

Enabling a Data-informed Public Sector: An Introductory Course to BDTI Essentials

Session 4: Analytics



Welcome!
The webinar will begin shortly.

DG CNECT

Directorate-General for Communications
Networks, Content and Technology

DG DIGIT

Directorate-General
for Digital Services



Some housekeeping



- The Chat and Q&A widgets – **Bottom right of the screen**
- Please post session-related questions in **Q&A**
- The session will be recorded and available shortly after the end of the session on our website

- **Do**
 - Participate in the chat during the session
 - Ask questions during the Q&A portion at the end
 - Give feedback after the session
 - Join the dedicated discussion board

- **Don't**
 - Self-promote
 - Disrespect anyone

Locate Chat and Q&A - Webex



A screenshot of a Webex meeting interface. The main area is a large grey rectangle representing a video feed. On the right side, there is a "Chat" window. Below the chat window, there is a "Send to:" dropdown menu set to "Everyone". Below that is a "Type your message" input field. A dropdown menu is open, showing "Q&A" and "Polling" options. At the bottom of the interface, there is a toolbar with various icons: a camera icon, a chat icon, a "Mute" button, a "Start video" button, a "Share" button, a "Record" button, a "Breakout sessions" button, a hand icon, a smiley face icon, a red "X" icon, a person icon, a speech bubble icon, and a three-dot menu icon. A green arrow points to the three-dot menu icon in the bottom right corner of the toolbar.

Enabling a Data-informed Public Sector: An Introductory Course to BDTI Essentials

Session 4: Analytics



Agenda

- Welcome [11:00-11:05]
- Session 4 Recap [11.05-11.15]
- Data Analytics [11:15-12:00]
- Q&A [12:00-12:10]
- Wrap up [12:10 – 12:15]

What is the Big Data Test Infrastructure (BDTI) ?



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

You have the key ingredients (datasets),
we equip you with the best **open-source tool**
to create amazing recipes for **public good**.



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

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

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 once 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 a free playground for data analytics?

<https://big-data-test-infrastructure.ec.europa.eu/>

Open-source tools to support your data journey



100%

5. Decision-Making

1. Collection

4. Visualisation

Orchestration

3. Analysis

2. Processing



MINIO

Data Lake

OPENLINK VIRTUOSO UNIVERSAL SERVER

mongoDB

Database



elasticsearch

Advanced Processing Engines

APACHE SPARK

100%

Metabase

Apache Superset

Development Environments

KNIME

Jupyter H2O.ai

R Studio



Use case:

"Identify Innovative Green Energy Projects from EU Universities"

Zoi and her team, work in the **Educational Department** of a **highly polluted EU region**.

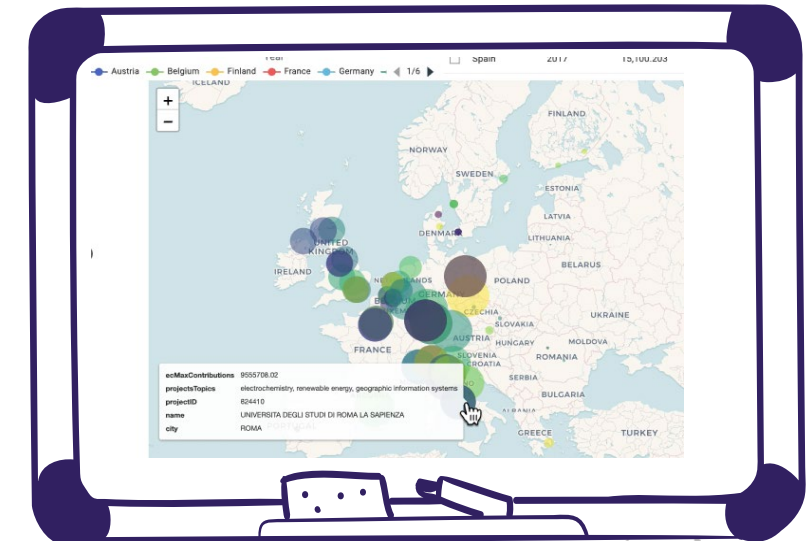
Their **purpose** is to identify potential **"green energy partnerships"** between EU universities to address pollution issues.

Zoi reached out the BDTI team to learn how to **connect the dots**, use the free BDTI playground to **create insights** and produce a **report**, which can be **easily updated** when new data is available.



They found some interesting **open data**:

- **List of innovation green energy projects** across EU countries
- **CO2 emissions** of these countries



Recap: Zoi Data Journey

<https://code.europa.eu/bdti/bdti-essentials-course>



Access the data from multiple sources

SESSION 1:
Data Access and Exploration

SESSION 2:
Data Cleaning and Transformation

Merge the data and store it in the desired format (end of ETL process)

SESSION 3:
Data Blending and Storage



SESSION 4:
Analytics: aggregation, visualisation, reporting

SESSION 5:
Advanced Analytics

EU Open data portal:

data.europa.eu

Formats:
csv, Excel, JSON

Tools:



Clean and transform the data to the correct shape



Make sense of data, extract insights and visualise them in a report



Enhance analytics by gathering data from the internet





Recap Session 3 – Data Blending and Storage

What is Data Blending and Storage?

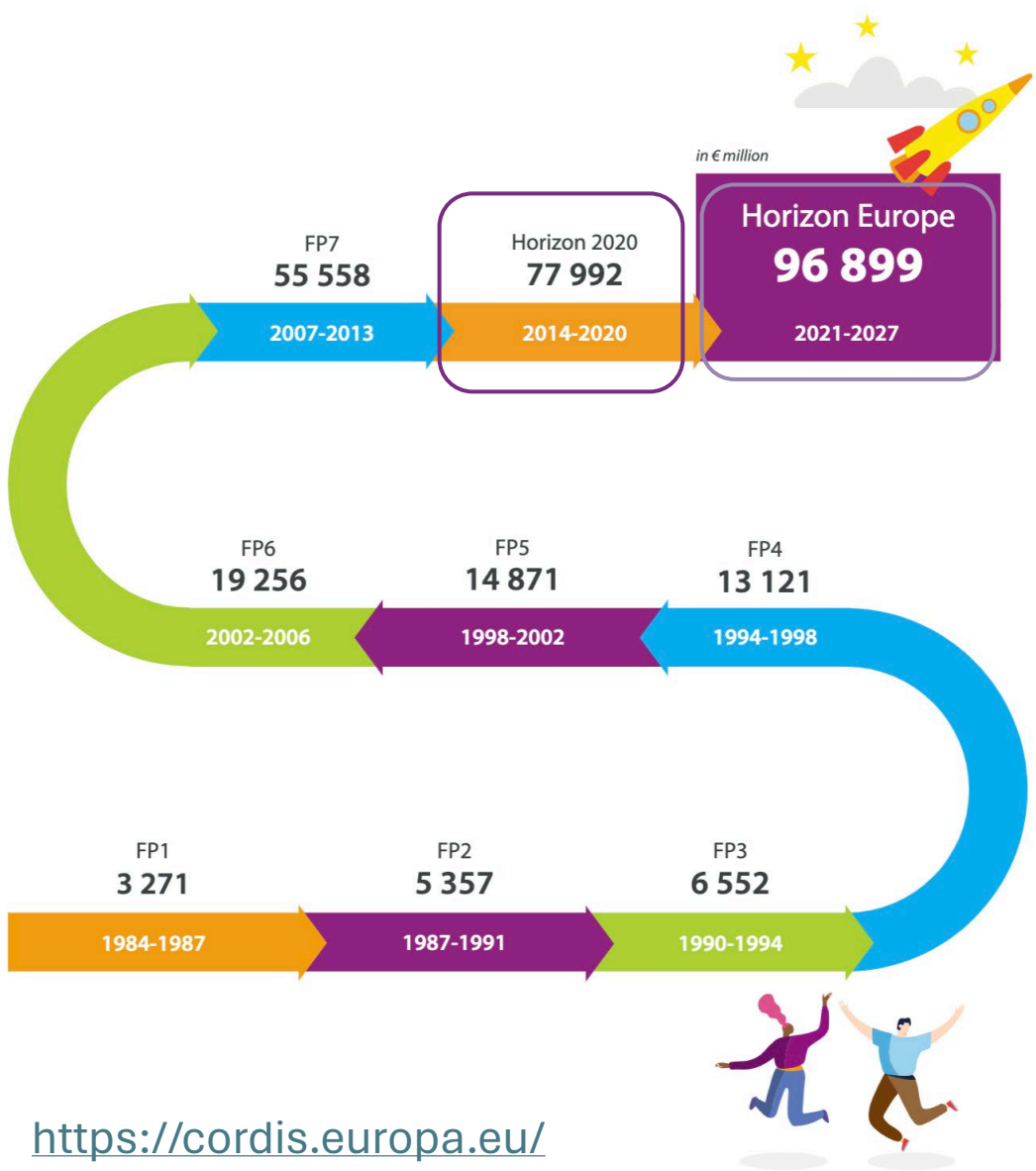


Blending	Export and Storage
<p>Stack new data at the bottom of a table → same columns, add rows</p>	<p>Export the data to store it in different file formats: CSV, Excel, Table, JSON.</p>
<p>Join information from tables by defining matching criteria → add columns</p>	<p>Scalability, when things get bigger, and we have too much data, it is better to use Databases</p>



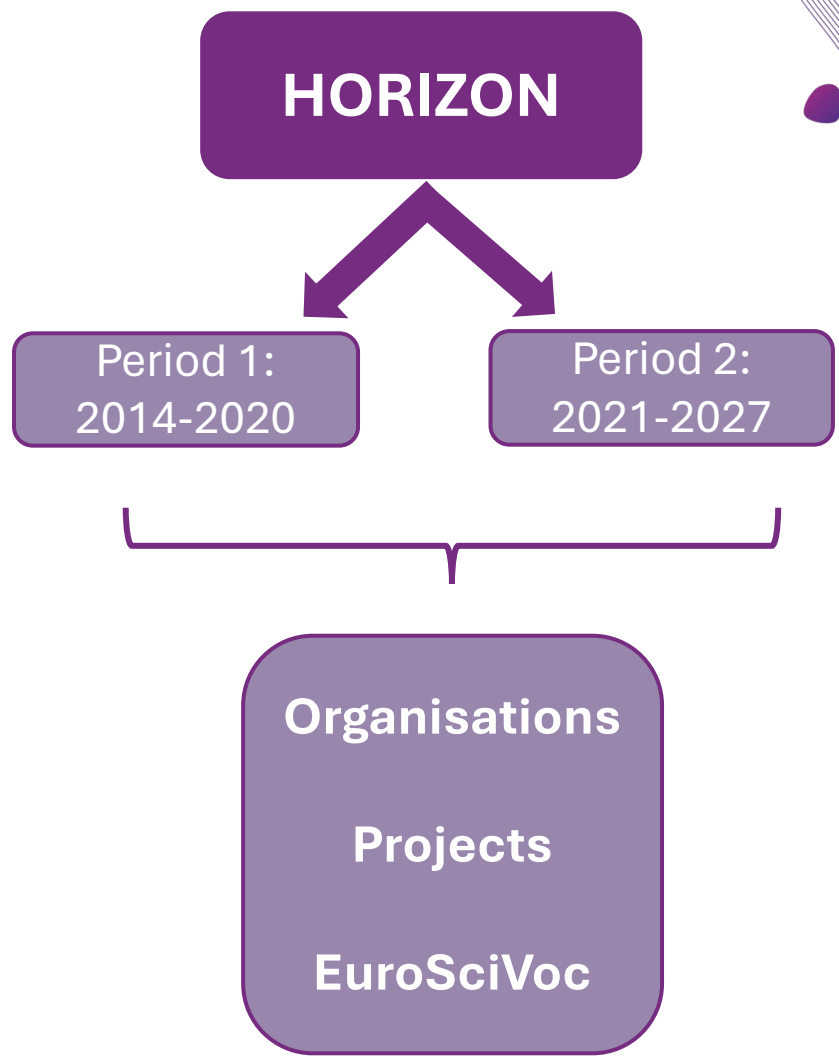
EVOLUTION OF THE R&I FRAMEWORK PROGRAMMES BUDGET

The EU budget has been significantly rising over time from EUR 3 271 million in FP1 to EUR 96 899 million today for Horizon Europe and Euratom. This illustrates the clear ambition of the EU for its main R&I funding instrument and increases relevance of science and technology in society to address our challenges.



<https://cordis.europa.eu/>

This budget compares favourably with the previous programme, Horizon 2020. In real terms, and excluding





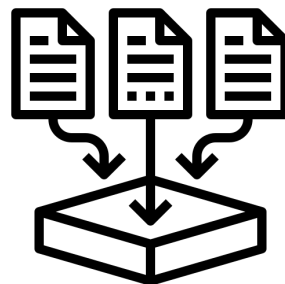
Exercise Review

Summary: Data Blending and Storage

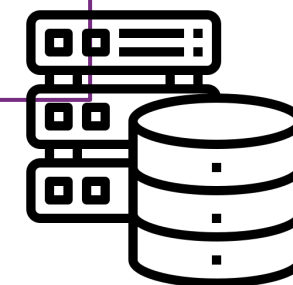


From multiple data files (8)

- Organisations (14-20/ 21-27)
- Projects (14-20/ 21-27)
- EuroSciVoc (14-20/ 21-27)
- CO2
- EU Country Names



To a **single** data file with all the information that we export and store





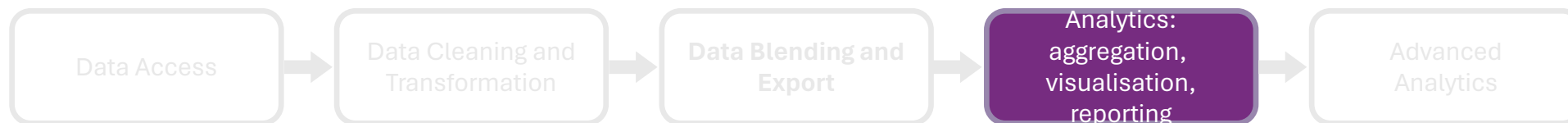
Session 4: Analytics, Visualisation, and Reporting

Learning Outcomes



At the end of this session, you should be able to:

1. Sign into the BDTI framework, initialise KNIME, PgAdmin, PostgreSQL, and Apache superset
2. Read data from a data base to KNIME and Apache Superset
3. Make sense of the data by applying basic aggregation
4. Create visualisations and a basic report



How do we get insights?

1) Aggregation

Create a summarised version of the data

2) Pivoting

Rearrange data to analyse it from different perspectives.

3) Visualisation

Transform data tables to communicate their results visually



Analytics: from objectives to insights



Objective	Insights
Identify countries with the most university involvement in green projects	Aggregate number of projects and plot data with a stacked bar chart
Identify the most active EU-based universities involved in green projects	Aggregate number of projects and plot data with a bar chart
Identify trends in started projects per country per year	Plot data with a line plot
Explore the relation between number of projects per university, energy project funding per university and a country's CO2 emission	Filter plot data with a parallel coordinates plot



Data Aggregation

Data Aggregation

- Create a summarised version of the data
- Aggregate by one or more categories
- Use one or more aggregation methods



Use Case

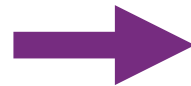
Zoi has reached the point where the data can be **aggregated** to get the necessary **insight** concerning the energy projects and CO2 emissions

Data Aggregation: grouping data



- Group data based on common attributes or categories.
- Summarise data within each group to gain insights.

Product ID	Category	# Ordered Items
P 1	Clothing	2
P 2	Home	3
P 3	Clothing	1
P 4	Clothing	5
P 5	Electronics	7
P 6	Electronics	5



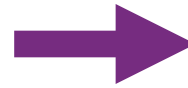
Group	Sum(# Ordered Items)
Clothing	8
Home	3
Electronics	12

Aggregated on Category
(group) by Sum (aggregation
method)

Data Aggregation: grouping data



Product ID	Category	# Ordered Items
P 1	Clothing	2
P 2	Home	3
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P 6	Electronics	5



Group	Sum(# Ordered Items)
Clothing	8
Home	3
Electronics	12

Group - Aggregate

Aggregation by counting number of projects per Uni



Rows: 21476 | Columns: 17

#	RowID	projectID	name	activityTy...	countryN...	street	ecMaxCo...	postCode	city	startDat
1	Row...	773606	PLIOSAUR EN...	PRC	United Kingd...	34 Sally Hill	50,000	BS20 7BH	PORTISHEAD...	2017-05
2	Row...	734032	NOVA INNOV...	PRC	United Kingd...	45 TIMBER B...	2,250,266	EH6 6QH	Edinburgh	2016-10
3	Row...	745862	SKF GMBH	PRC	Germany	GUNNAR WE...	14,914,599.5	97421	Schweinfurt	2017-07
4	Row...	745862	AGENCE INT...	PRC	Belgium	QUAI SAINT ...	14,914,599.5	7500	Tournai	2017-07
5	Row...	745862	SKF BV	PRC	Netherlands	MEIDOORNK...	14,914,599.5	3992 AE	Houten	2017-07
6	Row...	745862	RSK ENVIRO...	PRC	France	202 QUAI DE ...	14,914,599.5	92110	Clichy	2017-07
7	Row...	745862	MOJO MARIT...	PRC	United Kingd...	27 AVENUE R...	14,914,599.5	TR11 4AY	Falmouth	2017-07
8	Row...	745862	SKF MARINE ...	PRC	Germany	HERMANN B...	14,914,599.5	20457	HAMBURG	2017-07
9	Row...	745862	WOOD GROU...	PRC	France	60 RUE DE LA ...	14,914,599.5	75009	Paris	2017-07
10	Row...	745862	OFFSHORE R...	REC	United Kingd...	OFFSHORE H...	14,914,599.5	NE24 1LZ	Blyth Northu...	2017-07
11	Row...	745862	NOVA INNOV...	PRC	United Kingd...	45 TIMBER B...	14,914,599.5	EH6 6QH	Edinburgh	2017-07
12	Row...	745862	HMK TECHN...	PRC	United Kingd...	KAPPA HOUS...	14,914,599.5	CW12 1QJ	Congleton Ch...	2017-07
13	Row...	745862	THE UNIVER...	HES	United Kingd...	OLD COLLEG...	14,914,599.5	EH8 9YL	Edinburgh	2017-07
14	Row...	745862	JAMES FISH...	PRC	United Kingd...	MICHAELSO...	14,914,599.5	LA14 1HR	Barrow-In-Fu...	2017-07
15	Row...	745862	SKF (U.K) LI...	PRC	United Kingd...	SUNDON PAR...	14,914,599.5	LU3 3BL	Luton	2017-07
16	Row...	745855	OPENHYDRO ...	PRC	France	4 - 6 AVENUE	15,000,000	50106	Cherbourg-Oc...	2017-09
17	Row...	745855	CRIST OFFSH...	PRC	Poland	UL. CZECHO...	15,000,000	81 336	Gdynia	2017-09
18	Row...	745855	THE EUROPE...	OTH	United Kingd...	THE CHARLE...	15,000,000	KW16 3AW	Stromness	2017-09
19	Row...	745855	DANMARKS ...	HES	Denmark	ANKER ENGE...	15,000,000	2800	Kongens Lyn...	2017-09
20	Row...	745855	OPENHYDRO ...	PRC	Ireland	1 CUSTOM H...	15,000,000	D01 C2CS	Dublin 1	2017-09
21	Row...	745855	NAVAL ENER...	PRC	France	31-35 RUE DE	15,000,000	75015	Paris	2017-09
22	Row...	727793	SKF GMBH	PRC	Germany	GUNNAR WE...	4,401,565.25	97421	Schweinfurt	2016-11
23	Row...	727793	RHEINISCH...	HES	Germany	TEMPLERGR...	4,401,565.25	52062	Aachen	2016-11
24	Row...	727793	SKF MARINE ...	PRC	Germany	HERMANN B...	4,401,565.25	20457	HAMBURG	2016-11
25	Row...	727793	SIEMENS PLC	PRC	United Kingd...	SIR WILLIAM	4,401,565.25	GU16 8QD	Camberley	2016-11
26	Row...	727793	WOOD GROU...	PRC	France	60 RUE DE LA ...	4,401,565.25	75009	Paris	2016-11



Rows: 28 | Columns: 2

#	RowID	countryName	ecMaxCo...
1	RowID	Austria	496
2	Row	Belgium	951
3	Row	Bulgaria	142
4	Row	Croatia	148
5	Row	Cyprus	102
6	Row	Czech Republic	263
7	Row	Denmark	407
8	Row	Estonia	77
9	Row	Finland	339
10	Row	France	1753
11	Row	Germany	2142
12	Row	Greece	545
13	Row	Hungary	146
14	Row	Ireland	251
15	Row	Italy	1763
16	Row	Latvia	72
17	Row	Lithuania	63
18	Row	Luxembourg	63

Group - Aggregate

Aggregate in the different BDTI tools



SQL

```
SELECT SUM(column_to_aggregate) FROM  
table1 GROUP BY column_to_group;
```

R

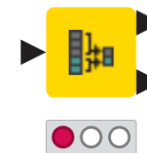
```
df <- read.csv('table1.csv')  
aggregate(df$column_to_aggregate,  
by=list(Category=df$column_to_group),  
FUN=sum)
```

PYTHON

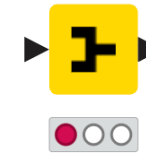
```
import pandas as pd  
df = pd.read_csv('table1.csv')  
grouped_df = df.groupby(['column_to_group']).sum()
```

KNIME

Row Aggregator



GroupBy



Pivoting

- Rearrange data to analyse it from different perspectives.
- Transform rows into columns or vice versa to facilitate analysis.

Product ID	Store	Category	# Ordered Items
P 1	Online	Clothing	2
P 2	Onsite	Home	3
P 3	Onsite	Clothing	1
P 4	Online	Clothing	5
P 5	Online	Electronics	7
P 6	Online	Electronics	5

Aggregation: Count

Category	Online	Onsite
Clothing	2	1
Home	0	1
Electronics	2	0

Aggregation: Sum (# Ordered Items)

Category	Online	Onsite
Clothing	7	1
Home	0	3
Electronics	12	0

Pivoting

Product ID	Store	Category	# Ordered Items
P 1	Online	Clothing	2
P 2	Onsite	Home	3
P 3	Onsite	Clothing	1
P 4	Online	Clothing	5
P 5	Online	Electronics	7
P 6	Online	Electronics	5

Aggregation: Sum (# Ordered Items)

Category	Online	Onsite
Clothing	7	1
Home	0	3
Electronics	12	0

Group - Pivot - Aggregate

Pivot to show number of projects by project type



Rows: 21476 | Columns: 17

#	RowID	projectID	name	activityTy...	countryN...	street	ecMaxCo...	postCode	city	startDat
	String	String	String	String	String	String	Number (dou...	String	String	Local Date
1	Row...	773606	PLIOSAUR EN...	PRC	United Kingd...	34 Sally Hill	50,000	BS20 7BH	PORTISHEAD...	2017-05
2	Row...	734032	NOVA INNOV...	PRC	United Kingd...	45 TIMBER B...	2,250,266	EH6 6QH	Edinburgh	2016-10
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5	Row...	745862	SKF BV	PRC	Netherlands	MEIDOORNK...	14,914,599.5	3992 AE	Houten	2017-07
6	Row...	745862	RSK ENVIRO...	PRC	France	202 QUAI DE...	14,914,599.5	92110	Clichy	2017-07
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9	Row...	745862	WOOD GROU...	PRC	France	60 RUE DE LA...	14,914,599.5	75009	Paris	2017-07
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26	Row...	727793	WOOD GROU...	PRC	France	60 RUE DE LA...	4,401,565.25	75009	Paris	2016-11



Rows: 28 | Columns: 6

#	RowID	countryName	HES	OTH	PRC	PUB	REC
	String	String	Number (integer)	Number (integer)	Number (integer)	Number (integer)	Number (integer)
1	Row...	Austria	127				
2	Row...	Belgium	15	334	514	59	245
3	Row...	Bulgaria	0	27	76	17	40
4	Row...	Croatia	38	20	73	25	28
5	Row...	Cyprus	39	11	79	15	4
6	Row...	Czech Republic	86	39	145	22	58
7	Row...	Denmark	221	60	229	34	23
8	Row...	Estonia	26	25	54	15	5
9	Row...	Finland	124	19	206	19	124
10	Row...	France	351	122	1323	74	542
11	Row...	Germany	626	148	1328	35	715
12	Row...	Greece	175	48	392	34	214
13	Row...	Hungary	26	24	86	17	27
14	Row...	Ireland	97	24	160	24	9
15	Row...	Italy	561	138	1285	88	408
16	Row...	Latvia	16	20	20	26	8
17	Row...	Lithuania	13	7	35	7	18
18	Row...	Luxembourg	7	3	52	6	12
19	Row...	Malta	5	5	12	8	1
20	Row...	Netherlands	326	89	810	53	237
21	Row...	Poland	70	37	153	32	77
22	Row...	Portugal	66	47	192	21	117
23	Row...	Romania	43	45	80	32	26
24	Row...	Slovakia	21	9	51	14	7
25	Row...	Slovenia	25	16	108	21	83
26	Row...	Spain	357	136	1265	165	802
27	Row...	Sweden	18	24	297	33	84
28	Row...	United Kingdom	709	100	720	48	52

Group - Pivot - Aggregate

Pivot in the different BDTI tools



SQL

```
SELECT "Category",  
SUM("# Ordered Items") filter (WHERE "Store" = "Onsite") AS  
'Onsite',  
SUM("# Ordered Items") filter (WHERE "Store" = "Online") AS  
'Online'  
FROM #table# GROUP BY "Category";
```

PYTHON

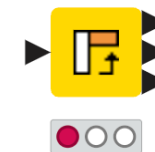
```
import pandas as pd  
df = pd.read_csv('table1.csv')  
pivoted_df = pd.pivot_table(df, values=['Store'],  
index=["Category"], aggfunc={'# Ordered Items': "sum"})
```

R

```
library(pivottabler)  
df <- read.csv('table1.csv')  
qhpvt(df, "Store", "Category", "sum(#  
Ordered Items)")
```

KNIME

Pivot



Data Aggregation - Summary

- **Summarised** version of the data
- **Aggregate** by one or more categories
- **Pivot** for a more detailed aggregation





Visualisation

How do we get insights?

1) Aggregation

Create a summarised version of the data

2) Pivoting

Rearrange data to analyse it from different perspectives.

3) Visualisation

Transform data tables to communicate their results visually



Data Visualisation

- Transform data tables to communicate their results visually
- Help data understanding and get more insights
- Enable identifying patterns and trends that are hidden in tabular format



Use Case

To see the insights in the data not visible in a table
Zoe's team is looking for some helpful visualisations

Analytics: from objectives to insights

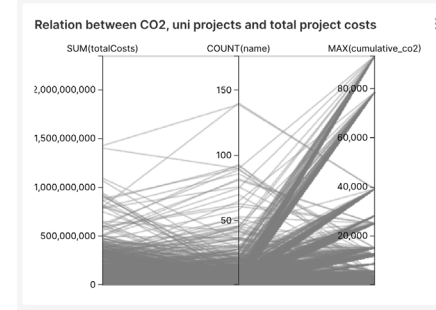
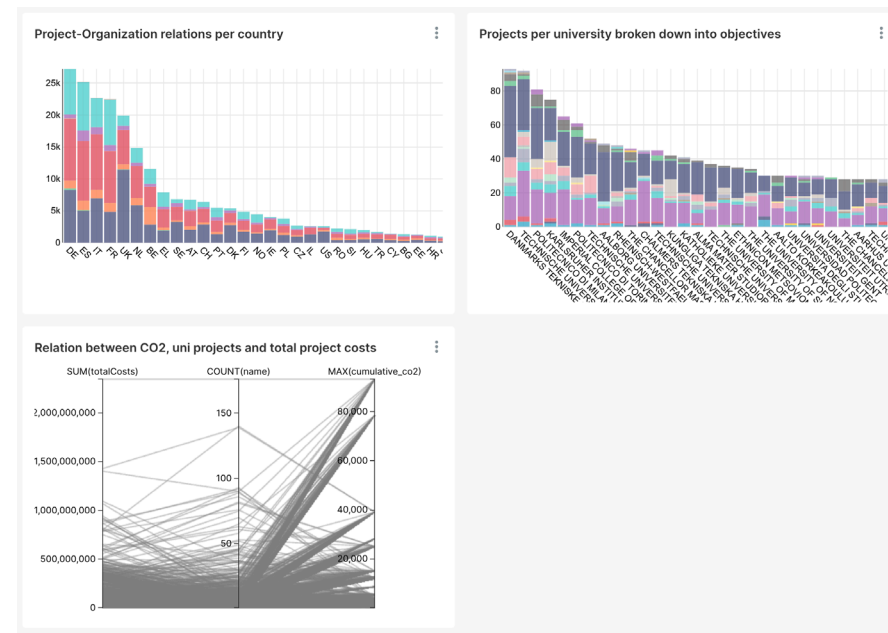
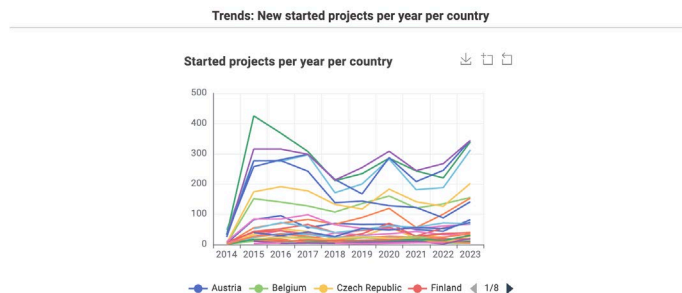
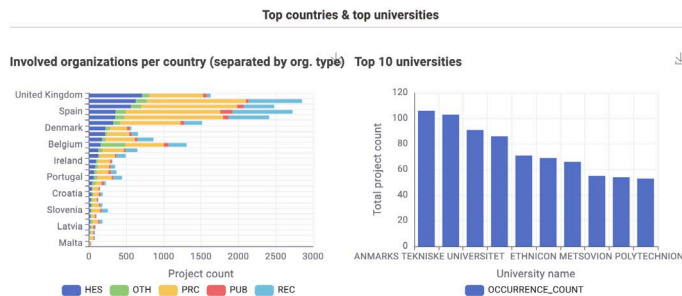


Objective	Insights
Identify countries with the most university involvement in green projects	Aggregate number of projects and plot data with a stacked bar chart
Identify the most active EU-based universities involved in green projects	Aggregate number of projects and plot data with a bar chart
Identify trends in started projects per country per year	Plot data with a line plot
Explore the relation between number of projects per university, energy project funding per university and a country's CO2 emission	Filter plot data with a parallel coordinates plot

Visualisation with the BDTI tools



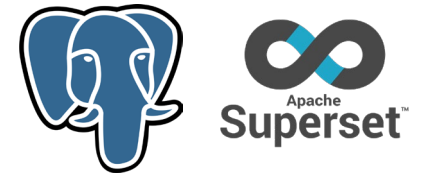
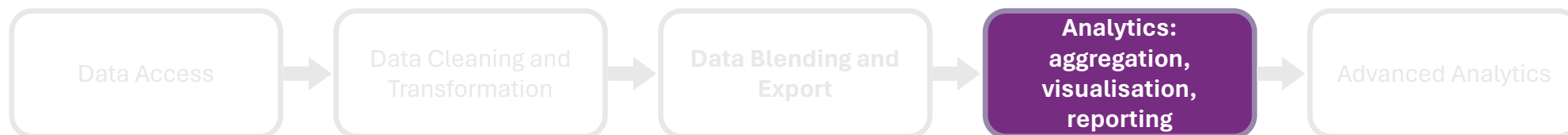
- 1) KNIME
- 2) Apache Superset
- 3) Metabase



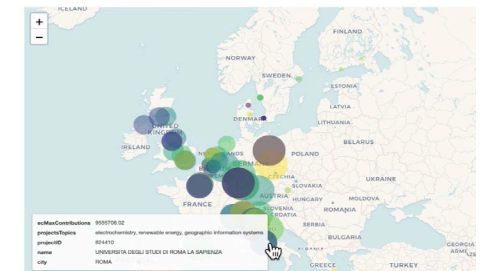
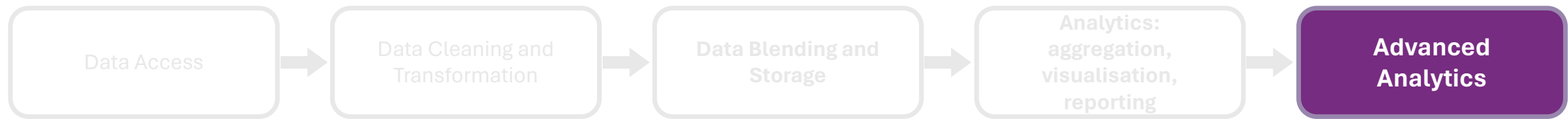
Summary

Now you should be able to:

1. Sign into the BDTI framework, initialise KNIME, PgAdmin, PostgreSQL, and Apache superset
2. Read data from a data base to KNIME and Apache Superset
3. Make sense of the data by applying basic aggregation
4. Create visualisations and a basic report



Next session (next week)



Practice, practice and practice!



- Slides, hands-on exercises, and solutions will be provided on the webinar Gitlab repository

<https://code.europa.eu/bdti/bdti-essentials-course>

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Name	Last commit	Last update
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BDTI_Banner_generic.png	Upload New File	5 days ago
LICENSE	Add LICENSE	5 days ago
README.md	Update README.md	5 days ago

README.md

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A banner image for the Digital Europe Programme. It features the European Commission logo on the left, a central white box with a yellow play button icon and the text "From hype to action:", and the Digital Europe Programme logo on the right. The background is dark purple with white wavy lines and small icons.

Practice, practice and practice!

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Session 4 - Exercise

Analytics: Data Aggregation, Visualisation and Reporting

Zoi has the data ready to work, now she wants to build a dashboard with some visualisations and generate a pdf report from it.

Access data from a DB

Pivot countries

Visualizations

Groupby and Rank CO2 emissions



Q&A

Your BDTI journey starts here



Congrats! You are on the first step to data-driven innovation.



•
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data project**



•
**Apply for BDTI Pilot-
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Course discussion board



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Big Data Test Infrastructure (BDTI)

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BDTI Essentials Course Discussion Board

 **Kim Gillick** Published on: 24/01/2024 Last update: 26/01/2024 Discussion

Unlike (3) Translate

Welcome!

Here, you can ask questions and discuss topics related to the [BDTI Essentials Online Course](#). The board is moderated by the BDTI team, so your questions will be answered quickly. We also encourage members to discuss and help each other where possible to build a collaborative space and rewarding community.

Helpful links



Get in touch and follow the BDTI activities



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



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