



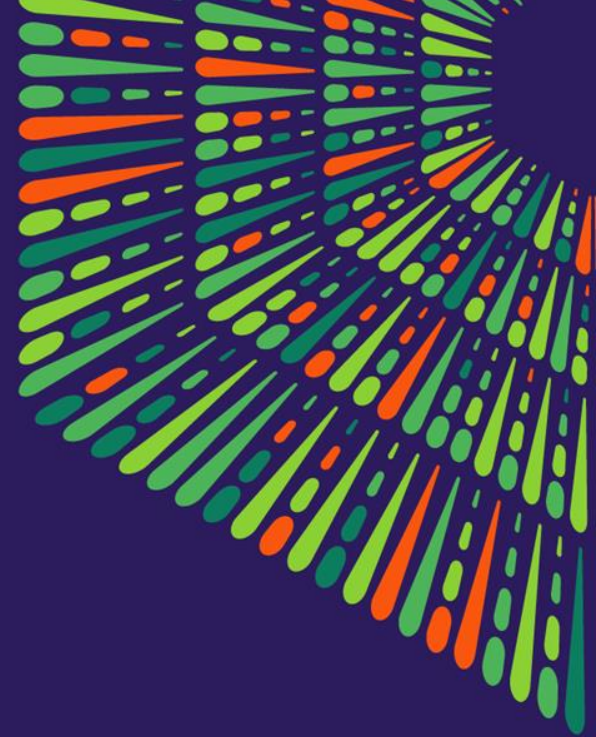
**The Hyve**

# The FAIRplus project: FAIR put into practice

Festival of Genomics and Biodata,  
25th of January 2022

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# Content

- Short introduction to The Hyve
- FAIR principles and the FAIR landscape
- FAIRplus:
  - FAIRification process
  - Dataset maturity model
  - FAIR cookbook
  - IMI data catalog





# The Hyve

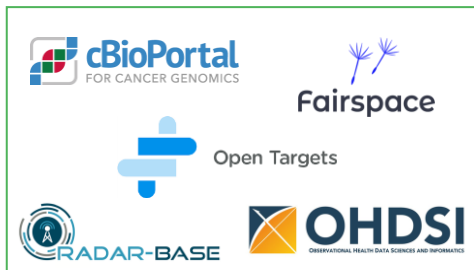
We enable **open science**  
by developing and implementing  
**open-source** solutions  
and **FAIRifying data** in life sciences

# Open innovation ecosystem at The Hyve

## National Health Data Networks



## Open Source Software



## Precompetitive Health Data Projects



## Partner Communities



# The FAIR Principles for (meta)data

## Findable

- F1. globally unique persistent identifier
- F2. rich metadata
- F3. metadata - data link
- F4. registered or indexed

## Accessible

- A1. retrievable using standardized protocol
  - A1.1 open, free and universally implementable
  - A1.2. authentication and authorization
- A2. metadata stay accessible

## Interoperable

- I1. use a formal language for knowledge representation
- I2. use vocabularies that follow FAIR principles
- I3. include qualified references to other (meta)data

## Reusable

- R1. described by relevant attributes
  - R1.1. clear and accessible data usage license
  - R1.2. detailed provenance
  - R1.3. meet domain-relevant community standards



**FAIRSFAIR**  
Fostering Fair Data Practices in Europe



DUTCH TECHCENTRE FOR LIFE SCIENCES

Pistoia Alliance 



**FAIRsharing.org**



# FAIRplus





## FAIRplus:

*“develop tools and guidelines for making life science data FAIR”*

Official website: <https://fairplus-project.eu/>

## IMI project (Innovative Medicines Initiative)

EU public-private partnership funding health research and innovation

- Consortium of 22 partners  
(12 academic, 7 Pharmaceutical companies (EFPIA) and 3 SMEs)
- Started: January 2019
- Ends: December 2022



**FAIRplus**



innovative  
medicines  
initiative

**efpia**

This project has received funding from the Innovative Medicines Initiative 2 Joint Undertaking under grant agreement No. 802750. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation and EFPIA companies.

[www.imi.europa.eu](http://www.imi.europa.eu)



# Project aims



Foster an innovation ecosystem for FAIR data  
FAIRplus Innovation & SME Forum



Develop a FAIRification toolkit  
**FAIR Cookbook**  
**FAIRplus maturity model**



Deliver training Fellowship scheme

Establish a value-based process for prioritisation and selection of IMI project databases



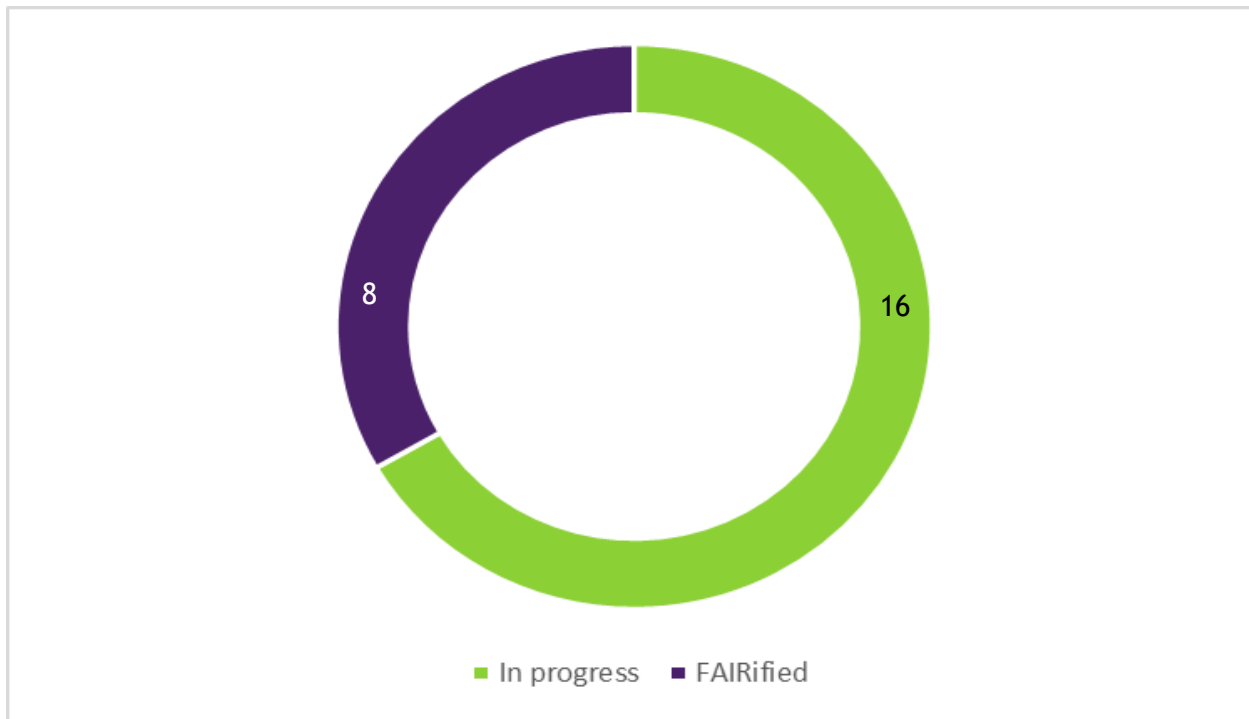
Make IMI and EFPIA datasets more FAIR

**Applying the FAIRification toolkit**  
**IMI Data Catalog**



**FAIRify 20 IMI datasets**

## Current uptake IMI projects in FAIRplus



# FAIRification process



# FAIRplus FAIRification Process

## Define FAIRification Goal

Determine goal for FAIRification, in terms of desired *usability of data* that isn't currently possible

## Project Examination

Examine the current state of the project with respect to *FAIRification goal*

### Identify Data Requirements

Determine the *indicators* that will specify how data needs to be presented/manipulated (wrt FAIR) to fulfil the expected usage

### Identify FAIRification Capabilities & Resources

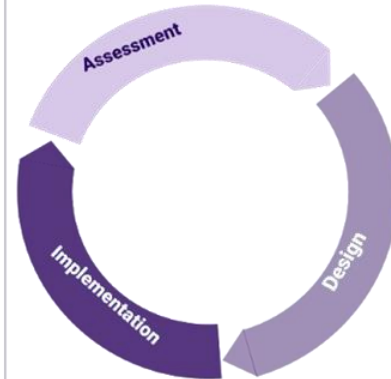
Determine data management *capabilities* (e.g. data annotation, data search and indexing) & *resources* (e.g. tools, databases, vocabulary services) needed to enable and support the FAIRification process

### Produce the FAIRification Backlog

Define a prioritized list of target FAIRification outcomes, concentrating on the desired results for the project rather than the specifics of the solution.

## Iterative FAIRification Cycles

Define and deliver *practical, achievable objectives* for a single 3 month release cycle that work towards the overall FAIRification goal



### 1- Assessment

Honest Evaluator to perform pre- and post-FAIRification assessments and to produce the summary report before and after every cycle

### 2- Design

Work with project representatives to develop a solution plan for the current cycle, which may involve developing new cookbook recipes or re-use existing ones.

### 3- Implementation

Execute the solution plan within the agreed time-frame. Prepare the resulting FAIRified data for the end-of cycle assessment and inform the Honest Evaluator when ready.

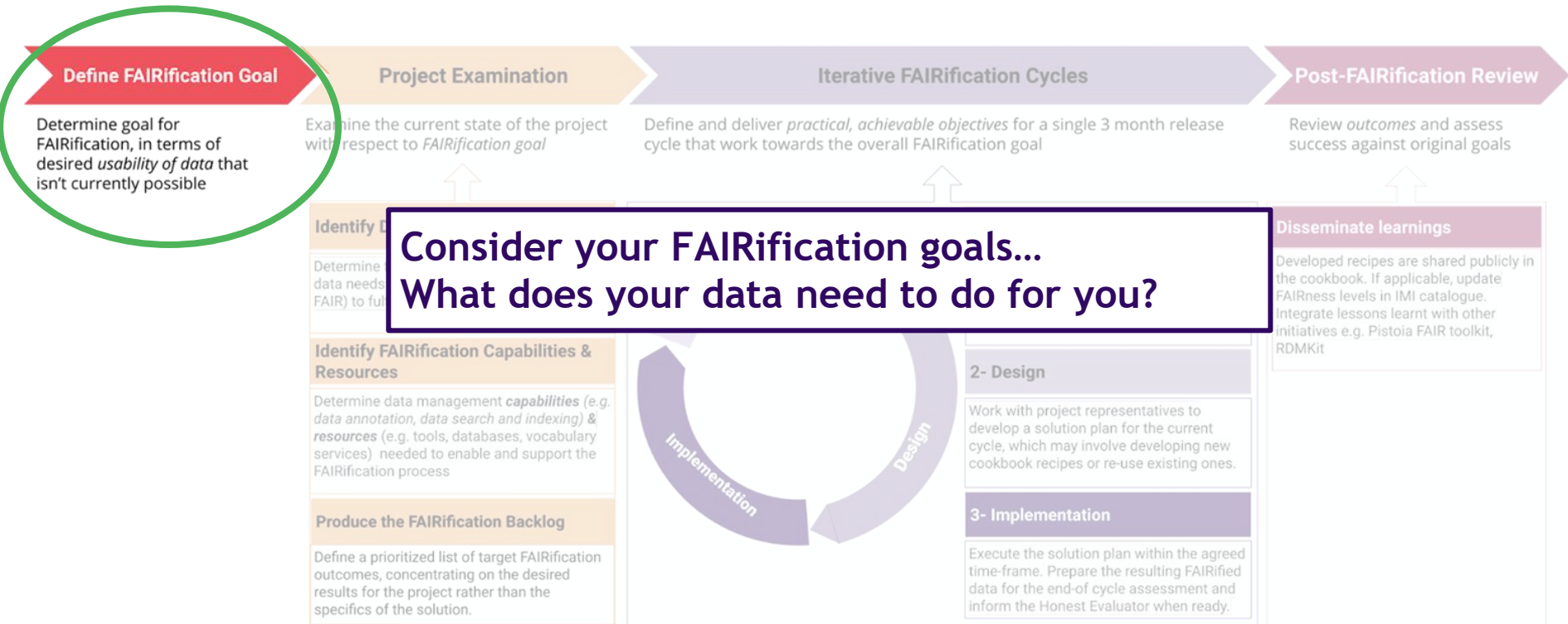
## Post-FAIRification Review

Review *outcomes* and assess success against original goals

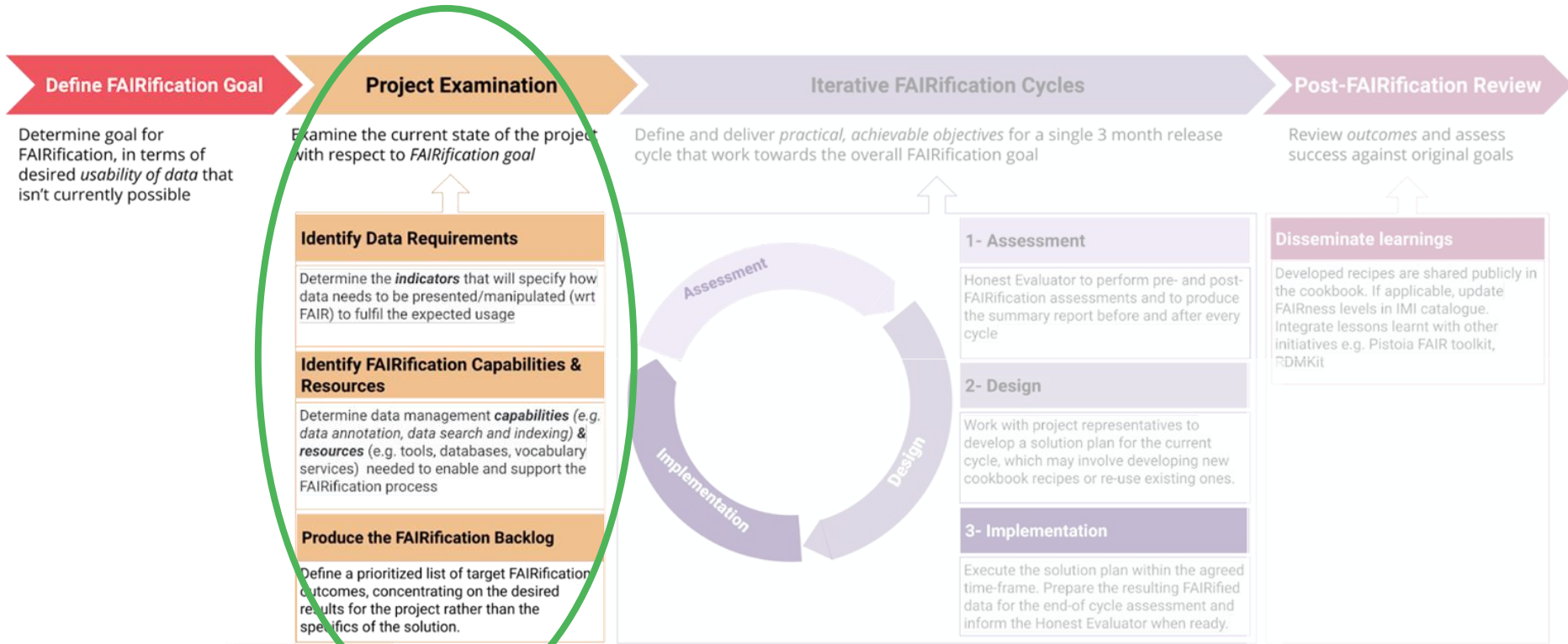
### Disseminate learnings

Developed recipes are shared publicly in the cookbook. If applicable, update FAIRness levels in IMI catalogue. Integrate lessons learnt with other initiatives e.g. Pistoia FAIR toolkit, RDMKit

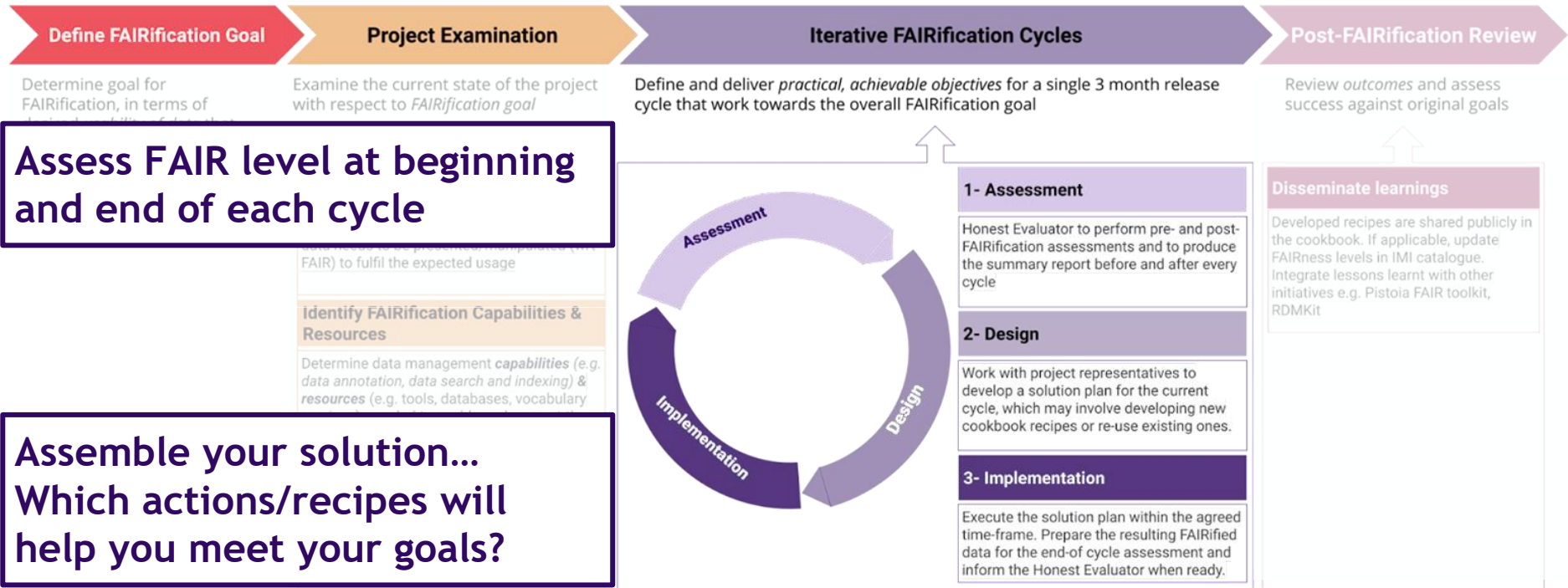
# The FAIRification Process



# The FAIRification Process

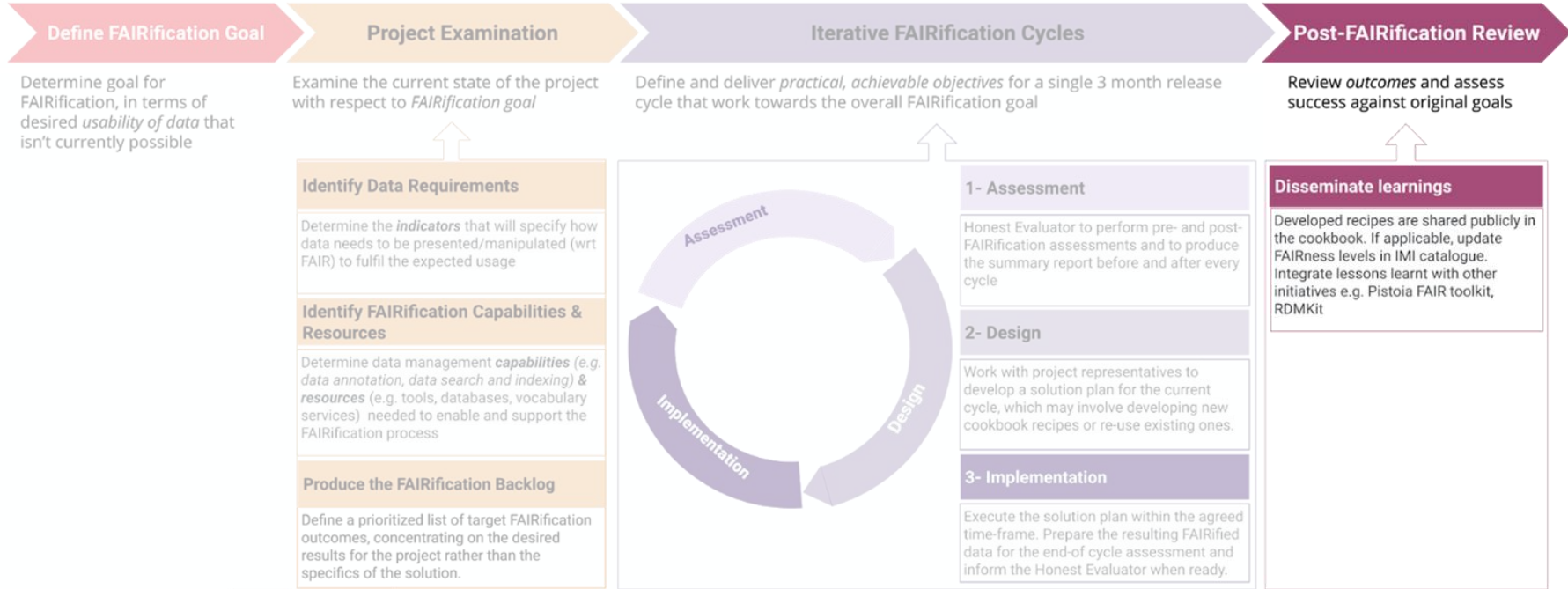


# The FAIRification Process





# FAIRplus FAIRification Process



# RDA indicators

## Background

Developed by RDA (Research data alliance) for “... *assessing adherence to the FAIR principles. These indicators are designed for re-use in evaluation approaches*”

Specification and guidelines

## Type

Manual assessment

## Prerequisites

- template/form for documenting the assessment
- knowledge of the dataset/database/project



## FAIR level assessment

# Learnings from the RDA indicators assessments

- not straightforward and not objective
- good starting point to get an idea on the FAIRness of a dataset and suggest possible improvement areas



# Dataset Maturity Model



# Alignment and Re-classification of Existing Indicators

FAIR	Classification	RDA ID	Indicator	RDA Priority	Related FAIR principles	Description	FAIR4FAIR
A1	Content	<b>RDA-A1-01M</b>	Metadata contains information to enable the user to get access to the data	Important	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	access information	F4-A1-01M: Metadata contains access level and access conditions of the data.
F1	Content	<b>RDA-F1-02M</b>	Metadata is identified by a globally unique identifier	Essential	F1: (Meta)data are assigned a globally unique and eternally persistent identifier.	URI for metadata object	N/A
F1	Content	<b>RDA-F1-02D</b>	Data is identified by a globally unique identifier	Essential	F1: (Meta)data are assigned a globally unique and eternally persistent identifier.	URI for data object	F4-F1-02D: Data is assigned a globally unique identifier
F2	Content	<b>RDA-F2-01M</b>	Rich metadata is provided to allow discovery	Essential	F2: Data are described with rich metadata.	metadata descriptive elements to enable search capability	F4-F2-01M: Metadata includes descriptive core elements (creator, title, data identifier, publisher, public)
F3	Content	<b>RDA-F3-01M</b>	Metadata includes the identifier for the data they describe.	Essential	F3: Metadata clearly and explicitly include the identifier of the data they describe.	metadata includes Data URI	F4-F3-01M: Metadata includes the identifier of the data it describes.
G	Content	<b>RDA-G-01M</b>	Metadata uses FAIR-compliant vocabularies	Important	G: (Meta)data use vocabularies that follow the FAIR principles.	Use of defined data elements (e.g. ISO 11179 DEX)	F4-G-01M: Metadata uses semantic resources
G	Content	<b>RDA-G-01D</b>	Data uses FAIR-compliant vocabularies	Useful	G: (Meta)data use vocabularies that follow the FAIR principles.	Use of controlled vocabularies / ontologies	N/A
G	Content	<b>RDA-G-01M</b>	Metadata includes references to other metadata	Important	G: (Meta)data include qualified references to other (meta)data	metadata-to-metadata links	F4-G-01M: Metadata includes links between the data and its related entities
G	Content	<b>RDA-G-01D</b>	Data includes references to other data	Useful	G: (Meta)data include qualified references to other (meta)data	data-to-data links	F4-G-01M: Metadata includes links between the data and its related entities
G	Content	<b>RDA-G-02M</b>	Metadata includes references to other data	Useful	G: (Meta)data include qualified references to other (meta)data	metadata-to-data links	F4-G-01M: Metadata includes links between the data and its related entities
G	Content	<b>RDA-G-02D</b>	Data includes qualified references to other data	Useful	G: (Meta)data include qualified references to other (meta)data	data-to-data links (annotated)	F4-G-01M: Metadata includes links between the data and its related entities
G	Content	<b>RDA-G-03M</b>	Metadata includes qualified references to other metadata	Important	G: (Meta)data include qualified references to other (meta)data	metadata-to-metadata links (annotated)	F4-G-01M: Metadata includes links between the data and its related entities
G	Content	<b>RDA-G-04M</b>	Metadata include qualified references to other data	Useful	G: (Meta)data include qualified references to other (meta)data	metadata-to-data links (annotated)	F4-G-01M: Metadata includes links between the data and its related entities
R1	Content	<b>RDA-R1-01M</b>	Plurality of accurate and relevant attributes are provided to allow reuse	Essential	R1: (Meta)data are richly described with a plurality of accurate and relevant attributes.	Metadata describes data content	F4-R1-01M: Metadata specifies the content of the data
R1.1	Content	<b>RDA-R1.1-01M</b>	Metadata includes information about the licence under which the data can be reused	Essential	R1.1: (Meta)data are released with a clear and accessible data usage license	metadata includes locally defined data usage license	F4-R1.1-01M: Metadata includes license information under which data can be reused.
R1.1	Content	<b>RDA-R1.1-02M</b>	Metadata refers to a standard reuse licence	Important	R1.1: (Meta)data are released with a clear and accessible data usage license	metadata includes standard data usage license	F4-R1.1-01M: Metadata includes license information under which data can be reused.
R1.2	Content	<b>RDA-R1.2-01M</b>	Metadata includes provenance information according to community specific standards	Important	R1.2: (Meta)data are associated with detailed provenance.	Provenance information represented in community standard	F4-R1.2-01M: Metadata includes provenance information about data creation or generation.
R1.2	Content	<b>RDA-R1.2-02M</b>	Metadata includes provenance information according to a cross-community language	Useful	R1.2: (Meta)data are associated with detailed provenance.	Provenance information represented in cross-domain format	F4-R1.2-01M: Metadata includes provenance information about data creation or generation.
I1	Format and representation	<b>RDA-I1-01D</b>	Data uses knowledge representation expressed in standardised format	Important	I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.	data format (standardised format)	N/A
I1	Format and representation	<b>RDA-I1-02D</b>	Data uses machine-understandable knowledge representation	Important	I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.	data representation (Machine-readable) - no community standard	N/A
I1	Format and representation	<b>RDA-I1-02M</b>	Metadata uses machine-understandable knowledge representation	Important	I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.	metadata representation (Machine readable)	F4-I1-01M: Metadata is represented using a formal knowledge representation language.
I1	Format and representation	<b>RDA-I1-01M</b>	Metadata uses knowledge representation expressed in standardised format	Important	I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.	metadata format (use contr. vocab)	F4-I1-01M: Metadata is represented using a formal knowledge representation language.
R1.1	Format and representation	<b>RDA-R1.1-03M</b>	Metadata refers to a machine-understandable reuse licence	Important	R1.1: (Meta)data are released with a clear and accessible data usage license	metadata representation of license info in machine readable format	F4-R1.1-01M: Metadata includes license information under which data can be reused.
R1.3	Format and representation	<b>RDA-R1.3-01M</b>	Metadata complies with a community standard	Essential	R1.3: (Meta)data meet domain-relevant community standards.	metadata representation (standard metadata model)	F4-R1.3-01M: Metadata follows a standard recommended by the target research community of the data
R1.3	Format and representation	<b>RDA-R1.3-02M</b>	Metadata is expressed in compliance with a machine-understandable community standard	Essential	R1.3: (Meta)data meet domain-relevant community standards.	metadata representation (standard metadata model) / format (machine readable)	F4-R1.3-01M: Metadata follows a standard recommended by the target research community of the data
R1.3	Format and representation	<b>RDA-R1.3-01D</b>	Data complies with a community standard	Essential	R1.3: (Meta)data meet domain-relevant community standards.	data representation (standard data model)	F4-R1.3-02D: Data is available in a file format recommended by the target research community.
R1.3	Format and representation	<b>RDA-R1.3-02D</b>	Data is expressed in compliance with a machine-understandable community standard	Important	R1.3: (Meta)data meet domain-relevant community standards.	data representation (standard data model) / format (machine readable)	F4-R1.3-02D: Data is available in a file format recommended by the target research community.
A1	Hosting environment	<b>RDA-A1-02M</b>	Metadata can be accessed manually (i.e. with human intervention)	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (metadata) (manual) links	F4-A1-02M: Metadata is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-02D</b>	Data can be accessed manually (i.e. with human intervention)	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (data) (manual) links	F4-A1-02M: Metadata is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-03M</b>	Metadata identifier resolves to a metadata record	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (metadata) via service	F4-A1-02M: Metadata is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-03D</b>	Data identifier resolves to a digital object	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (data retrievable) via service	F4-A1-02M: Metadata is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-04M</b>	Metadata is accessed through standardised protocol	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (metadata) (standard protocol) HTTP & FTP	F4-A1-02M: Metadata is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-04D</b>	Data is accessed through standardised protocol	Essential	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (data) (standard protocol) HTTP & FTP	F4-A1-02D: Data is accessible through a standardized communication protocol
A1	Hosting environment	<b>RDA-A1-05D</b>	Data can be accessed automatically (i.e. by a computer program)	Important	A1: (Meta)data are retrievable by their identifier using a standardised communication protocol.	Retrieval Capability (API)	F4-A1-03D: Data is accessible through a standardized communication protocol
A1.1	Hosting environment	<b>RDA-A1.1-01M</b>	Metadata is accessible through a free access protocol	Essential	A1.1: The protocol is open, free and universally implementable	Retrieval Capability (metadata) (open protocol) HTTP & FTP	F4-A1-03D: Data is accessible through a standardized communication protocol
A1.1	Hosting environment	<b>RDA-A1.1-01D</b>	Data is accessible through a free access protocol	Important	A1.1: The protocol is open, free and universally implementable	Retrieval Capability (data) (open protocol) HTTP & FTP	F4-A1-03D: Data is accessible through a standardized communication protocol
A1.2	Hosting environment	<b>RDA-A1.2-01D</b>	Data is accessible through an access protocol that supports authentication and authorization	Useful	A1.2: The protocol allows for an authentication and authorization where necessary	Retrieval Capability (data) (auth impl)	F4-A1-03D: Data is accessible through a standardized communication protocol
A2	Hosting environment	<b>RDA-A2-01M</b>	Metadata is guaranteed to remain available after the data is no longer available	Essential	A2: Metadata should be accessible even when the data is no longer available	Archiving Capability (metadata)	F4-A1-03D: Data is accessible through a standardized communication protocol
F1	Hosting environment	<b>RDA-F1-01M</b>	Metadata is identified by a persistent identifier	Essential	F1: (Meta)data are assigned a globally unique and eternally persistent identifier.	Metadata object persisted (saved) in a resource with PID	N/A
F1	Hosting environment	<b>RDA-F1-01D</b>	Data is identified by a persistent identifier	Essential	F1: (Meta)data are assigned a globally unique and eternally persistent identifier.	Data object persisted (saved) in a resource with PID	F4-F1-01D: Data is assigned a persistent identifier
F4	Hosting environment	<b>RDA-F4-01M</b>	Metadata is offered in such a way that it can be harvested and indexed	Essential	F4: (Meta)data are registered or indexed in a searchable resource.	Search Capability (Metadata record, stored and indexed)	F4-F4-01M: Metadata is offered in such a way that it can be retrieved by humans

# The Three Dimensions of FAIR Data Maturation

CONTENT-  
RELATED

**What** is reported in the dataset & the metadata

REPRESENTATION  
&  
FORMAT

**How** the data object & metadata object are represented and formatted

HOSTING  
ENVIRONMENT  
CAPABILITIES

What **capabilities** of the **hosting environment** that enables and supports the use of FAIR data

# FAIRplus Dataset Maturity Levels

5	Managed Data Assets	<b>Enterprise Level.</b> Data at this level is optimally managed at the most granular level in an environment offering <i>data governance, master data management and reference data management</i> capabilities.
4	Semantically Typed Data	<b>Cross-community Level.</b> This level focuses on cross-domain interoperability and is meant to be the level required for larger harmonization and integration projects.
3	Standardised Data	<b>Community Level.</b> Data at this level complies with community standard domain models, terminologies and formats, and is hosted in an environment offering searching and retrieval capabilities.
2	Described Data	<b>Project Level.</b> All datasets generated within a project are consistently described against a locally defined schema, controlled terminologies, and hosted in an environment offering data catalogue level searching capabilities.
1	Identifiable Data	<b>Data Object level.</b> Data at this level is identifiable as individual generic data objects and described by generic metadata elements. Hosting environment offers limited retrieval capabilities.
0	Single Use Data	No potential for re-use beyond lifetime of the research project.



L0

L1

L2

L3

L4

L5

## CONTENT-RELATED

The Data object or dataset as an entity is undefined or undescribed

No metadata available

A Data Object is defined and is assigned a globally unique and persistent identifier

Metadata for the data object includes generic descriptive elements of the data object as a whole (e.g., name, description, keywords)

Metadata includes study/project level summary information (i.e., project-level metadata)

Each study variable is reported in a single dataset field / variable

Metadata includes dataset field/variable level metadata (e.g. field name, field description and type)

Data values (i.e. field/variable values) are standardized against a locally defined dictionary of terms within and across datasets

Dataset metadata includes license information under which the dataset can be reused

Data values (i.e. field/variable values) are standardized against community standard controlled vocabularies and/or ontologies

Master Data Entities across all datasets are defined

Datasets are semantically typed

Datasets fields are semantically typed

Domain model entities are defined and harmonized against enterprise managed master data entities (e.g. Observation Features Types, Subject Types, Domain Types)

Field/Variable Level data is linked and harmonized against enterprise managed Reference Data (e.g. MDR registered Data Elements)

## REPRESENTATION &amp; FORMAT

No formal definition or representation of metadata

Metadata **not** available in machine interpretable **format** (e.g. no metadata or in pdf)

**Representation** of metadata conforms to a locally defined model/schema (e.g., dictionary of key/value pairs)

Metadata is available in machine readable **format** (e.g. CSV, JSON, XML)

The Data Object does **not** conform to a defined or structured **representation** (i.e. data model)

**Representation** of metadata conforms to a Defined Standard Model (e.g. DCAT, DublinCore, BioSchemas)

All project dataset(s) **representation** uniformly conform to a locally defined (project-defined) data model or schema

Dataset(s) available in machine readable **format** (e.g. CSV, JSON, XML or similar)

Overall Project/Study level data **representation** conforms to a community defined standard **domain model** (e.g., domain specific repos, OMOP, DATS, ISA)

Dataset(s) structural **representation** conforms to community standard Model (e.g. domain specific repos, SDTM, FHIR)

Dataset complies with a machine readable community standard **format** relevant to the adopted domain and data model

Master entity models are formally represented

Metadata is represented in a semantic machine interpretable form.

Data-linked Data Elements are represented and formatted in a community standard model/format (e.g. ISO 11179 MDR standard)

Data-linked controlled terminologies and ontologies are formatted and represented by community standards

## HOSTING ENVIRONMENT CAPABILITIES

Data or metadata is hosted in local storage (e.g., personal desktop, local file system or archive) and only retrievable by a single or limited users

Data or metadata hosted in an accessible resource but with no retrieval capability

Retrieval Capability

Data object is indexed and retrievable via its *globally unique and persistent identifier* by a standardized communication protocol

Metadata record is retrievable by a standardized communication protocol

The standardized communication protocol for data / metadata retrieval is open, free and universally implementable such as HTTP, FTP (e.g. simple links for download)

In case of sensitive data, the protocol allows for an authentication and authorisation

Retrieval Capability

Data exchange format retrieved using API technologies (REST, RPC, GRAPH-QL)

Search Capability

Metadata is registered or indexed in a searchable resource. Data can be retrieved via its metadata descriptive elements

Search Capability

Data content is searchable. (e.g. data is retrievable via queries for standardised field names, ontology or controlled terms reported in the datasets)

Archiving capability  
Metadata is accessible even when the data is no longer available.

Search Capability

Cross-study data is queryable via harmonized master data entities and their attributes

Hosting Environment implements **Master Data Management** Capability

Hosting Environment implements **Reference Data Management** Capability

Hosting Environment implements **Data Governance** Capability

# FAIR cookbook



# The FAIR Cookbook

## What is it?

An online, 'live' resource for the **life sciences**

A collection of recipes that cover the operation steps of FAIR data management

## Who is it for?

**Anyone** who needs practical assistance in their FAIRification journey or creates FAIR guidance and educational material

## Who developed it?

**Researchers** and **data managers**, professionals in the life sciences, from academia and industry.

Including ELIXIR members

# The FAIR Cookbook users



Researchers, data scientists and principal investigators



Data stewards, data managers and data curators



Software developers and terminology managers



Policy makers or funders



Trainers

# User questions



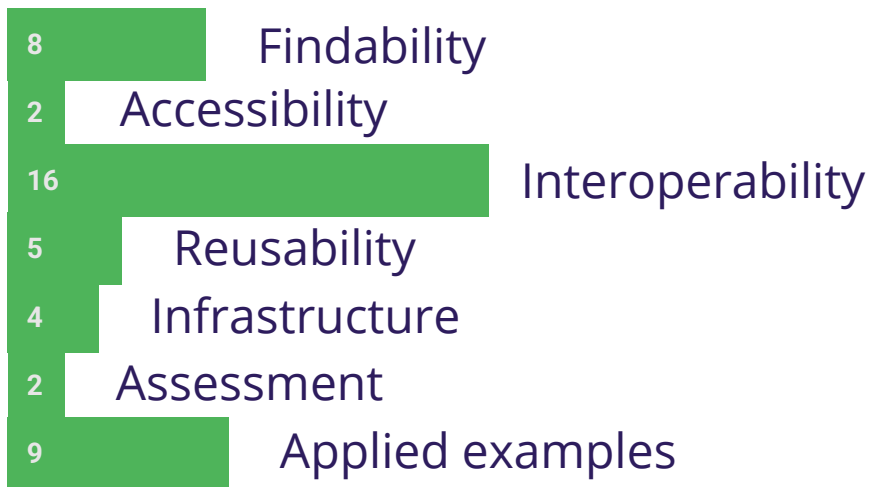
How to handle data access, choose licenses for datasets, package data for transfer, and provide sufficient descriptive metadata



Exemplar FAIRifications with clinical trial, epidemiological, and molecular data, and how to deal with sensitive, patient-centric data



# Current number of recipes per chapter



<https://fairplus.github.io/the-fair-cookbook/content/home.html>

# IMI Data catalog

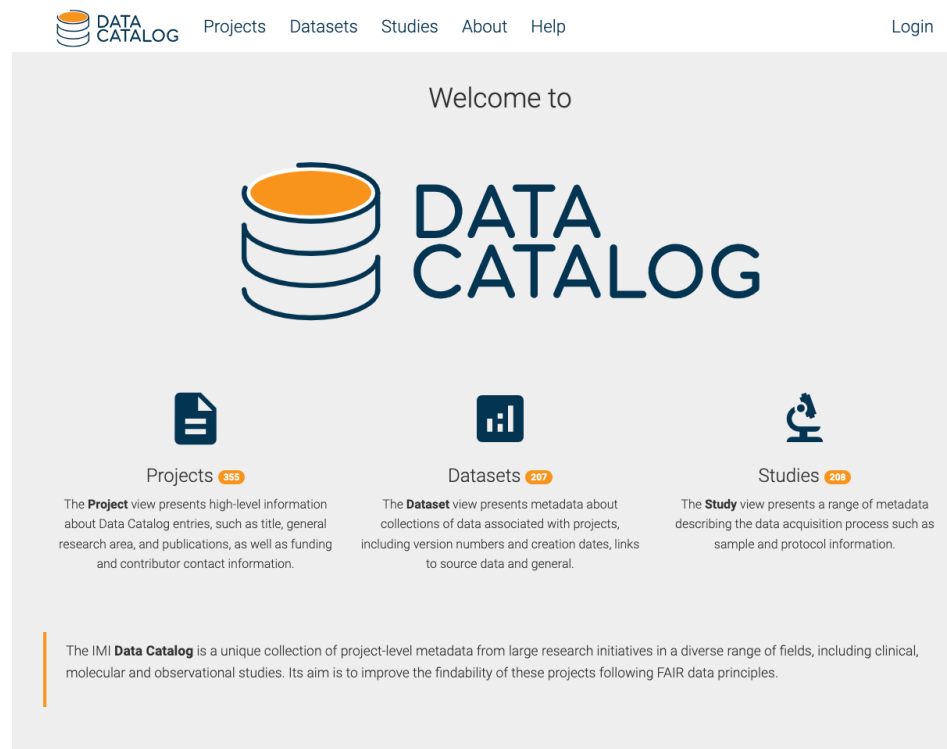




# Data Catalog

- Centralizes metadata of IMI projects, and other translational research datasets
- Joint effort IMI-eTRIKS consortium and ELIXIR Luxembourg
- On-going project (started Q3 2016)
- 355 projects and 207 datasets (including 168 IMI projects)

<http://datacatalog.elixir-luxembourg.org>



The screenshot shows the homepage of the Data Catalog. At the top, there is a navigation bar with the logo 'DATA CATALOG' and links for 'Projects', 'Datasets', 'Studies', 'About', and 'Help'. A 'Login' link is located in the top right corner. The main content area features a large 'Welcome to' message above the 'DATA CATALOG' logo, which consists of a stylized database icon and the text 'DATA CATALOG'. Below the logo, there are three main sections: 'Projects' (355), 'Datasets' (207), and 'Studies' (208). Each section includes a brief description of the view. At the bottom, a paragraph states: 'The IMI Data Catalog is a unique collection of project-level metadata from large research initiatives in a diverse range of fields, including clinical, molecular and observational studies. Its aim is to improve the findability of these projects following FAIR data principles.'

# OncoTrack

↓ Access Data

Data access link or link to access request form

Links to Project and Study views

“FAIRplus Evaluated” badge



↓ Export Metadata as DATS

Metadata download

Project		Studies	
Project Title	OncoTrack	Study title	OncoTrack
Project website	http://www.oncotrack.eu		

## General Dataset Information

Version	V1.0
Date of creation of the dataset	2017-01-05
Date of the last update of the dataset	2017-09-05
Data standards	<b>CDISC</b>
Experiment types	<b>whole genome sequencing</b> <b>exome sequencing</b> <b>transcriptome array</b> <b>methylation array</b> <b>microRNA array</b> <b>RNASeq</b> <b>proteomics</b> <b>deep-Sequencing</b>
Type of Samples Collected	<b>Healthy Surrounding Tissue (near tumor)</b> <b>Blood</b> <b>Serum</b> <b>Plasma</b> <b>Tumor Tissue</b>
Number of Samples Collected	>6000
Diseases in samples	<b>carcinoma of the colon</b>
Treatment of experiment	<b>antineoplastic agent</b>

Main metadata values. Fields in blue should be annotated with ontologies term

# Additional reading

- [Original article on FAIR principles](#)
- [Go-FAIR](#) FAIR principles
- [FAIRplus Website](#)
- FAIR [Cookbook](#)
- [RDA indicators](#)
- [Dataset Maturity Model](#) (Github, work in progress)
- [IMI Data Catalog](#)



## Acknowledgements

### FAIRplus colleagues:

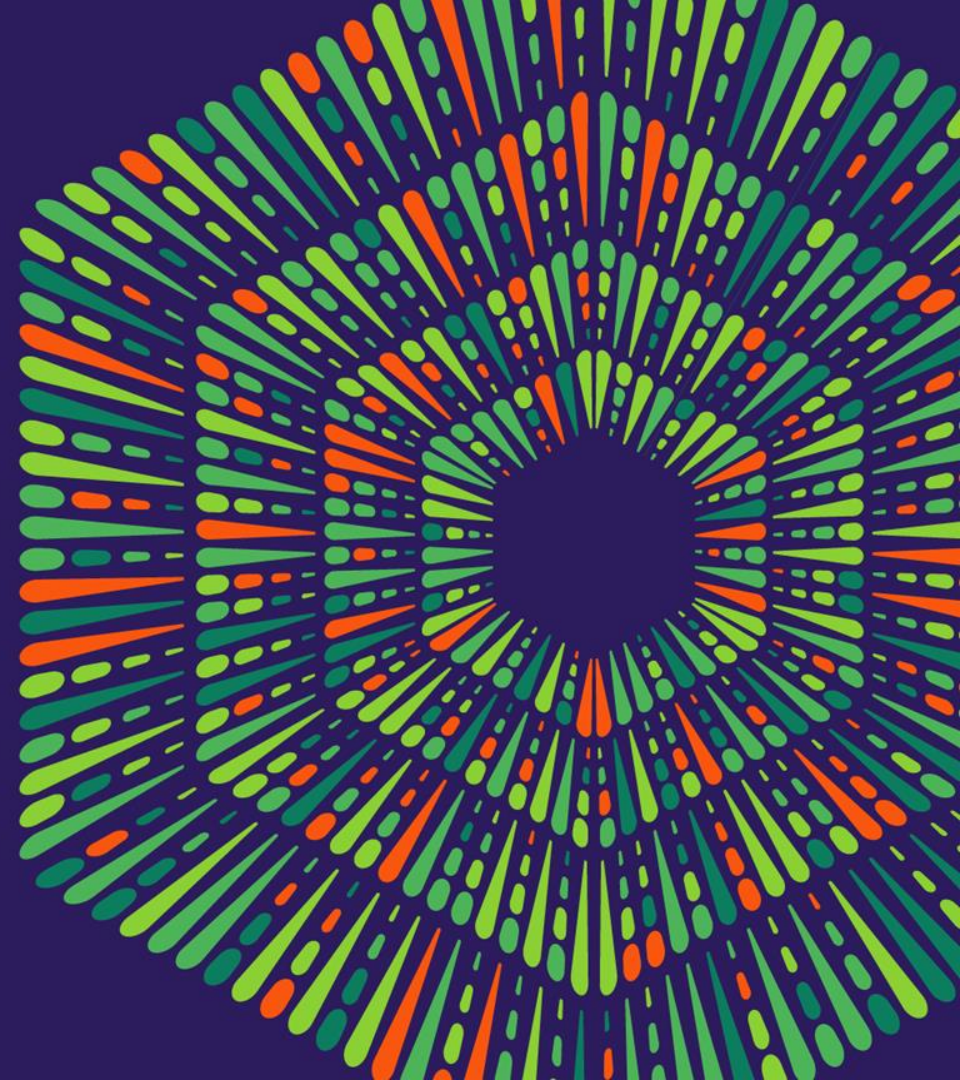
Danielle Welter, Luxembourg University

Ibrahim Emam, Imperial College London

Philippe Rocca-Serra, University of Oxford



QUESTIONS?





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