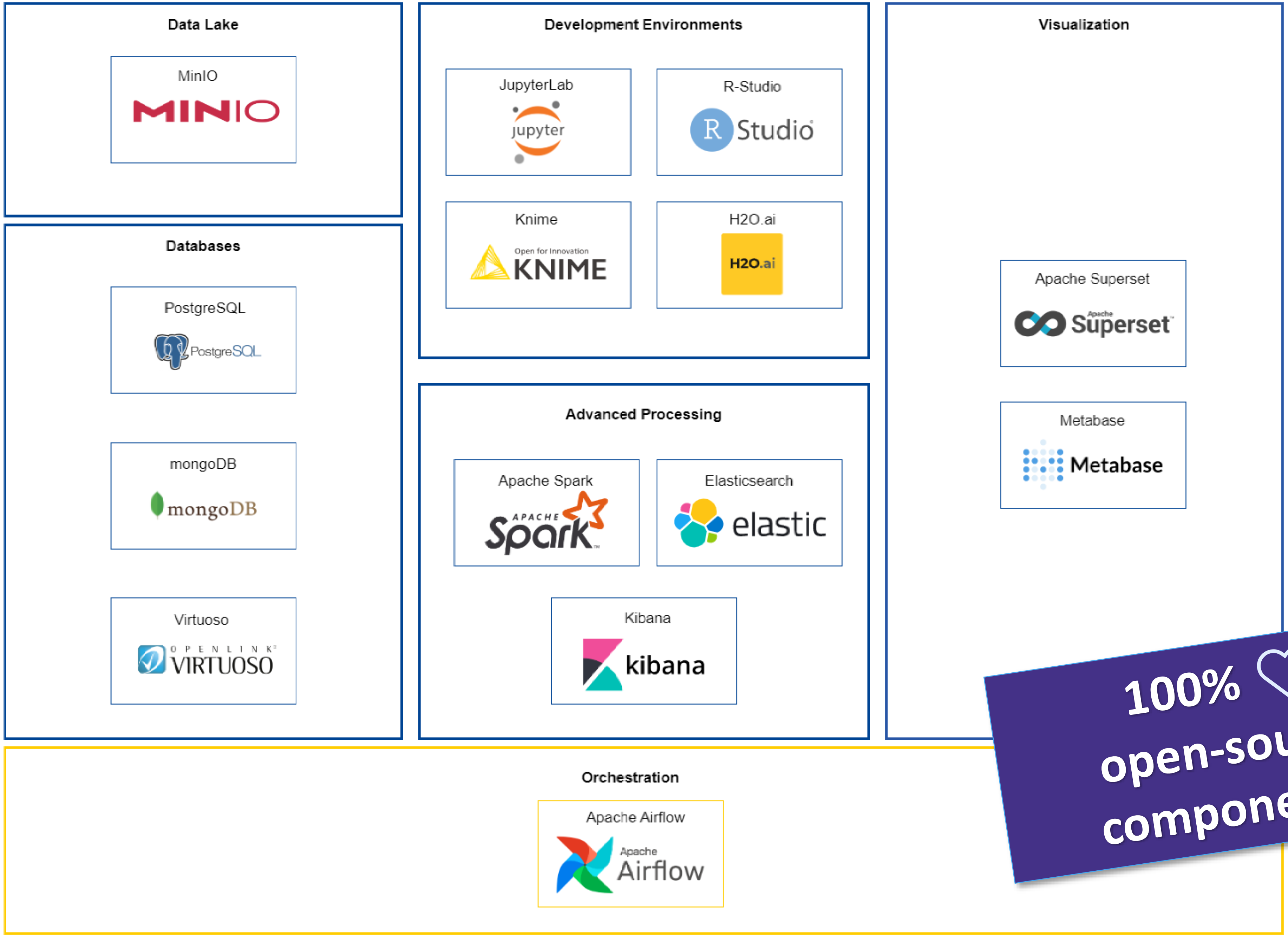
Test your idea → Extract value → Create knowledge

Big Data Test Infrastructure Objectives

- Increase the easy accessibility, **interoperability**, **quality** and **usability** of public sector information in compliance with the requirement of the **Open Data Directive**
- Boost the **re-use and combination of open public data** across the EU for the development of information products and services, including AI applications.
- High Value Datasets – Open Data Directive
- Testing **Business-to-Government** (B2G) data sharing collaborations for the **public good**
- Data Space Support Centre: explore and experiment with Big Data
- BDTI provides a safe **testing environment to run big data experiment**s for data space customers.

2

BDTI's Data Analytics Stack



Data Lake

- MinIO

Databases

- PostgreSQL
- mongoDB
- Virtuoso

Development Environments

- JupyterLab
- R-Studio
- Knime
- H2O.ai

Advanced Processing

- Apache Spark
- Elasticsearch
- Kibana

Visualization

- Apache Superset
- Metabase

Orchestration

- Apache Airflow

100% ♡
open-source
components

https://big-data-test-infrastructure.ec.europa.eu/service-offering_en

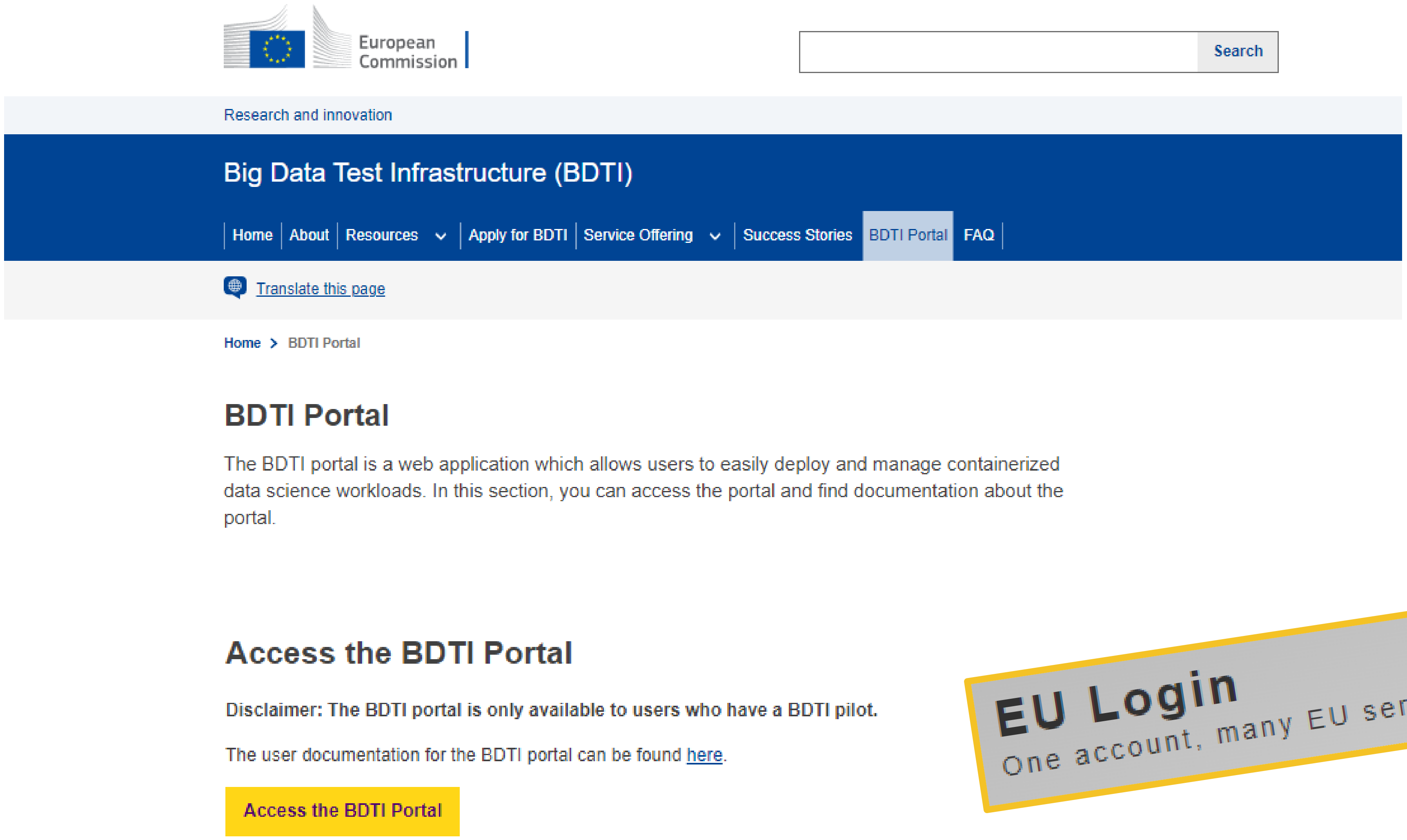
3

BDTI in practice

- Access and overview of the BDTI portal
- Concrete application of the BDTI

3

Access to BDTI portal directly from your browser (EU Login integration)



European Commission

Search

Research and innovation

Big Data Test Infrastructure (BDTI)

Translate this page

Home > BDTI Portal

BDTI Portal

The BDTI portal is a web application which allows users to easily deploy and manage containerized data science workloads. In this section, you can access the portal and find documentation about the portal.

Access the BDTI Portal

Disclaimer: The BDTI portal is only available to users who have a BDTI pilot.

The user documentation for the BDTI portal can be found here.

Access the BDTI Portal

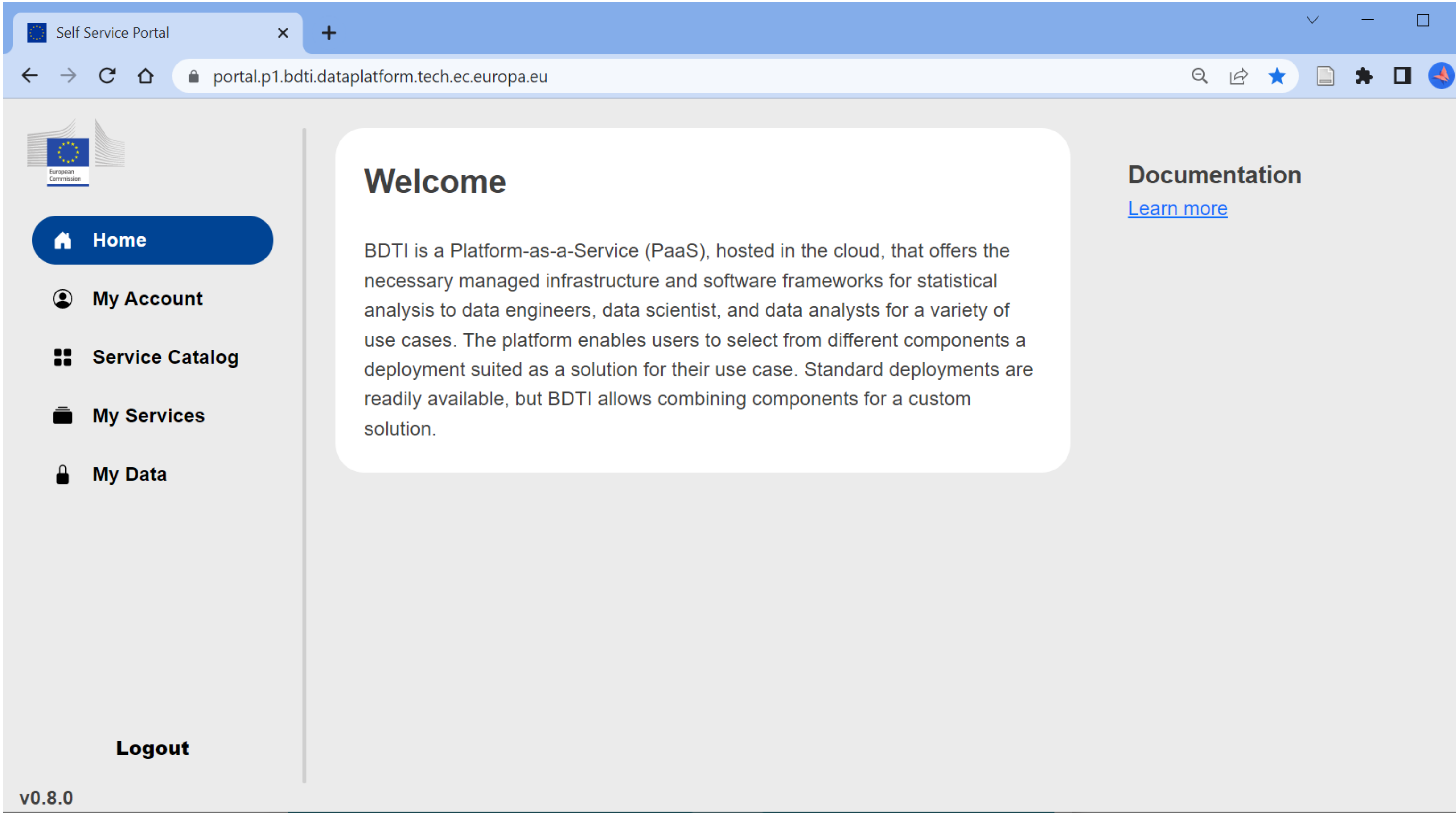
EU Login

One account, many EU services

For teams part of BDTI pilots

3

The BDTI portal

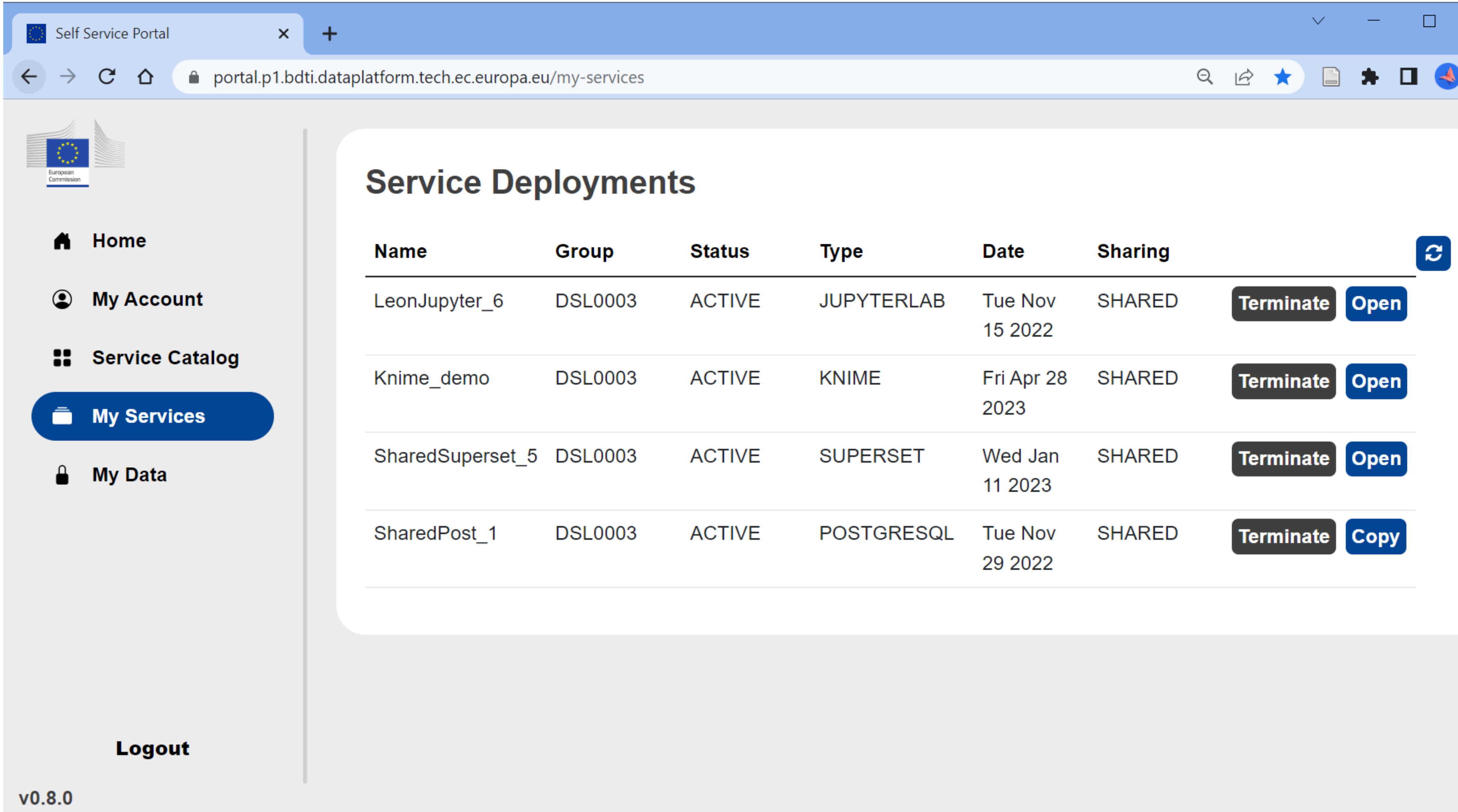


Welcome

BDTI is a Platform-as-a-Service (PaaS), hosted in the cloud, that offers the necessary managed infrastructure and software frameworks for statistical analysis to data engineers, data scientist, and data analysts for a variety of use cases. The platform enables users to select from different components a deployment suited as a solution for their use case. Standard deployments are readily available, but BDTI allows combining components for a custom solution.

3

The BDTI portal: My Services

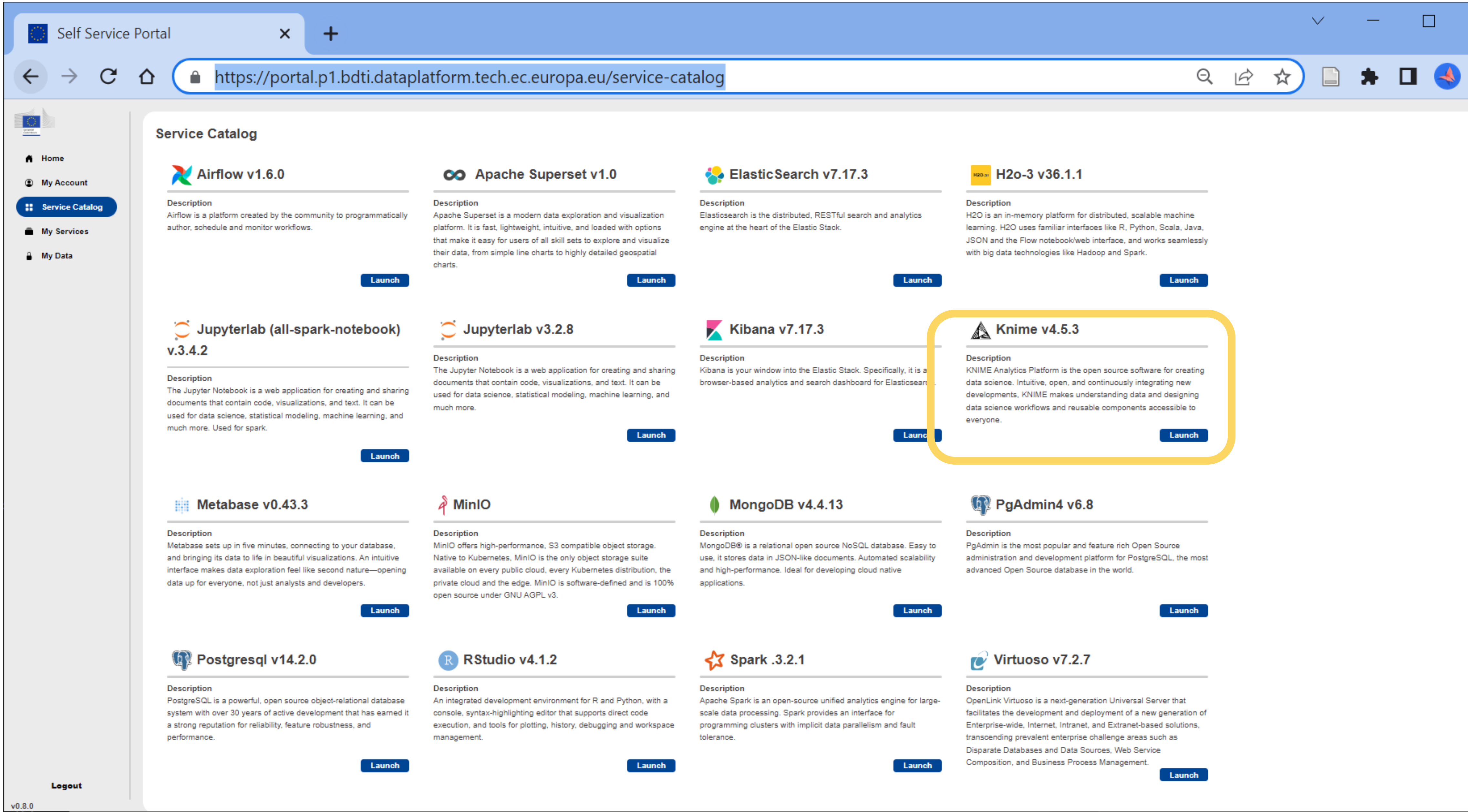


Service Deployments

Name	Group	Status	Type	Date	Sharing	
LeonJupyter_6	DSL0003	ACTIVE	JUPYTERLAB	Tue Nov 15 2022	SHARED	Terminate Open
Knime_demo	DSL0003	ACTIVE	KNIME	Fri Apr 28 2023	SHARED	Terminate Open
SharedSuperset_5	DSL0003	ACTIVE	SUPERSET	Wed Jan 11 2023	SHARED	Terminate Open
SharedPost_1	DSL0003	ACTIVE	POSTGRESQL	Tue Nov 29 2022	SHARED	Terminate Copy

3

The BDTI portal: service catalogue



Service Catalog

Airflow v1.6.0

Description
Airflow is a platform created by the community to programmatically author, schedule and monitor workflows.

Launch

Apache Superset v1.0

Description
Apache Superset is a modern data exploration and visualization platform. It is fast, lightweight, intuitive, and loaded with options that make it easy for users of all skill sets to explore and visualize their data, from simple line charts to highly detailed geospatial charts.

Launch

ElasticSearch v7.17.3

Description
Elasticsearch is the distributed, RESTful search and analytics engine at the heart of the Elastic Stack.

Launch

H2o-3 v36.1.1

Description
H2O is an in-memory platform for distributed, scalable machine learning. H2O uses familiar interfaces like R, Python, Scala, Java, JSON and the Flow notebook/web interface, and works seamlessly with big data technologies like Hadoop and Spark.

Launch

Jupyterlab (all-spark-notebook) v.3.4.2

Description
The Jupyter Notebook is a web application for creating and sharing documents that contain code, visualizations, and text. It can be used for data science, statistical modeling, machine learning, and much more. Used for spark.

Launch

Jupyterlab v3.2.8

Description
The Jupyter Notebook is a web application for creating and sharing documents that contain code, visualizations, and text. It can be used for data science, statistical modeling, machine learning, and much more.

Launch

Kibana v7.17.3

Description
Kibana is your window into the Elastic Stack. Specifically, it is a browser-based analytics and search dashboard for Elasticsearc

Launc

Knime v4.5.3

Description
KNIME Analytics Platform is the open source software for creating data science. Intuitive, open, and continuously integrating new developments, KNIME makes understanding data and designing data science workflows and reusable components accessible to everyone.

Launch

Metabase v0.43.3

Description
Metabase sets up in five minutes, connecting to your database, and bringing its data to life in beautiful visualizations. An intuitive interface makes data exploration feel like second nature—opening data up for everyone, not just analysts and developers.

Launch

MinIO

Description
MinIO offers high-performance, S3 compatible object storage. Native to Kubernetes, MinIO is the only object storage suite available on every public cloud, every Kubernetes distribution, the private cloud and the edge. MinIO is software-defined and is 100% open source under GNU AGPL v3.

Launch

MongoDB v4.4.13

Description
MongoDB® is a relational open source NoSQL database. Easy to use, it stores data in JSON-like documents. Automated scalability and high-performance. Ideal for developing cloud native applications.

Launch

PgAdmin4 v6.8

Description
PgAdmin is the most popular and feature rich Open Source administration and development platform for PostgreSQL, the most advanced Open Source database in the world.

Launch

Postgresql v14.2.0

Description
PostgreSQL is a powerful, open source object-relational database system with over 30 years of active development that has earned it a strong reputation for reliability, feature robustness, and performance.

Launch

RStudio v4.1.2

Description
An integrated development environment for R and Python, with a console, syntax-highlighting editor that supports direct code execution, and tools for plotting, history, debugging and workspace management.

Launch

Spark .3.2.1

Description
Apache Spark is an open-source unified analytics engine for large-scale data processing. Spark provides an interface for programming clusters with implicit data parallelism and fault tolerance.

Launch

Virtuoso v7.2.7

Description
OpenLink Virtuoso is a next-generation Universal Server that facilitates the development and deployment of a new generation of Enterprise-wide, Internet, Intranet, and Extranet-based solutions, transcending prevalent enterprise challenge areas such as Disparate Databases and Data Sources, Web Service Composition, and Business Process Management.

Launch

3

BDTI Demonstrator:
Towards a data-Informed Government Spending

Goal:
Show how the BDTI can be used by different users (at different levels of complexity) to **derive insights from government spendings to take data-informed actions**

A **user-centered** approach:

- Elena and Daniel, public servants
- Low data literacy skills
- **Problem**: high government spending in public lighting
- **Solution**: how to optimize public lighting to reduce government spending

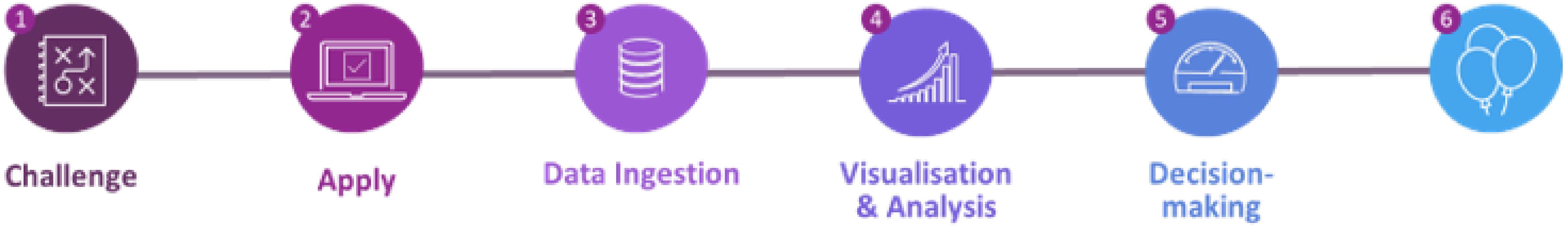
3

BDTI Demonstrator and KNIME: Data-Informed Government Spending

Elena

- Observes high government spending reported in the news
- Uses Optical Character Recognition (OCR) to extract relevant information from a folder of PDF invoices from the Energy Supplier.
- She then combines this output with other data (.csv, .xlsx) on her government's spending.
- She feeds the consolidated dataset to a relational database that she can access with her dashboarding service.
- Elena visualizes the enriched government spending data in a Dashboard.
- She analyses the charts and discovers that her government is spending **more on public lighting** than other comparable municipalities.

(**Services used:** KNIME, PostgreSQL, Apache Superset)

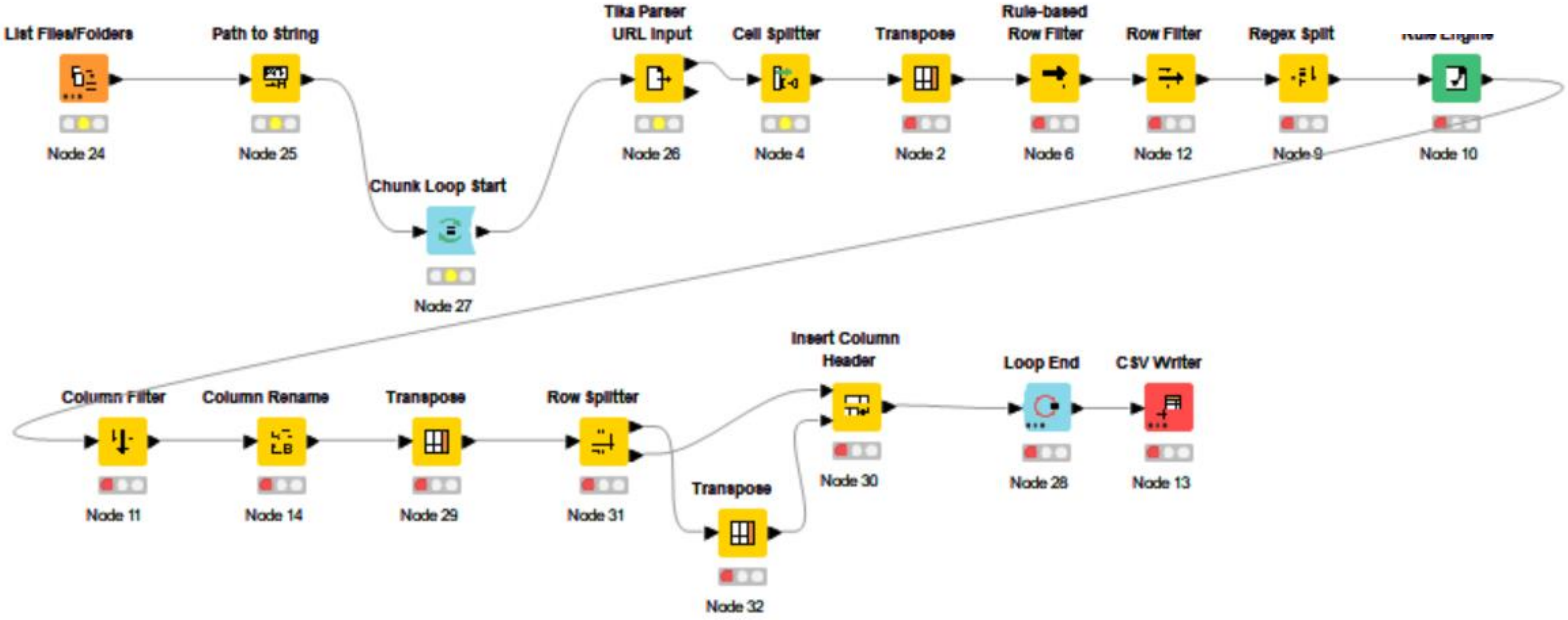


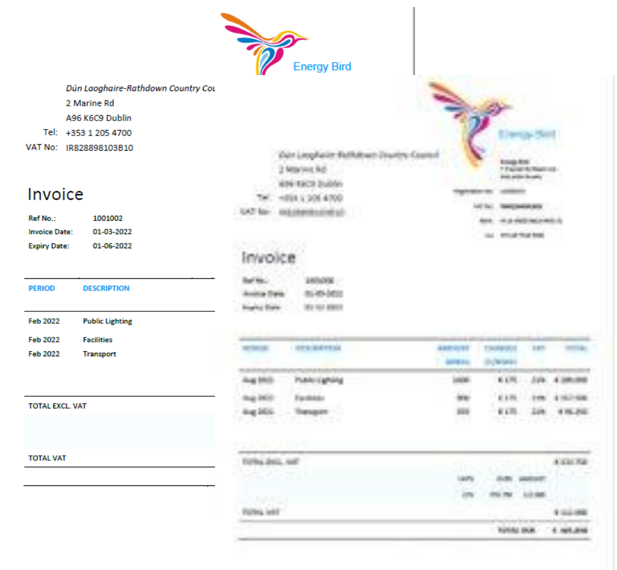
3

BDTI Demonstrator: KNIME Workflow

*3: KNIME_OCR_multiple_pdf

This Knime workflow connects to a folder containing PDF invoices. It loops over the invoices one at a time to apply OCR. When all invoices are read, the retrieved parameters are stored into a single csv file. Right-click a node and select configure to see what the node does. The node called Tike Parser URL Input is the node that performs the actual optical character recognition.





Energy Bird

Dún Laoghaire-Rathdown Country Cou
2 Marine Rd
A96 K6C9 Dublin
Tel: +353 1 205 4700
VAT No: IR828898103B10

Invoice

Ref No.: 1001002
Invoice Date: 01-03-2022
Expiry Date: 01-06-2022

PERIOD	DESCRIPTION
Feb 2022	Public Lighting
Feb 2022	Facilities
Feb 2022	Transport

TOTAL EXCL. VAT

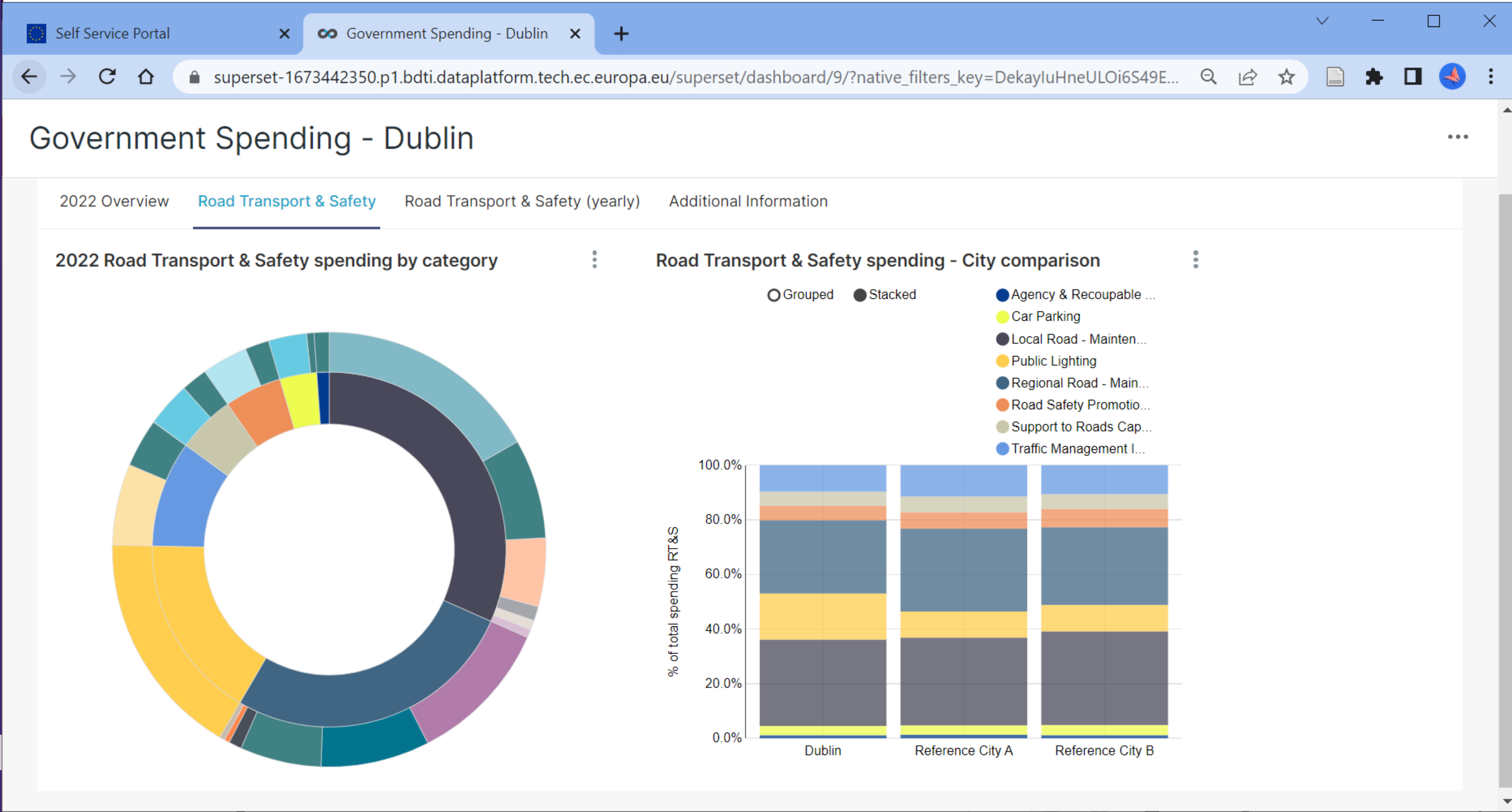
TOTAL VAT

Invoice

BDTI in practice

3

BDTI Demonstrator: Dashboard



Self Service Portal
Government Spending - Dublin
superset-1673442350.p1.bdti.dataplatform.tech.ec.europa.eu/superset/dashboard/9/?native_filters_key=DekayluHneULOi6S49E...

Government Spending - Dublin

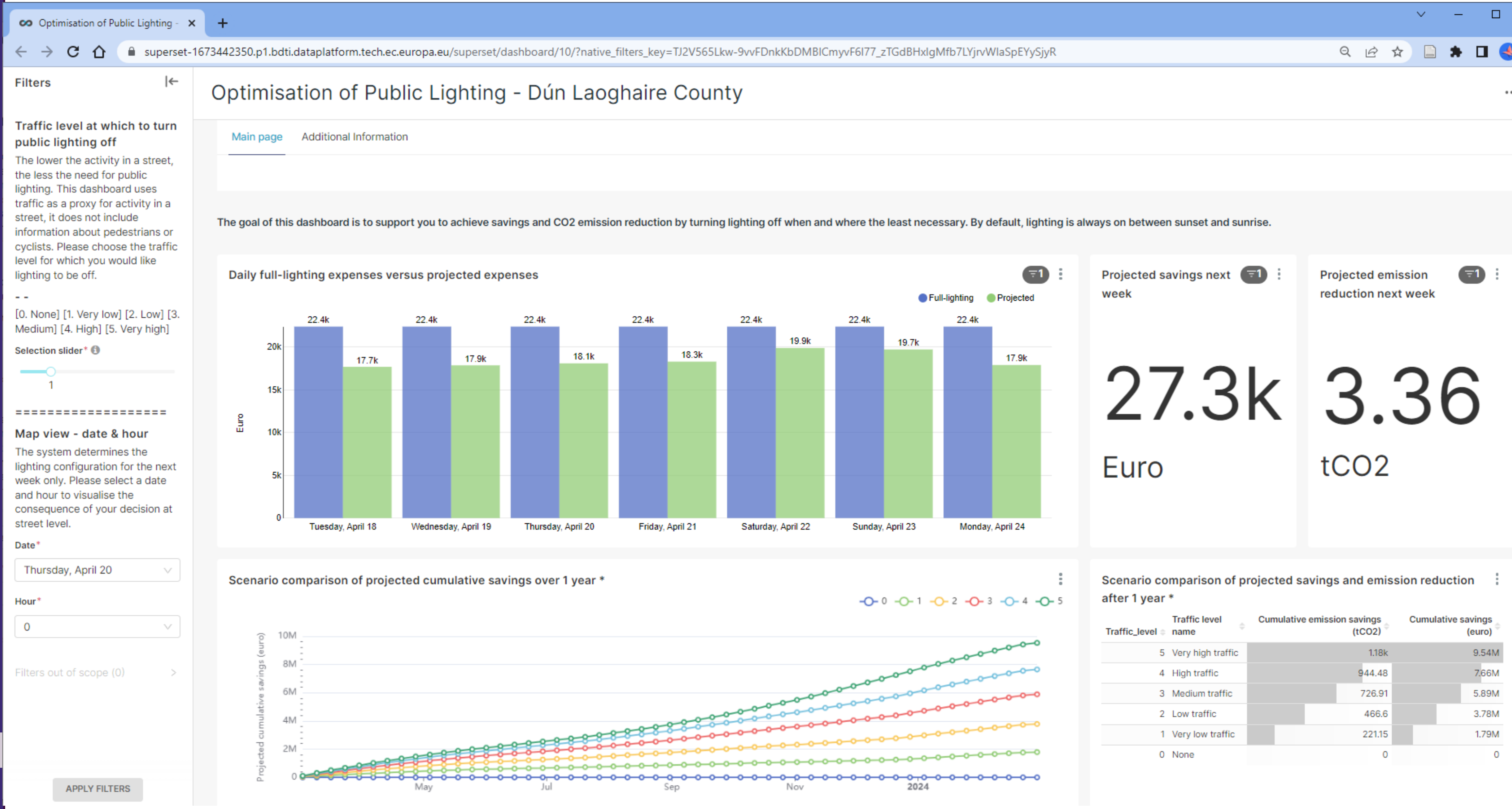
2022 Overview | Road Transport & Safety | Road Transport & Safety (yearly) | Additional Information

2022 Road Transport & Safety spending by category

Road Transport & Safety spending - City comparison

BDTI in practice

BDTI Demonstrator: Dashboard



Optimisation of Public Lighting -
superset-1673442350.p1.bdti.dataplatform.tech.ec.europa.eu/superset/dashboard/10/?native_filters_key=TJ2V565Lkw-9vvFDnkKbDMBICmyvF6I77_zTGdBHxlgMfb7LYjrvWlaSpEYySjyR

Filters

Traffic level at which to turn public lighting off

The lower the activity in a street, the less the need for public lighting. This dashboard uses traffic as a proxy for activity in a street, it does not include information about pedestrians or cyclists. Please choose the traffic level for which you would like lighting to be off.

- -

[0. None] [1. Very low] [2. Low] [3. Medium] [4. High] [5. Very high]

Selection slider*: 1

===================

Map view - date & hour

The system determines the lighting configuration for the next week only. Please select a date and hour to visualise the consequence of your decision at street level.

Date*: Thursday, April 20

Hour*: 0

Filters out of scope (0)

APPLY FILTERS

Optimisation of Public Lighting - Dún Laoghaire County

Main page | Additional Information

The goal of this dashboard is to support you to achieve savings and CO2 emission reduction by turning lighting off when and where the least necessary. By default, lighting is always on between sunset and sunrise.

Daily full-lighting expenses versus projected expenses

Projected savings next week

27.3k

Euro

Projected emission reduction next week

3.36

tCO2

Scenario comparison of projected cumulative savings over 1 year *

Scenario comparison of projected savings and emission reduction after 1 year *

Traffic_level	Traffic level name	Cumulative emission savings (tCO2)	Cumulative savings (euro)
5	Very high traffic	1.18k	9.54M
4	High traffic	944.48	7.66M
3	Medium traffic	726.91	5.89M
2	Low traffic	466.6	3.78M
1	Very low traffic	221.15	1.79M
0	None	0	0

4

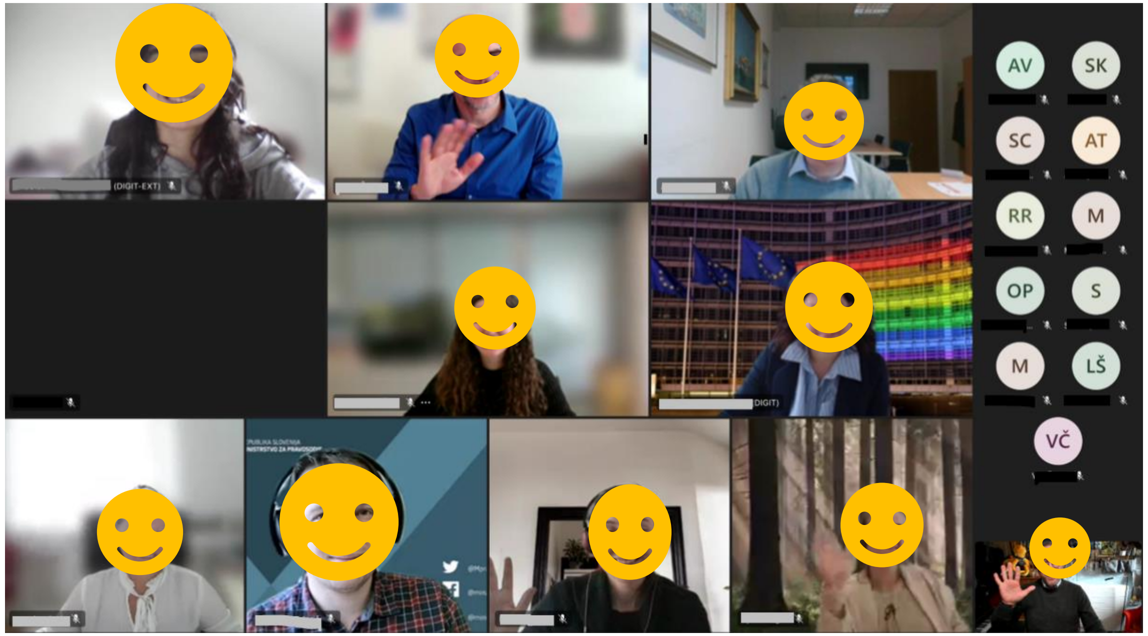
BDTI's community

- Developing the BDTI community and how can you help us

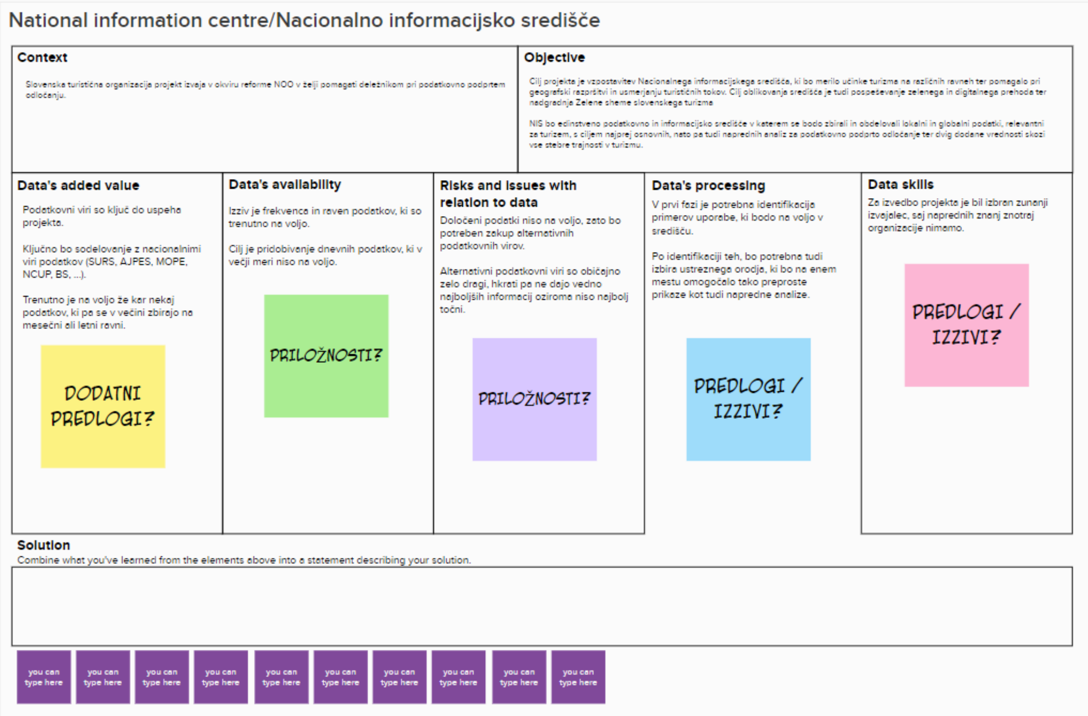
4

BDTI National Information Sessions

Goal: introduce BDTI, learn about data analytics projects, develop your data analytics community!



BDTI Information Session (April 2022) in Slovenia in collaboration with the **Slovenian Ministry of Digital Transformation**



National information centre/Nacionalno informacijsko središče

Context

Slovenska turistična organizacija projekt izvaja v okviru reforme NOO v želji pomagati deležnikom pri podatkovno podprtem odločanju.

Objective

Cilj projekta je vzpostavitev Nacionalnega informacijskega središča, ki bo merilo učinke turizma na različnih ravneh ter pomagalo pri geografski razpršitvi in usmerjanju turističnih tokov. Cilj oblikovanja središča je tudi pospeševanje zelenega in digitalnega prehoda ter nadgradnja Zelene sheme slovenskega turizma

NIS bo edinstveno podatkovno in informacijsko središče v katerem se bodo zbirali in obdelovali lokalni in globalni podatki, relevantni za turizem, s ciljem najprej osnovnih, nato pa tudi naprednih analiz za podatkovno podprto odločanje ter dvig dodane vrednosti skozi vse stebre trajnosti v turizmu.

Data's added value

Podatkovni viri so ključ do uspeha projekta.

Ključno bo sodelovanje z nacionalnimi viri podatkov (SURS, AJPES, MOPE, NCUP, BS, ...).

Trenutno je na voljo že kar nekaj podatkov, ki pa se v večini zbirajo na mesečni ali letni ravni.

DODATNI PREDLOGI?

Data's availability

Izziv je frekvenca in raven podatkov, ki so trenutno na voljo.

Cilj je pridobivanje dnevnih podatkov, ki v večji meri niso na voljo.

PRILOŽNOSTI?

Risks and issues with relation to data

Določeni podatki niso na voljo, zato bo potreben zakup alternativnih podatkovnih virov.

Alternativni podatkovni viri so običajno zelo dragi, hkrati pa ne dajo vedno najboljših informacij oziroma niso najbolj točni.

PRILOŽNOSTI?

Data's processing

V prvi fazi je potrebna identifikacija primerov uporabe, ki bodo na voljo v središču.

Po identifikaciji teh, bo potrebna tudi izbira ustreznega orodja, ki bo na enem mestu omogočalo tako preproste prikaze kot tudi napredne analize.

PREDLOGI / IZZIVI?

Data skills

Za izvedbo projekta je bil izbran zunanji izvajalec, saj naprednih znanj znotraj organizacije nimamo.

PREDLOGI / IZZIVI?

Solution

Combine what you've learned from the elements above into a statement describing your solution.

you can type here | you can type here | you can type here | you can type here | you can type here | you can type here | you can type here | you can type here | you can type here | you can type here

BDTI Canva used in Mural during the BDTI Information Session in Slovenia

From Hype to Action

The BDTI Canva

by the BTDI Team

The BDTI Canva aims to help you build a strong data use case through a series of questions.

For more information,
visit the BDTI website

Contact us by email:
EC-BDTI-PILOTS@ec.europa.eu

Context:
Who are you? Who are your stakeholders?

Objective(s):
What is the problem you are trying to address?
What is your timeframe?

Data's added value:
Which information helps you address the problem? From which sector and or domain?

Data's availability:
Does the data you need exist?If it doesn't exist, can you collect it? From whom can you get the data you need? Can you reuse the data? What license applies to the data you'd like to use? How is the quality of the data you'd like to use? Are the different datasets interoperable? Do you know how to connect the dots?

Data's risk(s):
What could go wrong when using data to address this objective? Are there legal and ethical considerations to make? Are you dealing with personal data?

Data's processing:
What do you need to gather, process and analyze the data (i.e., tools, software, computing power, ...)? Do you already have them? If you do not, where can you get them (e.g., applying to the BDTI)?

Data skills:
What data literacy and skills do you need (i.e., data engineering, data analysis, data science, data visualization)? Do you already have these available within your team/organization?

Your solution
Combine what you've learned from the elements above into a statement describing your solution

4 Who used it already?

CONSELLERIA DE SANITAT (CS) - Text Mining

Conselleria de Sanitat, the Health Public Administration of the Comunidad Valenciana Regional Government, needed a tool capable of analysing and extract knowledge from the huge quantity of scientific clinical articles coming from different sources (i.e. PubMed.gov, Covid-19 related clinical articles).

GENERALITAT VALENCIANA
Conselleria de Sanitat
Universal i Salut Pública

Advanced **data visualization** and **text mining** tools to help **extracting knowledge contained in the documents**, supporting clinicians and managers in their clinical practices andd day-to-day work.

EU CONVALESCENT PLASMA DATABASE – Data sharing

The European Blood Alliance is working together with the European Commission (DG SANTE) to create and manage an **EU-wide open-access platform** that collects data to support a study on **Covid-19 convalescent plasma therapy**. The aim of the study is to assess in which conditions the convalescent plasma treatment is most effective, in order to take data driven decisions on the therapy and focus the efforts of the research in the most promising directions.

eba
EUROPEAN
BLOOD
ALLIANCE

A ready-to-use, virtual environment in which **data collected through a custom-built website** are ingested and anonymized, to be then analyzed with advanced data visualization and analytical tools. Initially, only donation data were processed, then the scope was increased to capture the **end-to-end of blood plasma, from donation to patient/clinical trial.**

CITY OF FLORENCE – Mobility data

The main goal of the Municipality is to perform a **cross correlation between the multiple datasets** available within the city to understand how people were and are moving between the different districts, to then derive precious insights about mobility the most and about **how services can be redesigned to foster cultural activities and events.**

Città di
FIRENZE

Predictive, descriptive and time-series analysis on multiple datasets collected **before, during and after the Covid-19 pandemic** such as: public Wi-Fi sensors, parking and geo-referenced data of people movements (i.e. tourists).

4 Who used it already?

The vision: Public Procurement Data Spaces

Every year in the EU, over **250 000 public authorities spend around €2 trillion (around 13.6% of GDP)** on the purchase of services, goods, and supplies. EU directives govern procurement contracts above certain thresholds to ensure the transparency of the procedure.

The Public Procurement Data Space (PPDS) will:

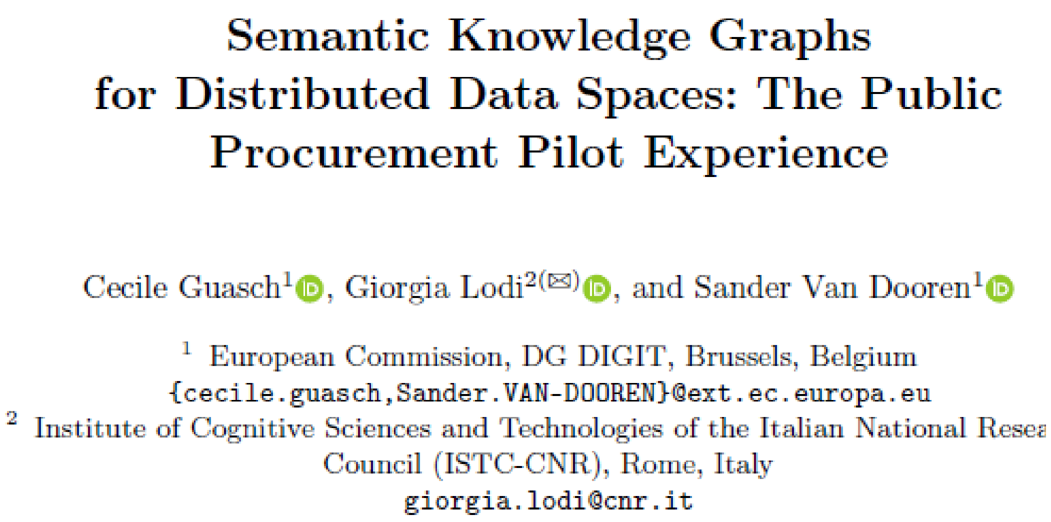
- connect European databases, including TED data on public procurement, and national procurement data sets available in national portals
- facilitate access for companies and SMEs to public procurement procedures across the EU.
- increase transparency, integrity, and accountability of public spending while fighting corruption and collusion.
- generate key insights for policy-making

https://single-market-economy.ec.europa.eu/single-market/public-procurement/digital-procurement/public-procurement-data-space-ppds_en

4

Who used it already?
Semantic Knowledge Graphs for Distributed Data Spaces

The Public Procurement Pilot Experience



Semantic Knowledge Graphs for Distributed Data Spaces: The Public Procurement Pilot Experience

Cecile Guasch[1], Giorgia Lodi[2](✉), and Sander Van Dooren[1]

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Council (ISTC-CNR), Rome, Italy
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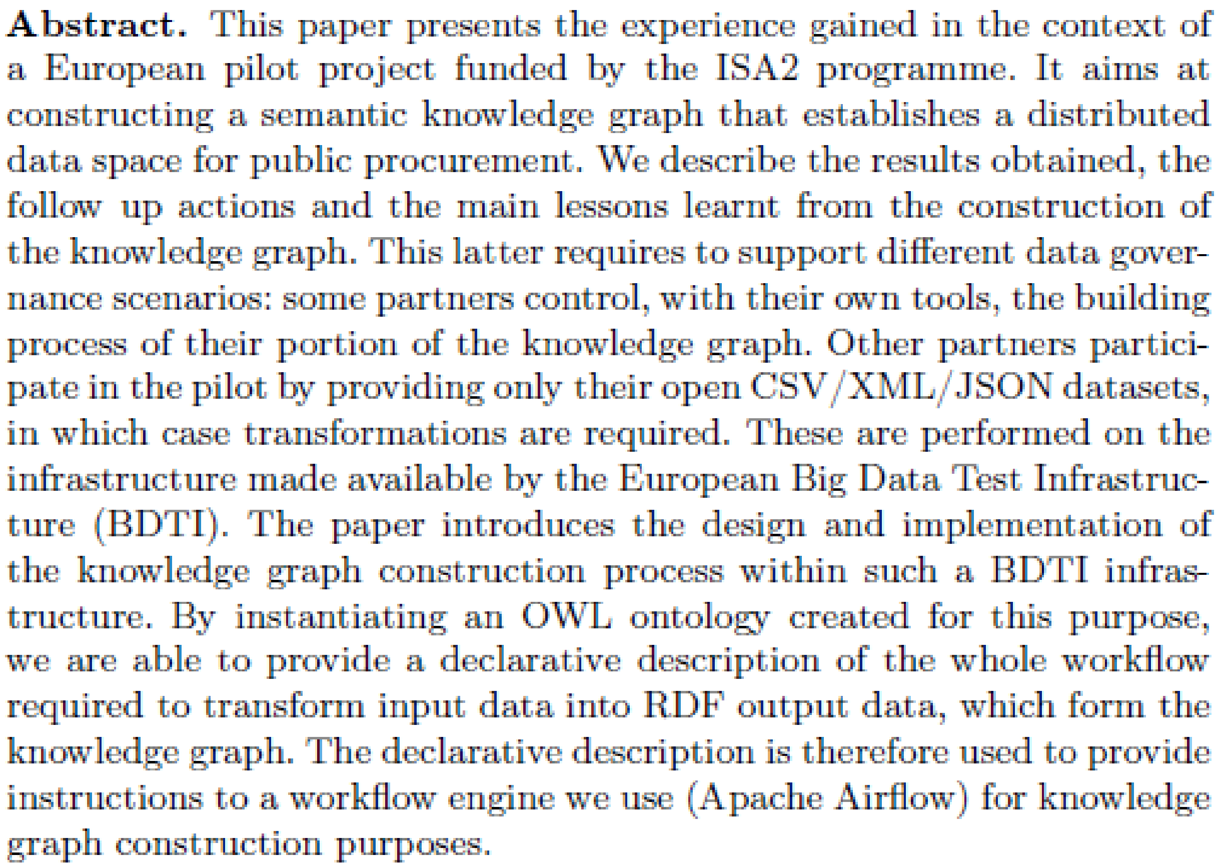

Abstract. This paper presents the experience gained in the context of a European pilot project funded by the ISA2 programme. It aims at constructing a semantic knowledge graph that establishes a distributed data space for public procurement. We describe the results obtained, the follow up actions and the main lessons learnt from the construction of the knowledge graph. This latter requires to support different data governance scenarios: some partners control, with their own tools, the building process of their portion of the knowledge graph. Other partners participate in the pilot by providing only their open CSV/XML/JSON datasets, in which case transformations are required. These are performed on the infrastructure made available by the European Big Data Test Infrastructure (BDTI). The paper introduces the design and implementation of the knowledge graph construction process within such a BDTI infrastructure. By instantiating an OWL ontology created for this purpose, we are able to provide a declarative description of the whole workflow required to transform input data into RDF output data, which form the knowledge graph. The declarative description is therefore used to provide instructions to a workflow engine we use (Apache Airflow) for knowledge graph construction purposes.

Guasch, C., Lodi, G., & Dooren, S. V. (2022, October). Semantic Knowledge Graphs for Distributed Data Spaces: The Public Procurement Pilot Experience. In *The Semantic Web–ISWC 2022: 21st International Semantic Web Conference, Virtual Event, October 23–27, 2022, Proceedings* (pp. 753-769). Cham: Springer International Publishing. https://iswc2022.semanticweb.org/index.php/accepted-papers/

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1. Get familiar with the BDTI service on our website
2. Brainstorm on your data analytics project using our BDTI Canva and then fill in the BDTI template request form
3. Submit your pilot request (template) by email: EC-BDTI-PILOTS@ec.europa.eu
4. Meet with us to elaborate on your use case
5. Pilot Project is approved if:

   Brings value,

   can be done in 6 months, sufficient resources available (skills, team, data)
6. Your test environment is set up
7. You can start piloting and create value!

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References

Academic references:

Guasch, C., Lodi, G., & Dooren, S. V. (2022, October). Semantic Knowledge Graphs for Distributed Data Spaces: The Public Procurement Pilot Experience. In The Semantic Web–ISWC 2022: 21st International Semantic Web Conference, Virtual Event, October 23–27, 2022, Proceedings (pp. 753-769). Cham: Springer International Publishing. https://iswc2022.semanticweb.org/index.php/accepted-papers/

Mergel, I., Rethemeyer, R. K., & Isett, K. (2016). Big data in public affairs. *Public Administration Review*, *76*(6), 928-937.

Pirog, M. A. (2014). Data will drive innovation in public policy and management research in the next decade. *Journal of Policy Analysis and Management*, 537-543.

Tan, E., & Crompvoets, J. (Eds.). (2022). *The new digital era governance: How new digital technologies are shaping public governance*. Wageningen Academic Publishers.

European Commission websites:

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en

https://digital-strategy.ec.europa.eu/en/policies/legislation-open-data

https://commission.europa.eu/publications/interoperable-europe-act-proposal_en

https://digital-strategy.ec.europa.eu/en/policies/data-governance-act

https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1113

https://digital-strategy.ec.europa.eu/en/activities/digital-programme

https://dssc.eu/wp-content/uploads/2023/03/DSSC-Data-Spaces-Glossary-v1.0.pdf

https://digital-strategy.ec.europa.eu/en/library/staff-working-document-data-spaces