



# Un peu de biblio FAIR

Romain David – Réunion A.N.R. FOOSIN



ANR-19-DATA-0019-01

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# FAIR pourquoi Faire

Quelles raisons ?

Quelle data concernées ?

Quelles ressources ?

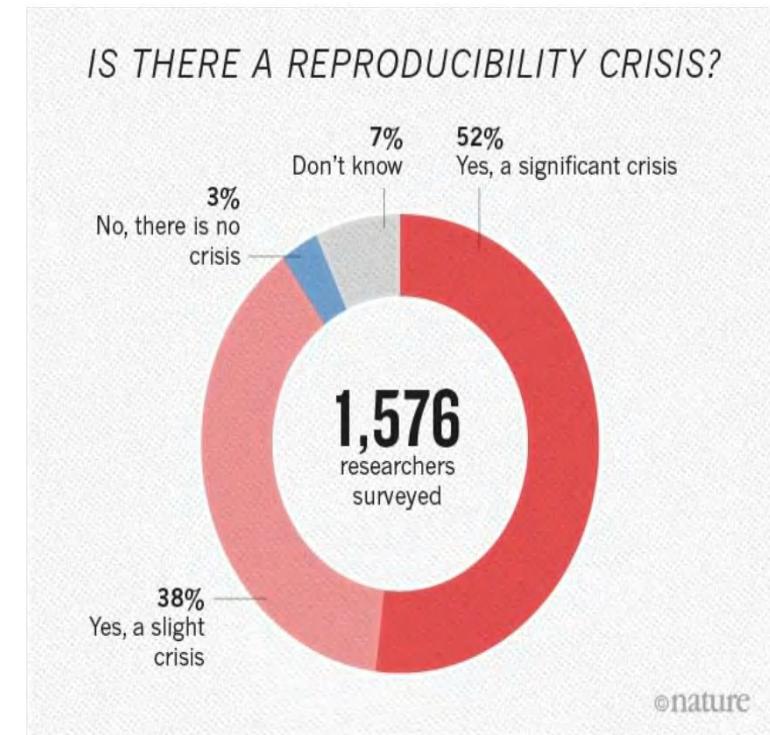
Quels moyens ?

Quels processus ?



# Une crise de la reproductibilité

- ❖ Selon une étude réalisée auprès de 1 500 scientifiques et publiée par Nature en 2016 ([https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970?WT.mc\\_id=SFB\\_NNEWS\\_1508\\_RHBox](https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970?WT.mc_id=SFB_NNEWS_1508_RHBox)) :
  - plus de 70 % des chercheurs disent avoir échoué à reproduire l'expérience scientifique d'un autre chercheur
  - plus de 50% reconnaissent n'avoir pas réussi à reproduire leur propre expérience
- ❖ La crise de la reproductibilité concerne la reproduction des expériences scientifiques mais aussi la réutilisation des données brutes pour reproduire de façon indépendante des analyses statistiques



# Open science et / ou éthique de la science

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## Préserver les données de la recherche à l'ère du Big Data

09.09.2016, par Guillaume Garvanèse

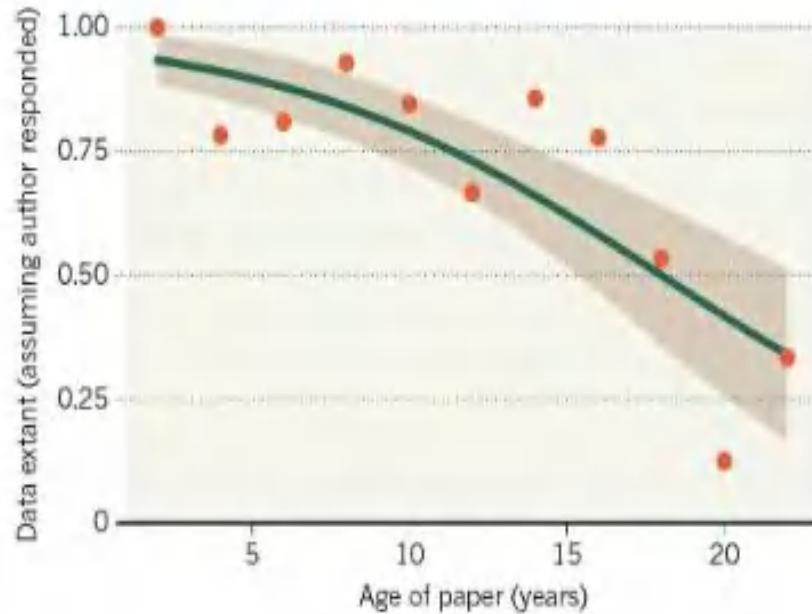


# A la recherche des données perdues?

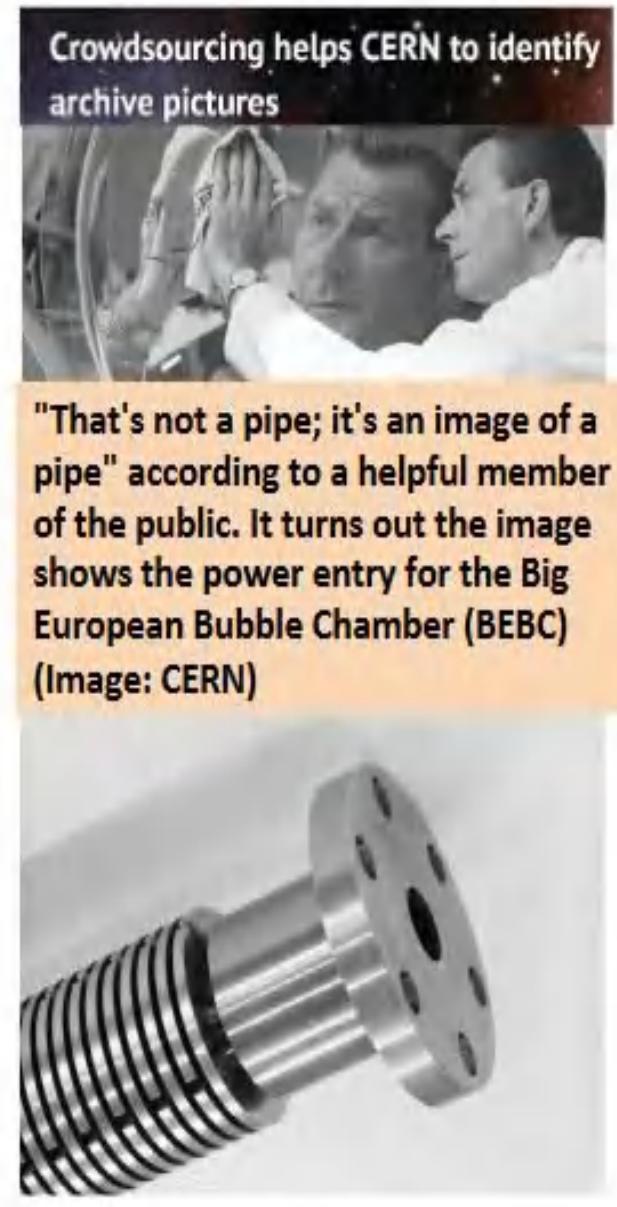
- Le plan de management des données doit prendre en compte le long terme

## MISSING DATA

As research articles age, the odds of their raw data being extant drop dramatically.



C.Diaconu



## Challenges

### Préserver les « octets » – Supports, centres de données

- Algorithmes, workflows etc.
- Software: complexe, fragile

### Préserver les connaissances – Indexation, metadata, standards,...

- Documentation, connaissances
- Collaborations (et compétences) à long terme

Comment | Open Access | Published: 15 March 2016

# The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson, Michel Dumontier, [...] Barend Mons

*Scientific Data* **3**, Article number: 160018 (2016) | [Cite this article](#)

**98k** Accesses | **1296** Citations | **1492** Altmetric | [Metrics](#)

An Addendum to this article was published on 19 March 2019

## Abstract

There is an urgent need to improve the infrastructure supporting the reuse of scholarly data. A diverse set of stakeholders—representing academia, industry, funding agencies, and scholarly publishers—have come together to design and jointly endorse a concise and measureable set of principles that we refer to as the FAIR Data Principles. The intent is that these may act as a guideline for those wishing to enhance the reusability of their data holdings. Distinct from peer initiatives that

## Box 2 | The FAIR Guiding Principles

### To be Findable:

- F1. (meta)data are assigned a globally unique and persistent identifier
- F2. data are described with rich metadata (defined by R1 below)
- F3. metadata clearly and explicitly include the identifier of the data it describes
- F4. (meta)data are registered or indexed in a searchable resource

### To be Accessible:

- A1. (meta)data are retrievable by their identifier using a standardized communications protocol
  - A1.1 the protocol is open, free, and universally implementable
  - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
- A2. metadata are accessible, even when the data are no longer available

### To be Interoperable:

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

### To be Reusable:

- R1. meta(data) are richly described with a plurality of accurate and relevant attributes
  - R1.1. (meta)data are released with a clear and accessible data usage license
  - R1.2. (meta)data are associated with detailed provenance
  - R1.3. (meta)data meet domain-relevant community standards

# Cloudy, increasingly FAIR; revisiting the FAIR Data guiding principles for the European Open Science Cloud

Barend Mons<sup>a,b,c,\*</sup>, Cameron Neylon<sup>d</sup>, Jan Velterop<sup>e</sup>, Michel Dumontier<sup>f</sup>,  
Luiz Olavo Bonino da Silva Santos<sup>b,g</sup> and Mark D. Wilkinson<sup>h</sup>

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<sup>h</sup> Centre for Plant Biotechnology and Genomics U.P.M. – I.N.I.A., Madrid, Spain

**Abstract.** The FAIR Data Principles propose that all scholarly output should be Findable, Accessible, Interoperable, and Reusable. As a set of guiding principles, expressing only the kinds of behaviours that researchers should expect from contemporary data resources, how the FAIR principles should manifest in reality was largely open to interpretation. As support for the Principles has spread, so has the breadth of these interpretations. In observing this creeping spread of interpretation, several of the original authors felt it was now appropriate to revisit the Principles, to clarify both what FAIRness is, and is not.

Keywords: FAIR Data, Open Science, interoperability, data integration, standards

# Data as increasingly FAIR Digital Objects

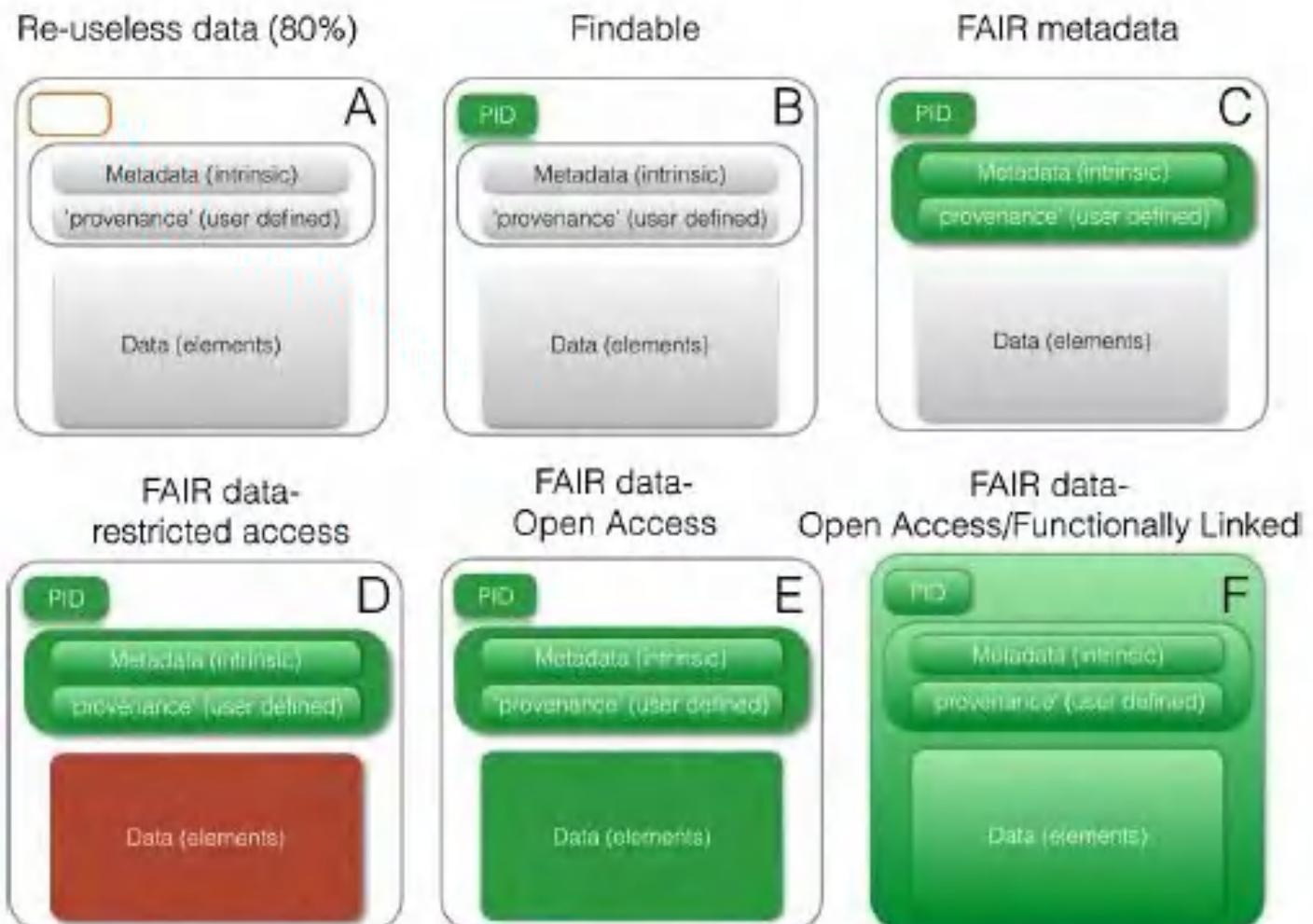


Fig. 1. Varying degrees of FAIRness. As elements become coloured, they have become FAIR. For example, adding a persistent identifier (PID) increases the fairness of that component. Coloured elements in green are FAIR and open, coloured elements in red are FAIR and closed. In the final panel, the mechanism for expressing the relationship between the ID, the metadata, and the data, is also FAIR (i.e. follows a widely accepted and machine-readable standard, such as DCAT or NanoPublications) and interlinked with other related FAIR data or analytical tools on the Internet of FAIR Data and Services.



Related to other papers in this special issue	3 (p30); 20 (p199); 7 (p66)
Addressing FAIR principles	F1, F2, F3, F4, A1, R1

## The “A” of FAIR – As Open as Possible, as Closed as Necessary

Annalisa Landi<sup>1†</sup>, Mark Thompson<sup>2</sup>, Viviana Giannuzzi<sup>1</sup>, Fedele Bonifazi<sup>1</sup>, Ignasi Labastida<sup>3</sup>, Luiz Olavo Bonino da Silva Santos<sup>4</sup> & Marco Roos<sup>2</sup>

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<sup>3</sup>Learning and Research Resources Centre (CRAI), Universitat de Barcelona, Catalunya 08007, Spain

<sup>4</sup>GO FAIR International Support & Coordination Office (GFISCO), Leiden, The Netherlands

**Keywords:** Accessibility of health data; FAIR metadata; GDPR; Data sharing; ELSI

Citation: A. Landi, M. Thompson, V. Giannuzzi, F. Bonifazi, I. Labastida, L.O. Bonino da Silva Santos & M. Roos. The “A” of FAIR – As open as possible, as closed as necessary. *Data Intelligence* 2(2020), 47–55. doi: 10.1162/dint\_a\_00027

# Interoperability and FAIRness through a novel combination of Web technologies

Mark D. Wilkinson<sup>1</sup>, Ruben Verborgh<sup>2</sup>, Luiz Olavo Bonino da Silva Santos<sup>3</sup>, Tim Clark<sup>4,5</sup>, Morris A. Swertz<sup>6</sup>, Fleur D.L. Kelpin<sup>6</sup>, Alasdair J.G. Gray<sup>7</sup>, Erik A. Schultes<sup>8</sup>, Erik M. van Mulligen<sup>9</sup>, Paolo Ciccarese<sup>10</sup>, Arnold Kuzniar<sup>11</sup>, Anand Gavai<sup>11</sup>, Mark Thompson<sup>12</sup>, Rajaram Kaliyaperumal<sup>12</sup>, Jerven T. Bolleman<sup>13</sup> and Michel Dumontier<sup>14</sup>

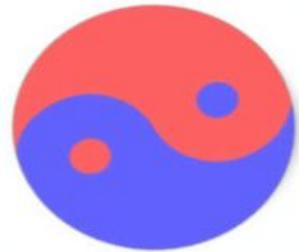
<sup>1</sup> Center for Plant Biotechnology and Genomics UPM-INIA, Universidad Politécnica de Madrid, Madrid, Spain

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<sup>3</sup> Dutch Techcentre for Life Sciences, Utrecht, The Netherlands

<sup>4</sup> Department of Neurology, Massachusetts General Hospital, Boston, MA, United States of America

<sup>5</sup> Department of Neurology, Harvard Medical School, Boston, United States of America



## Technical infrastructure (generic operations) Data / social agreements (domain-specific content)

### Box 2 | The FAIR Guiding Principles

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  - R1.3. (meta)data meet domain-relevant community standards

The Yin-Yang of the Internet of FAIR  
Data and Services  
Erik Schultes, GO FAIR  
<http://orcid.org/0000-0001-8888-635X>  
January 2019  
<https://osf.io/453d2/>

## DIRECTIVE (UE) 2019/1024 DU PARLEMENT EUROPÉEN ET DU CONSEIL

du 20 juin 2019

concernant les données ouvertes et la réutilisation des informations du secteur public  
(refonte)*Embargo maximum 6 mois à 3 ans*

LE PARLEMENT EUROPÉEN ET LE CONSEIL DE L'UNION EUROPÉENNE,

- (27) Le volume des données de la recherche produit connaît une croissance exponentielle et pourrait être réutilisé en dehors de la communauté scientifique. Afin d'être en mesure de faire face efficacement et globalement à des défis de société qui vont croissant, il est devenu crucial et urgent de pouvoir accéder à des données de différentes sources, secteurs et disciplines, les combiner et les réutiliser. Ces données comprennent des statistiques, des résultats d'expériences, des mesures, des observations faites sur le terrain, des résultats d'enquêtes, des enregistrements d'entretiens et des images. Elles comprennent également des métadonnées, des spécifications et d'autres objets numériques. Les données de la recherche diffèrent des articles scientifiques présentant et commentant des résultats de recherche scientifique effectuée par les auteurs. Pendant de nombreuses années, la disponibilité et la possibilité de réutiliser les données de la recherche scientifique obtenues à l'aide de fonds publics ont fait l'objet d'initiatives spécifiques. Le libre accès s'entend comme la pratique consistant à fournir gratuitement l'accès en ligne à des résultats de recherche à l'utilisateur final, sans restriction sur l'utilisation et la réutilisation au-delà de la possibilité d'exiger l'indication de l'auteur. Les politiques de libre accès visent en particulier à donner aux chercheurs et au grand public accès aux données de la recherche le plus tôt possible dans le processus de diffusion et à faciliter leur utilisation et réutilisation. Le libre accès contribue à améliorer la qualité, à réduire la duplication inutile des recherches, à accélérer le progrès scientifique, à lutter contre la fraude scientifique, et peut globalement favoriser la croissance économique et l'innovation. Outre ce qui concerne le libre accès, des efforts méritoires sont consentis pour veiller à ce que la planification de la gestion des données deviennent une pratique scientifique universelle et soutenir la diffusion de données de la recherche qui soient traçables, accessibles, interopérables et réutilisables (principe FAIR).



EUROPEAN COMMISSION  
Directorate-General for Research & Innovation



# H2020 Programme

## Guidelines on FAIR Data Management in Horizon 2020

E.U. European Commission Directorate-General for Research and Innovation report: H2020  
Programme Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016

# Horizon 2020 FAIR Data Management Plan (DMP) template

Version: 26 July 2016

## Introduction

This Horizon 2020 FAIR DMP template has been designed to be applicable to any Horizon 2020 project that produces, collects or processes research data. You should develop a **single DMP for your project** to cover its overall approach. However, where there are specific issues for individual datasets (e.g. regarding openness), you should clearly spell this out.

### FAIR data management

In general terms, your research data should be 'FAIR', that is findable, accessible, interoperable and re-usable. These principles precede implementation choices and do not necessarily suggest any specific technology, standard, or implementation-solution.

This template is not intended as a strict technical implementation of the FAIR principles, it is rather inspired by FAIR as a general concept.



EUROPEAN COMMISSION  
Turning  
FAIR into reality  
Final Report and Action  
Plan from the European Commission  
Expert Group on FAIR Data  
European  
Commission Expert Group on FAIR Data

Novembre 2018

### 4.2.3 Essential components of the FAIR ecosystem

The FAIR data ecosystem can be expressed in terms of a number of interacting components or, more traditionally, as layers providing distinct services or functions. The abstract core for data management and access needs to be defined, just as an analogous understanding was essential for the Internet to define routable messages as the core of data exchange between Internet nodes. As observed above, the atomic entity for a FAIR ecosystem is a FAIR Digital Object, generally comprising data, a persistent identifier, metadata conformant to standards, and code when relevant. Openly-specified persistent identifiers and persistent resolution systems available at a global level can create a global domain of registered FAIR Digital Objects as a precondition for the Findability, Accessibility, Interoperability and Re-use of data. Using persistent identifiers introduces a step of indirection<sup>74</sup> that requires maintenance, but is necessary to support stable references in a global virtual data domain in which data locations will change, in which copies and versions will be created and in which provenance information, attached to the persistent identifier, will clarify the versioning history of the data.

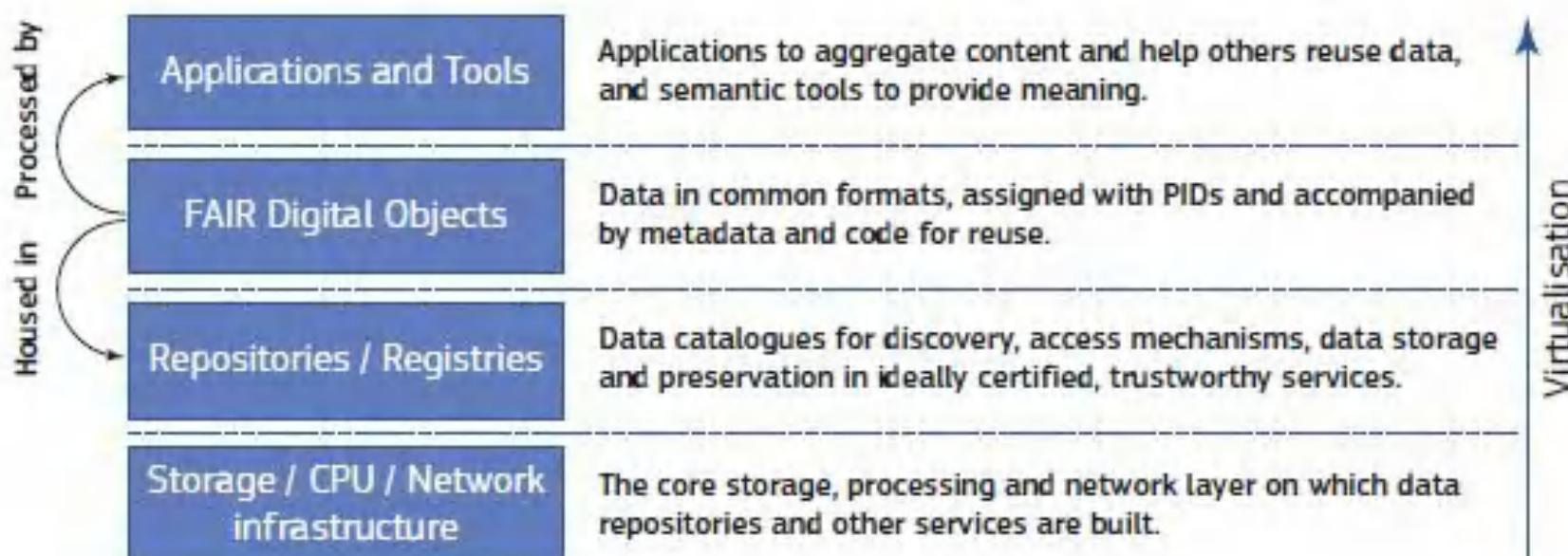
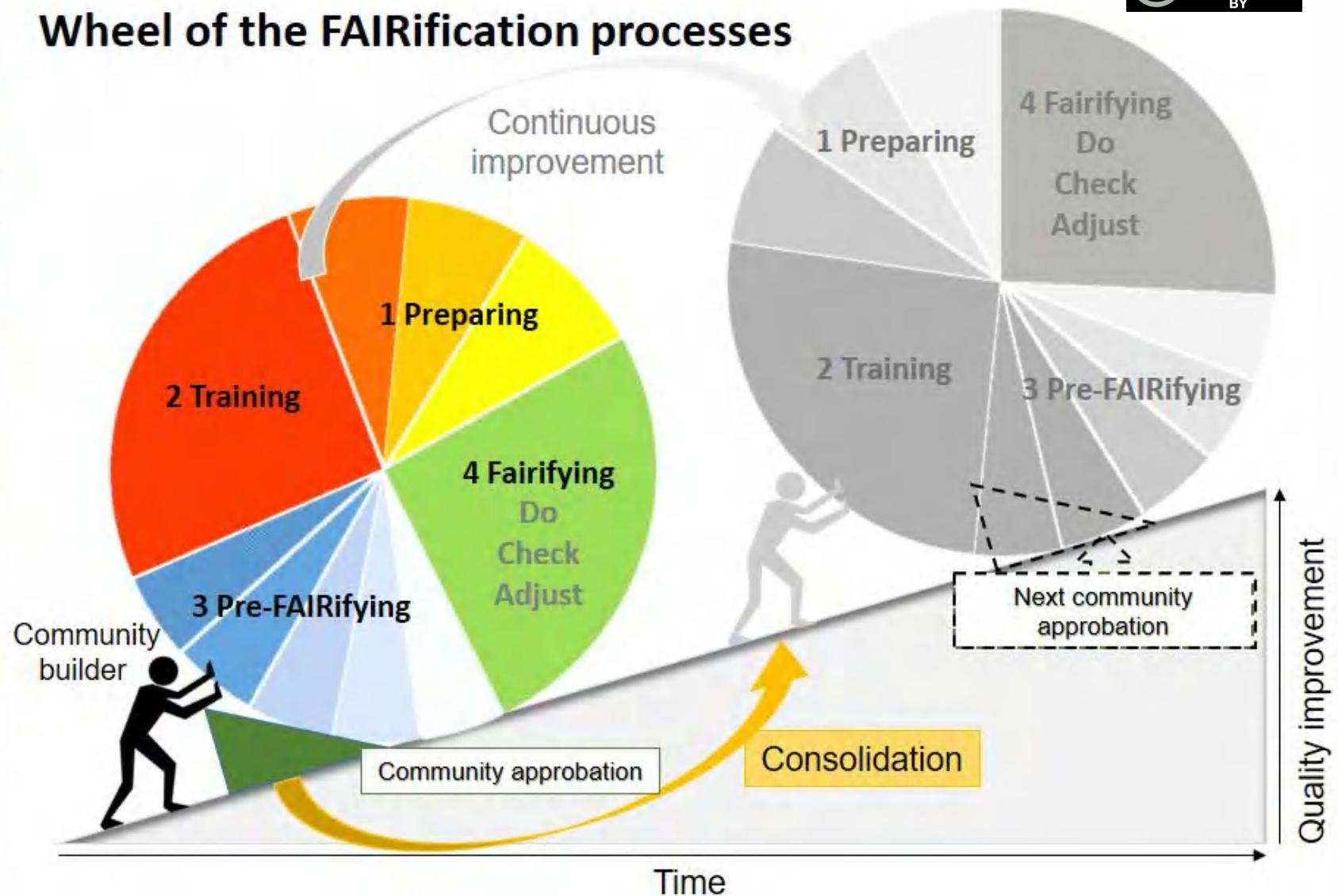


Figure 10. The technical infrastructure layers and increasing degrees of virtualisation

## Wheel of the FAIRification processes



This table is an ongoing work that needs to be collectively discussed. Your feedback is welcome.

FAIRification processes and steps														
		Explain FAIRification	Define constituents	Define advantages	Increase FAIR interest	Convince partners	Building shared strategy	Define community	Define objects and variables	Select items to be identified	Analyse common denominators	Do: Download tooling	Check: Find interesting ones	Adjust: Identifying gaps and new expectation
Research funders		F	E	E	FR	R						FR	E	R
Policy makers		CG	E	E	CGR	RG	G					E		
Coordination fora		CG	CG	CG	CG	CG	CG	CG	G	G	G	G	G	G
Standards bodies		GT	G	G	GT	G	T		G	G	T	GT		G
Research providers		CGT	E	E	CGT	GV	GT	GI				ET		ER
Research communities		C	IP	IP	EV	PI	IV	PIV	V	V	V	IP	IPV	IPV
Data service providers		CG	GV	G	IT	I	GIT			V?	IT	V	I	
Data stewards		PCG	GV	GV	IPT	I	IPT	I	IP	IP	IP	IT	EI	I
		Preparing			Training			Pre-FAIRyfying				FAIRifying		

C: Convince

E: Evaluate

F: Fund

G: Guide

I: Implement

P: Pilot (at least 1 per phase)

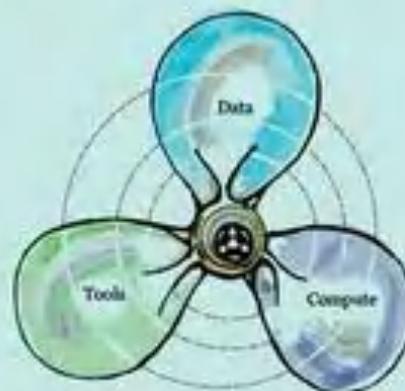
R: Reward

T: Train

V:Validate

# DATA STEWARDSHIP FOR OPEN SCIENCE

Implementing FAIR Principles



BAREND MONS



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## Réaliser un plan de gestion de données « FAIR » : guide de rédaction

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Ce document a pour vocation d'accompagner les chercheurs et chargés de projets dans la rédaction de plans de gestion de données de la recherche (Data Management Plans, DMP). La structure proposée tient compte du cycle de vie des données, de leur création dans le cadre d'un projet de recherche jusqu'à leur archivage. Elle s'appuie également sur divers modèles de plans de gestion de données tels que celui de la National Science Foundation (NSF) ou de l'Interuniversity Consortium for Political and Social Research (ICPSR).

Ce guide intègre les attendus de la Commission européenne dans le cadre d'Horizon 2020 et du FAIR data management : les champs requis par la Commission européenne sont signalés par un drapeau dans le texte.

# 50 nuances de FAIR

...

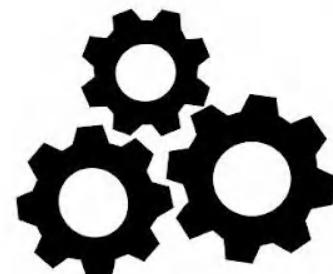
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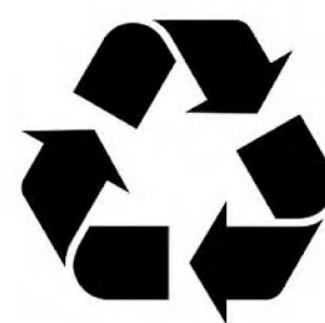
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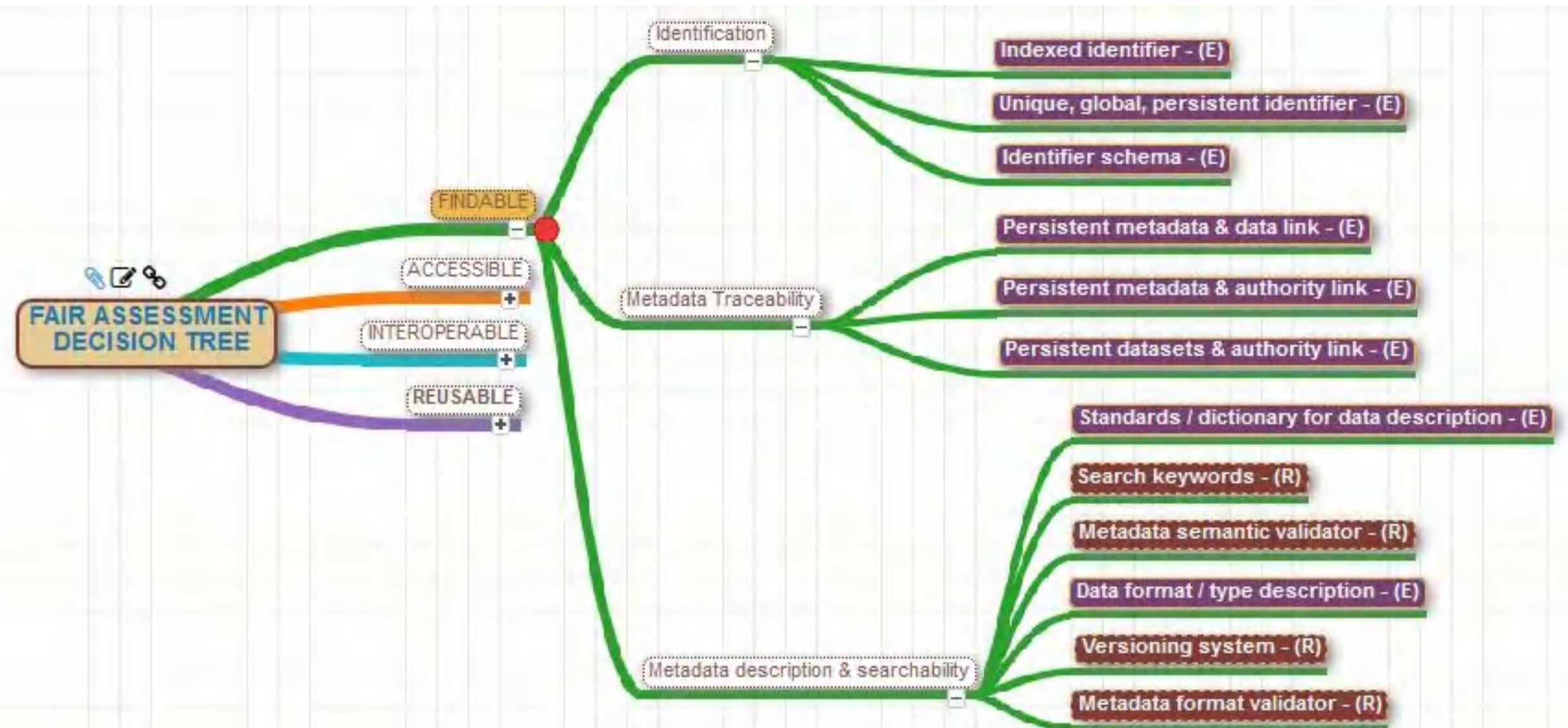
# FAIR Data Maturity Model (FDMM) WG - Maturity indicators in progress

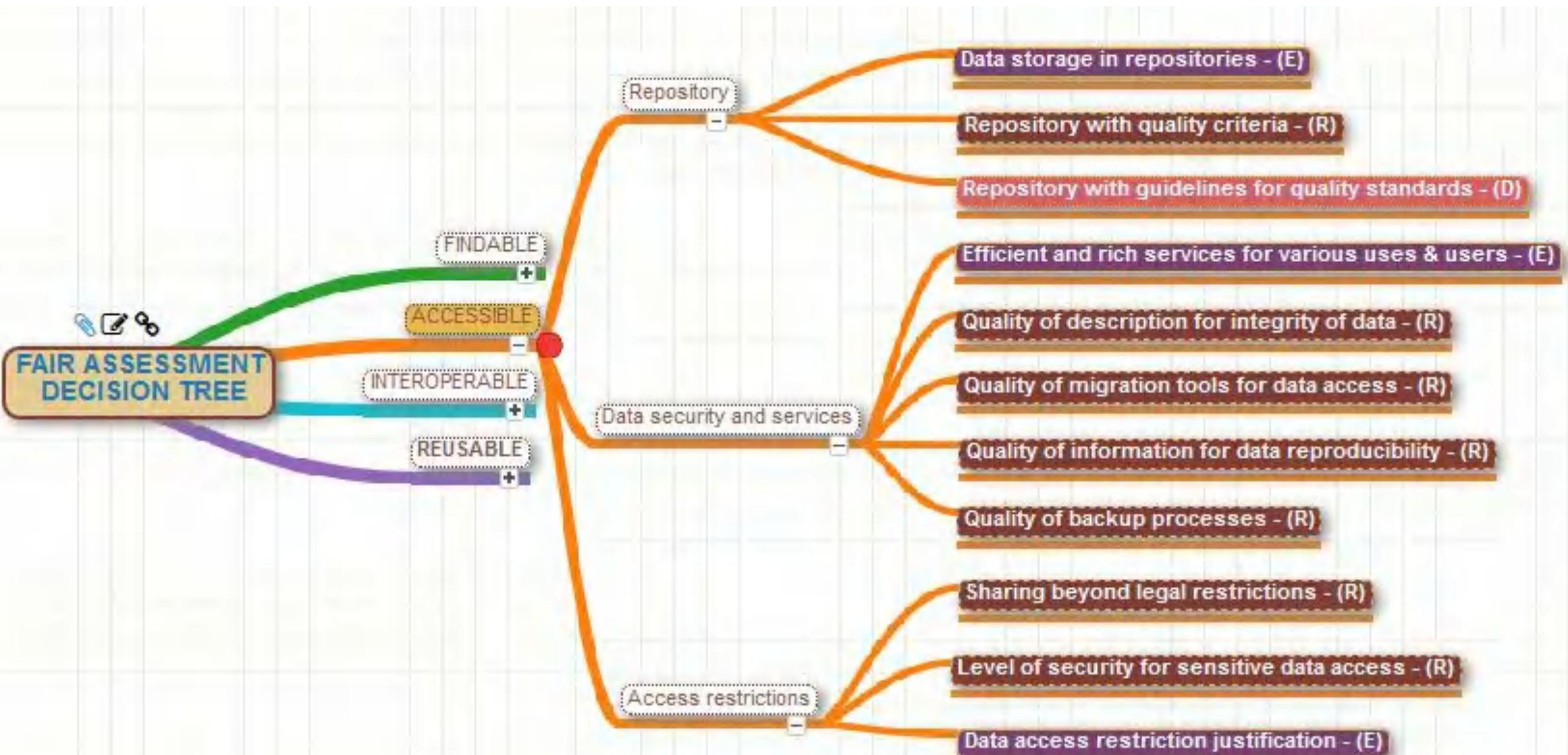
PRINCIPLE	INDICATOR_ID	INDICATORS	PRIORITY
F	F1	Metadata is identified by a persistent identifier	Mandatory
	F1	Data is identified by a persistent identifier	Mandatory
	F1	Metadata is identified by a universally unique identifier	Mandatory
	F1	Data is identified by a universally unique identifier	Mandatory
	F2	Sufficient metadata is provided to allow discovery, following domain/discipline-specific metadata standard	Recommended
	F3	Metadata includes the identifier for the data	Recommended
	F4	Metadata is offered/published/exposed in such a way that it can be harvested and indexed	Mandatory
A	A1	Metadata includes information about access conditions	Mandatory
	A1	Data can be accessed manually (i.e. with human intervention)	Mandatory
	A1	Data can be accessed automatically (i.e. by a computer program)	Recommended
	A1	Metadata identifier resolves to a metadata record	Mandatory
	A1	Data identifier resolves to a digital object	Mandatory
	A1	Metadata is accessed through standardised protocol	Recommended
	A1	Data is accessible through standardised protocol	Recommended
	A1.1	Metadata is accessible through a free access protocol	Mandatory
	A1.1	Data is accessible through a free access protocol	Recommended
	A1.1	Metadata is accessible through an open-source access protocol	Recommended
	A1.1	Data is accessible through an open-source access protocol	Recommended
	A1.1	Actions to be taken by a reuser to get access to the data are well documented	Recommended
	A1.2	Metadata includes information relevant for access control	Mandatory
	A1.2	Data is accessible through an access protocol that supports authentication	Optional
	A1.2	Data is accessible through an access protocol that supports authorisation	Optional
	A2	Metadata is guaranteed to remain available after data is no longer available	Mandatory

FAIR Data Maturity Model Guideline and glossary

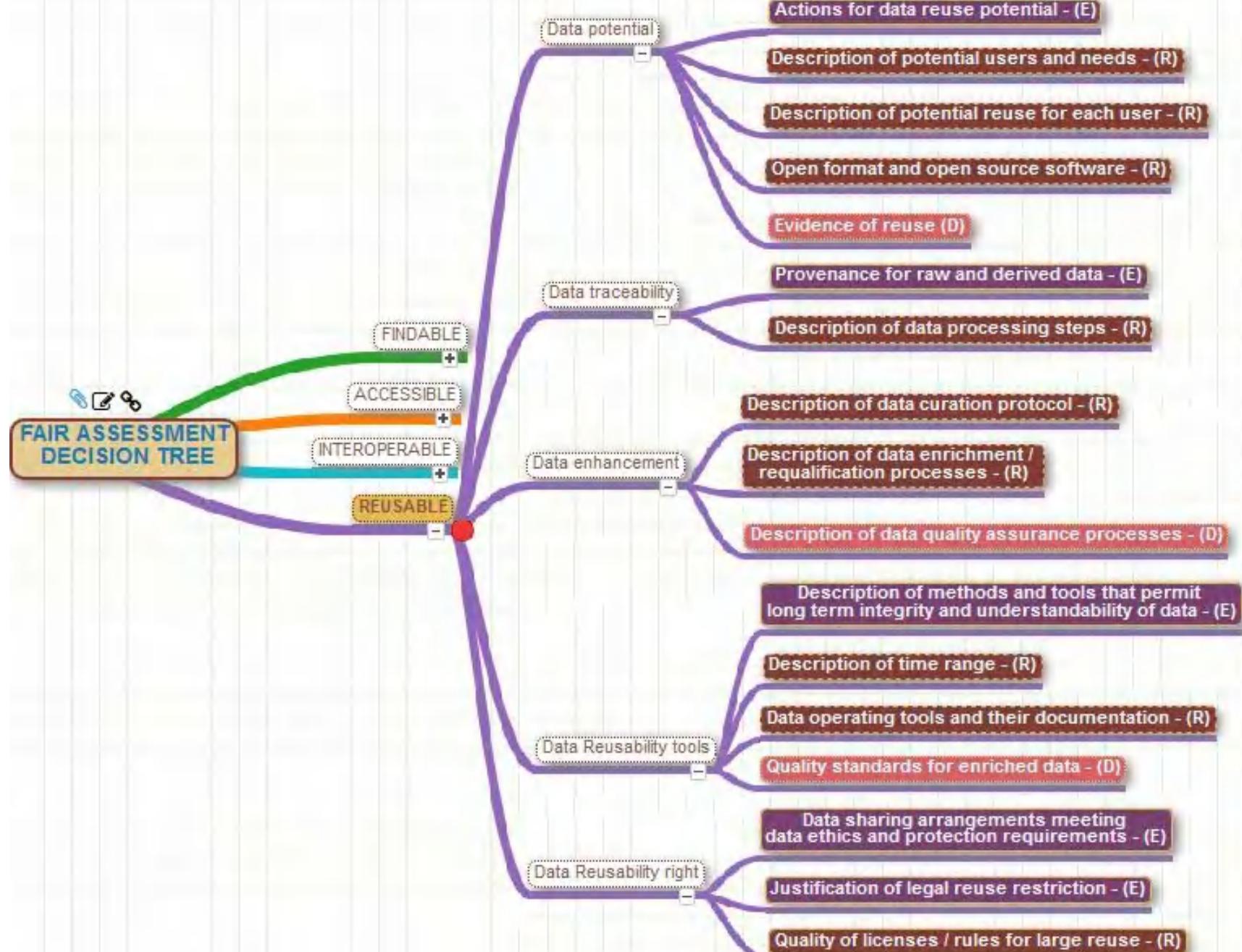
[https://docs.google.com/document/d/1pDGGL3-BbBJu18KlfZUI3AizKLHXGXdli\\_mPtpEWmeg/edit#heading=h.gjdgxs](https://docs.google.com/document/d/1pDGGL3-BbBJu18KlfZUI3AizKLHXGXdli_mPtpEWmeg/edit#heading=h.gjdgxs)

I	I1	I1-01M	Metadata uses knowledge representation expressed in standardised format	Mandatory
	I1	I1-01D	Data uses knowledge representation expressed in standardised format	Recommended
	I1	I1-02M	Metadata uses machine-understandable knowledge representation	Mandatory
	I1	I1-02D	Data uses machine-understandable knowledge representation	Recommended
	I1	I1-03M	Metadata uses self-describing knowledge representation	Optional
	I1	I1-03D	Data uses self-describing knowledge representation	Optional
	I2	I2-01M	Metadata uses standard vocabularies	Recommended
	I2	I2-01D	Data uses standard vocabularies	Recommended
	I2	I2-02M	Metadata uses FAIR-compliant vocabularies	Recommended
	I2	I2-02D	Data uses FAIR-compliant vocabularies	Optional
	I3	I3-01M	Metadata includes references to other metadata	Recommended
	I3	I3-01D	Data includes references to other data	Recommended
	I3	I3-02M	Metadata includes references to other data	Optional
	I3	I3-02D	Data includes sufficiently qualified references to other data	Optional
R	I3	I3-03M	Metadata includes sufficiently qualified references to other metadata	Recommended
	I3	I3-04M	Metadata include sufficiently qualified references to other data	Optional
	R1	R1-01M	Sufficient metadata is provided to allow reuse, following domain/discipline-specific metadata standard	Mandatory
	R1.1	R1.1-01M	Metadata includes information about the licence under which the data can be reused	Mandatory
	R1.1	R1.1-02M	Metadata refers to a standard reuse licence	Recommended
	R1.1	R1.1-03M	Metadata includes licence information in the appropriate element of the metadata standard used	Mandatory
	R1.1	R1.1-04M	Metadata refers to a machine-understandable reuse licence	Recommended
	R1.1	R1.1-05M	Metadata includes information about consent for reuse (e.g. for personal data)	Recommended
	R1.2	R1.2-01M	Metadata includes provenance information according to community-specific standards	Recommended
	R1.2	R1.2-02M	Metadata includes provenance information according to a cross-domain language	Optional
	R1.3	R1.3-01M	Metadata complies with a community standard	Recommended
	R1.3	R1.3-01D	Data complies with a community standard	Recommended
	R1.3	R1.3-02M	Metadata is expressed in compliance with a machine-understandable community standard	Recommended
	R1.3	R1.3-02D	Data is expressed in compliance with a machine-understandable community standard	Recommended









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The GO FAIR initiative aims to implement the [FAIR data principles](#), making data Findable, Accessible, Interoperable and Reusable.

This group is set up as a public resource for researchers, service providers, developers and science managers who are interested in FAIR data management. It starts out with a focus on resources to promote a FAIR academic culture in research institutions / research communities and will be gradually extended - both by the staff of the GO FAIR International Support and Coordination Office and any stakeholder who would like to contribute.

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# FAIR Data and Services in Biodiversity Science and Geoscience

Larry Lannom , Dimitris Koureas and Alex R. Hardisty

Posted Online January 31, 2020

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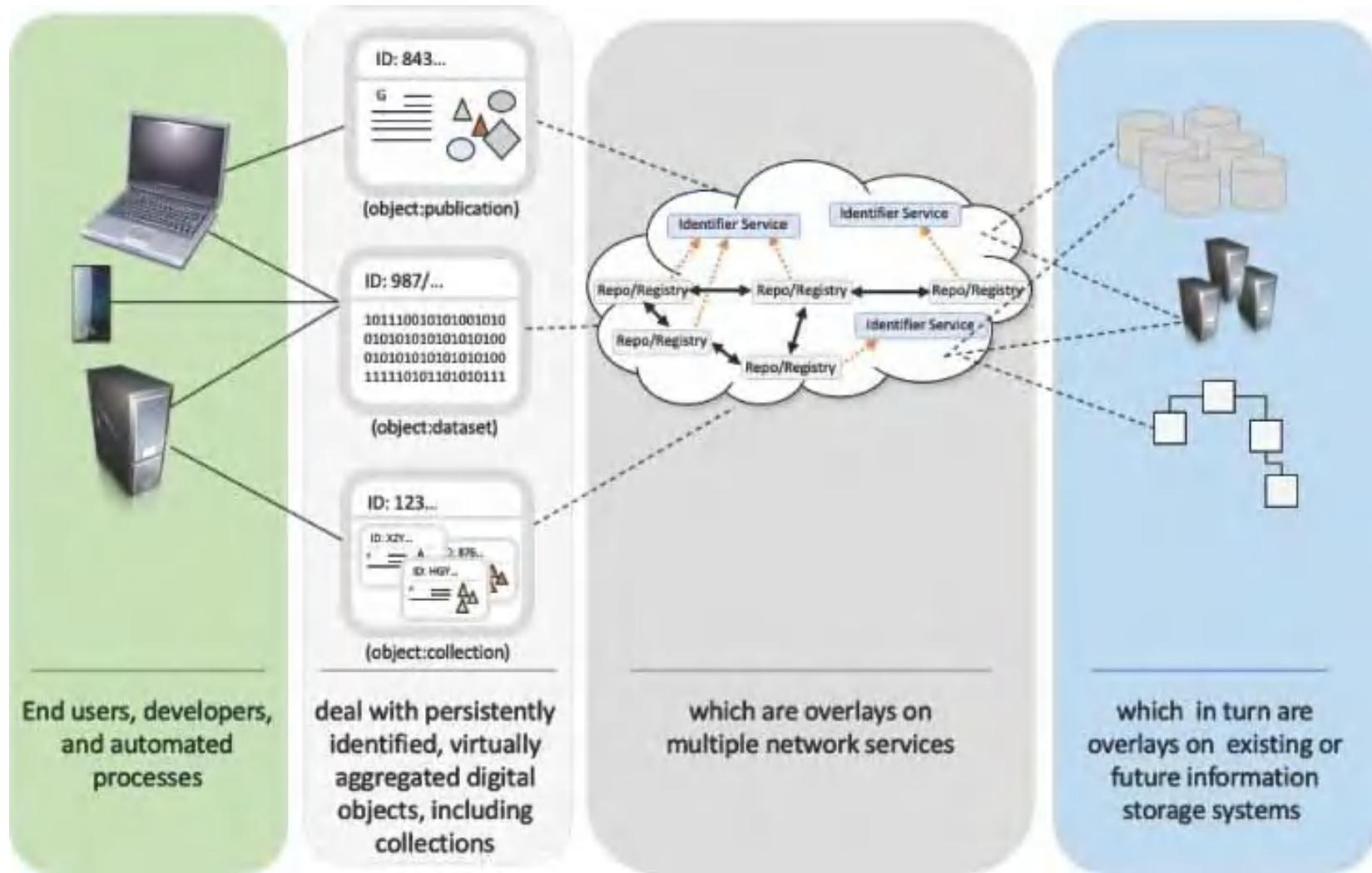
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## FAIR for Beginners

You have perhaps heard that data should be FAIR - Findable, Accessible, Interoperable and Reusable? Learn about the FAIR principles and why they are important, gain insight into how they are used and find FAIR tools you can use in your research.



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[Giancarlo Guizzardi](#)

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**Keywords:** FAIR, Semantic Interoperability, Ontology, ontologies



Published • Versions 3 | Vol 2 (1) : 158–170 2020



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## FAIR Convergence Matrix: Optimizing the Reuse of Existing FAIR-Related Resources



Hana Pergl Sustkova , Kristina Maria Hettne, Peter Wittenburg, Annika Jacobsen, Tobias Kuhn, Robert Pergl, Jan Slifka, Peter McQuilton, Barbara Magagna, Susanna-Assunta Sansone, Markus Stocker, Melanie Imming, Larry Iannom, Mark Musen, Erik Schulze  

## The FAIR Funder:

A pilot programme to make it easy for funders to require  
and for grantees to produce FAIR Data

FAIR Funders Collaboration<sup>1</sup>

February 15, 2019

There is a growing acknowledgement in the scientific community of the importance of making experimental data machine findable, accessible, interoperable, and reusable (FAIR). Recognizing that

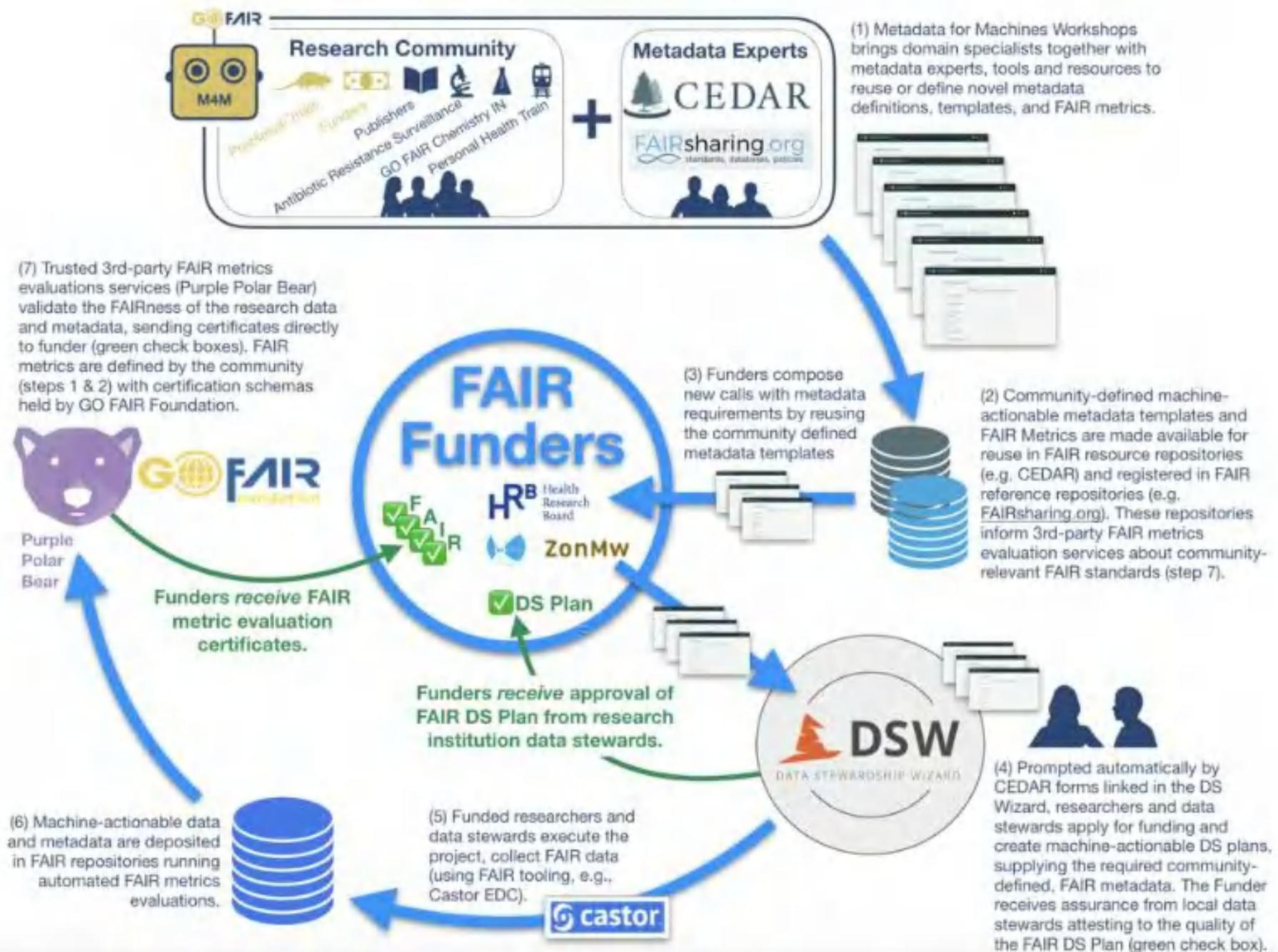


Figure 1: FAIR Funders workflow incorporating seven essential stages necessary to complete a funding cycle

WORLD VIEW • 25 FEBRUARY 2020

## Invest 5% of research funds in ensuring data are reusable



It is irresponsible to support research but not data stewardship, says Barend Mons.

Barend Mons 



Many of the world's hardest problems can be tackled only with data-intensive, computer-assisted research. And I'd speculate that the vast majority of research data are

 PDF version

We estimated that Europe will have at least **10 million serious data producers** among its 70 million science and technology professionals and 1.7 million researchers. So we will need to educate about 500,000 data stewards of various kinds to support researchers through experimental design and data capture, curation, storage, analytics, publication and reuse.



[Home](#) | [Data Intelligence](#) | [List of Issues](#) | [Volume 2 , No. 1-2](#) | [Making FAIR Easy with FAIR Tools: From Creolization to Convergence](#)



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# Making FAIR Easy with FAIR Tools: From Creolization to Convergence

[Mark Thompson](#) , [Kees Burger](#), [Rajaram Kaliyaperumal](#), [Marco Roos](#) and [Luiz Olavo Bonino da Silva Santos](#)

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COMMENT · 04 JUNE 2019 · CORRECTION 05 JUNE 2019

# Credit data generators for data reuse

To promote effective sharing, we must create an enduring link between the people who generate data and its future uses, urge Heather H. Pierce and colleagues.

Heather H. Pierce , Anurupa Dev, Emily Statham & Barbara E. Bierer



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[Make scientific data FAIR](#)

NEWS · 28 FEBRUARY 2020

# China bans cash rewards for publishing papers

New policy tackles perverse incentives that drive ‘publish or perish’ culture and might be encouraging questionable research practices.

Smriti Mallapaty

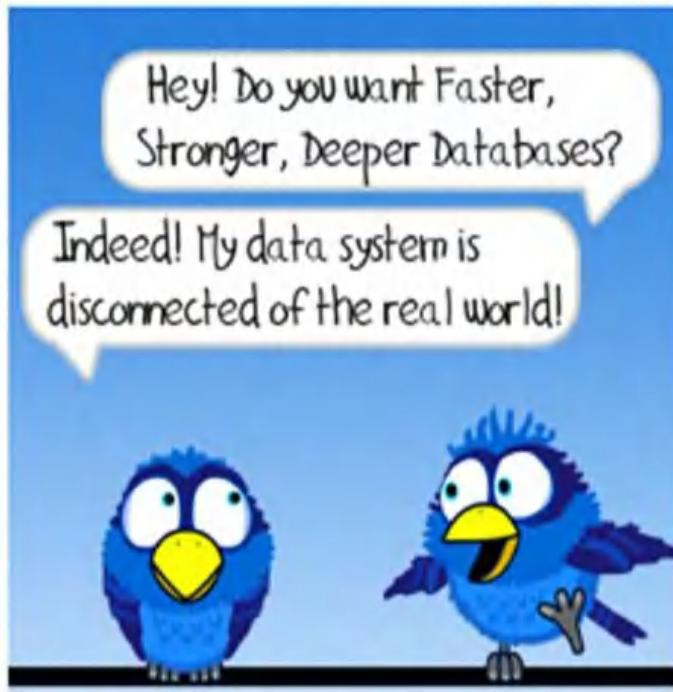


Chinese institutions have been told to stop paying researchers bonuses for publishing in journals, as part of a new national policy to cut perverse incentives that encourage scientists to publish lots of papers rather than focus on high-impact work.

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# We need man power for FAIR!



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SHARC interest group at [www.rd-alliance.org/groups/sharing-rewards-and-credit-sharc-ig](http://www.rd-alliance.org/groups/sharing-rewards-and-credit-sharc-ig)

Romain David, Laurence Mabile, Mohamed Yahia, Anne Cambon-Thomsen, Anne-Sophie Archambeau, et al..

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