



FAIR Data Maturity Model

Workshop #6

4th December 2019



Agenda

5′	Welcome, objectives of the meeting
5′	Roundtable
5′	State of play
30′	Pilot testing Presentations
30′	Discussions about testing results
10'	Draft guidelines
5′	Action items & next steps



Context

The principles are **NOT** strict

- Ambiguity
- Wide range of interpretations of FAIRness



Different FAIR Assessment Frameworks

- Different metrics
- No comparison of results
- No benchmark



SOLUTION is to bring together **stakeholders** to build on **existing approaches** and **expertise**

- Set of **core assessment criteria** for FAIRness.
- FAIR data maturity model & toolset
- FAIR data checklist
- RDA recommendation

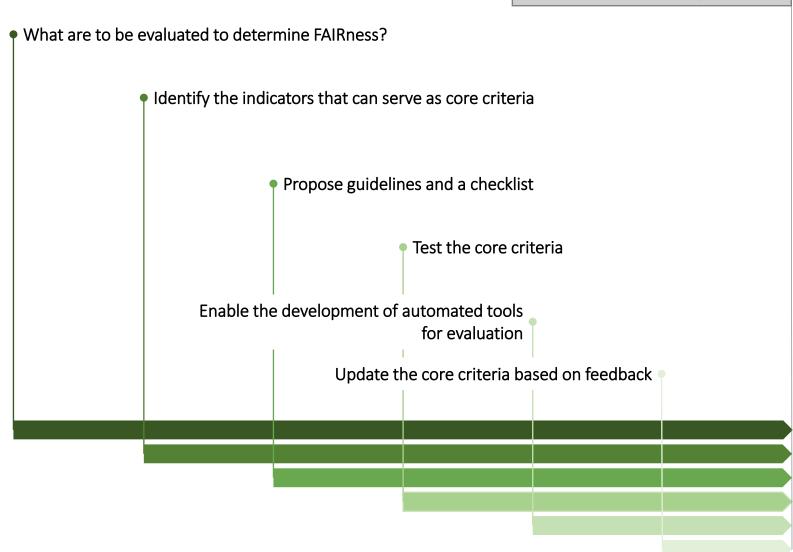
Join the RDA Working Group: RDA WG web page | GitHub





Objectives

FAIR data maturity model





Scope

BUT the Working Group does **NOT** have the purpose to ...

- develop yet-another-evaluation-method: the core criteria are intended to provide a common 'language' across evaluation approaches, not to be applied directly to datasets.
- define how the core criteria need to be evaluated. The exact way to evaluate data based on the core criteria is up to the owners of the evaluation approaches, taking into account the requirements of their community
- revise and re-design the FAIR principles



Roundtable

In the chat window, please type...

- Your name
- Your affiliation
- Your role
 - Researcher
 - Librarian
 - Service provider
 - Policy maker
 - > Funder

Introducing the editorial team



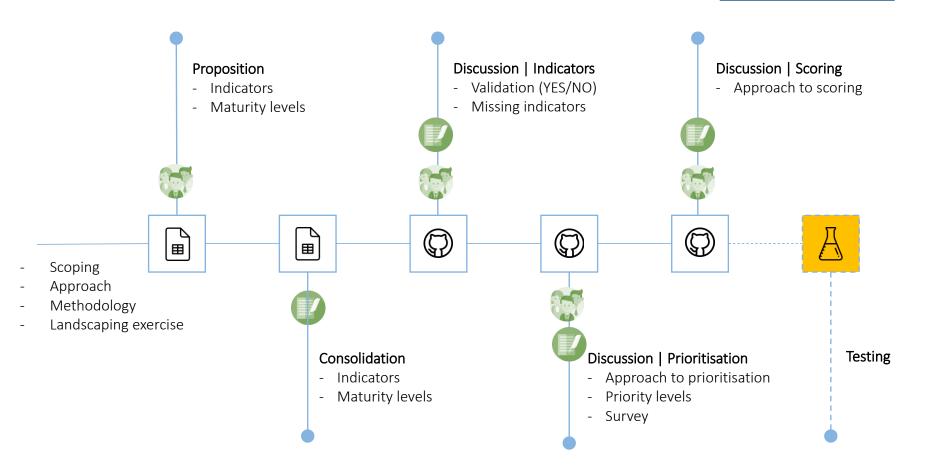


1. Definition	DONE
2. Development	CLOSING
i) First phase	DONE
ii) Second phase	CLOSING
3. Testing	ONGOING
4. Delivery	ON HOLD

^{*} Any comments are still welcomed with regards to the output produced during the first phase | <u>GitHub</u>









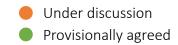
- ◆ Goal is to <u>finalise</u> indicators and priorities
- Indicators and priorities will be further used in their current state
- Indicators and priorities will be re-evaluated after the testing phase



Development



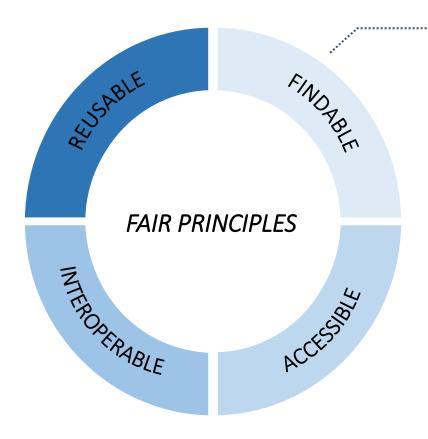
Overview | Indicators & levels



		 F1 (Meta)data are assigned globally unique and persistent identifiers
F	_	F2 Data are described with rich metadata
	F	F3 Metadata clearly and explicitly include the identifier of the data they describe
		 F4 (Meta)data are registered or indexed in a searchable resource
		 A1 (Meta)data are retrievable by their identifier using a standardised communication protocol
Α	٨	 A1.1 The protocol is open, free and universally implementable
	^	 A1.2 The protocol allows for an authentication and authorisation where necessary
		 A2 Metadata are accessible, even when the data are no longer available
		 I1 (Meta)data use a formal, accessible, shared and broadly applicable language for knowledge representation
I	 I2 (Meta)data use vocabularies that follow the FAIR principles 	
		 I3 (Meta)data include qualified references to other (meta)data
		 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
	R	 R1.2 (Meta)data are associated with detailed provenance
		 R1.3 (Meta)data meet domain-relevant community standards



Overview | Indicators & levels



Indicators for Findability

- [F1-01M] Metadata is identified by a persistent identifier
- [F1-01D] Data is identified by a persistent identifier
- [F1-02M] Metadata is identified by a universally unique identifier
- [F1-02D] Data is identified by a universally unique identifier
- [F2-01M] Sufficient metadata is provided to allow discovery, following domain/discipline-specific metadata standard
- [F2-02M] Metadata is provided for the discovery-related elements defined by the RDA Metadata IG, as much as possible and relevant, if no domain/discipline-specific metadata standard is available
- [F3-01M] Metadata includes the identifier for the data
- [F4-01M] Metadata is offered/published/exposed in such a way that it can be harvested and indexed

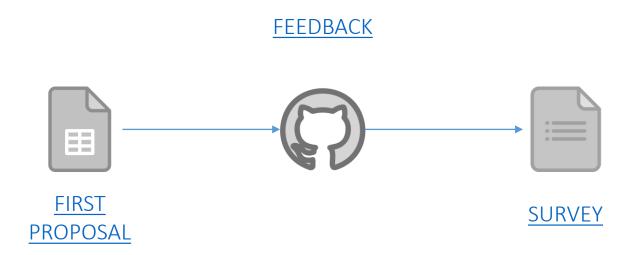
^{*} The full list of indicators can be found on the following GSheet



Development | Weighting

Weighting the indicators, developed as part of the WG, following the <u>key words for</u> use in RFC2119

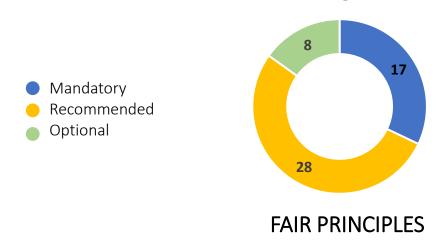
- Mandatory: indicator MUST be satisfied for FAIRness (Essential)
- **Recommended**: indicator **SHOULD** be satisfied, if at all possible (Important)
- > Optional: indicator MAY be satisfied, but not necessarily so (Useful)

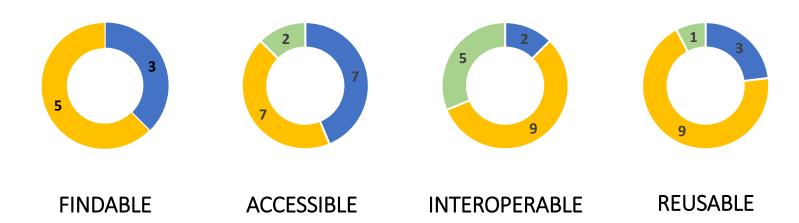




Development | Weighting Stats

Distribution of the weight of the indicators







Pilot testing Presentation



Evaluation of RDA FAIR indicators

Françoise Genova - Astronomic



Context

WHY

Finding, accessing, interoperating and reusing data is at the core of astronomical research. The community has long been working to develop its international, open data sharing framework fitting its requirements. The framework is implemented by data providers, including the ground and space-based telescope archives and the widely used added-value data services, and used by the community in its daily research work (it is often invisible from users, so people may not be aware that they use it when accessing data and using tools). It is essential to test how the disciplinary practices to find, access, interoperate and reuse data are fitting with the proposed FAIR Data Maturity criteria. Astronomy provides a good real-life operational example for that.

WHAT

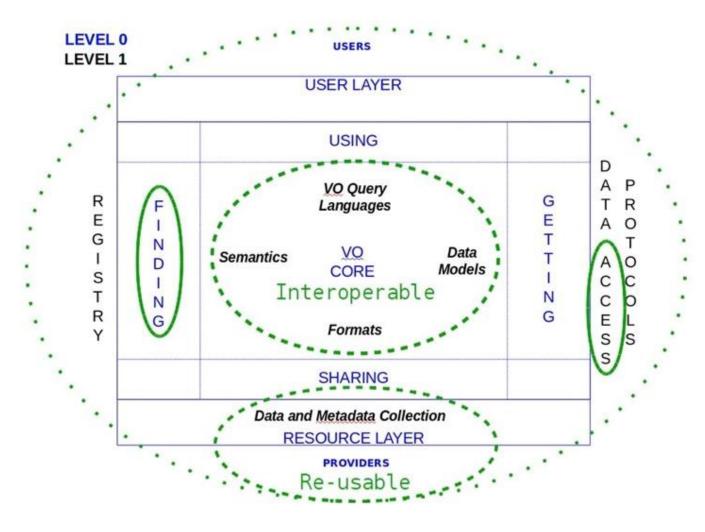
The astronomical data sharing framework includes a common format, FITS, which integrates data and metadata, and the standards and tools of the astronomical Virtual Observatory (VO), which provide findability, discoverability and interoperability. The VO standards are developed and maintained by the International Virtual Observatory Alliance (IVOA, http://ivoa.net). The VO framework is used/customized by other disciplines (astroparticle physics, planetary sciences, solar physics, the Virtual Atomic and Molecular Data Centre), so the test of usefulness goes beyond astronomy.

HOW

We checked each proposed criterion wrt. the community requirements on finding, accessing, interoperating and reusing data and the astronomical data sharing framework. We identified which criteria are implemented 'automatically' when data is provided through the Virtual Observatory, which ones rely on the data provider for implementation, and which ones require a combination of the two. We paid particular attention to the criteria currently tagged as 'Mandatory', since they will play a key role in the acceptance and rejection of data as FAIR if evaluation is performed using yes/no procedures (which may well happen based on the WG recommendations even if it is not the WG aim).



VO is FAIR ... wrt. our needs







One view of the VO from an application:







Overall results (1)

What worked well:

- The Virtual Observatory enables a significant fraction of the criteria to be satisfied, which is a plus for data providers
- Common data providers' practices also align with some of the criteria
- No proposal to change the criteria, except eventually to improve the understandability and usability of a few of them

What didn't work well:

- Overall comparison with community requirement
 - Data Reuse and Interoperability are the key user requirements in astronomy. Find and Access are developed to enable R and I, and not as an objective per se. This starting point is very different from the one of the disciplines for which reproducibility is the key requirement (e.g., biology), for which being able to Find and Access specific data sets is the key criteria.
 - Findability and accessibility are not defined the same way with the two different starting points.
 - These differences have critical consequences on which criteria should be defined as mandatory wrt. community practices.



Overall results (2)

What didn't work well (cont'd):

- Comments on the individual principles
 - Find: Finding data is a dynamic process for astronomers, who want to find data of interest for their research. The VO allows users to make simple or complex queries on all the data services declared in the VO, using a wealth of metadata. The PID is an element of findability among many others and is not the be-all and end-all of FAIRness as they appear in the FAIR principles and criteria for F and A (F1-01D, F1-02D, F3.01M, A1-03D).
 - Access: Access to data manually or by a machine is at the core of our system. Astronomical data is mostly open by default, which means that A1.2-10M is not mandatory, but our metadata can include information relevant to access control when relevant.
 - Interoperability: Interoperability is the core objective of the VO. We note that this is the only principle which has no Mandatory criterion, which means that data can be evaluated as FAIR in the proposed system without fulfilling any of the I criteria.
 - Reusability: Reusability is a core requirement for astronomical data. Data is open by default and is massively reused. Usage rights rely mostly on disciplinary ethics: cite the origin of data when data is cited. In some cases, an explicit license for usage is provided, but not always. This does not impair the widespread acceptance of data sharing and reuse. Four R criteria, two of them Mandatory, deal with license information.



Overall results (3)

What didn't work well (cont'd):

- Additional comments
 - In our case some metadata are attached to the data collection, others to the data item.
 - Cascading criteria: Twice two criteria exclusive from each other (F2-01M/F2-02M; R1-01M/R1-02M). This means that one of the two criterion is irrelevant if the other one is fulfilled.
 - Consent for reuse (R1.1-05M) is irrelevant in our case.
 - What is a 'FAIR compliant vocabulary' (I1-02M, I2-02D)? Is a vocabulary standard which has a DOI and is freely available and reusable a FAIR compliant vocabulary?
 - What is a 'sufficiently qualified reference' to something (I3-02D, I3-03D, I3-04D)?



Discussion points

- We hear that disciplinary practices have to be taken into account when defining FAIRness, and also that to become FAIR is a process towards disciplinary and cross-disciplinary FAIRness. As shown by our analysis the weight of the different criteria is different with different disciplinary points of view. We do not want to change the criteria, but we strongly suggest to use compliance scales instead of yes/no compliance evaluation. This will provide an inclusive system and a way to set up goals and measure progress.
- If compliance scales are established, they should include a 'non applicable' level.
- Open by default should be considered as acceptable, in spite of the possible legal hurdles.
- We note that significant costs are induced when one has to modify well established characteristics of a legacy discipline-wide, world wide data system. The large research infrastructures are supported to serve their communities, which can be an issue for engaging resources to fulfil criteria not relevant to disciplinary requirements. However they can aim at making progress gradually with the help of the compliance scales described above.
- To check the set of criteria with different, diverse communities is critical to ensure usability, wide acceptance and take-up.
- **We plan to write an IVOA Note describing the assessment reported here.**



IMI FAIRplus Project: Evaluation of Biomedical Datasets by RDA FAIR Indicators

Comparing the Outcomes of Multiple Independent Evaluators for FAIRness Assessment











22 participants 12 academic, 7 EFPIA, 3 SME **ELIXIR** - Project Coordinator **Janssen** - Project Leader

> €8.23M budget €4M H2020 EC funding €4.23M FEPIA in-kind

> > 42 months

PPPs, funded from 2019 to 2022 AstraZeneca NOVARTIS A Open PHACTS Swiss Institute of Bioinformatics Bayer thehyve Boehringer Ingelheim Imperial College LUXEMBOURG EMBL-EBI lygature Maastricht University Fraunhofer TOULOUSE III





IMI Project Portfolio100 translational research projects in Public-private partnerships

Our challenge:

How do we design, test and refine our tools and processes in a way that scales to our data volumes?



•FAIR maturity assessment

- Standards, metrics
- Capacity building
- Support

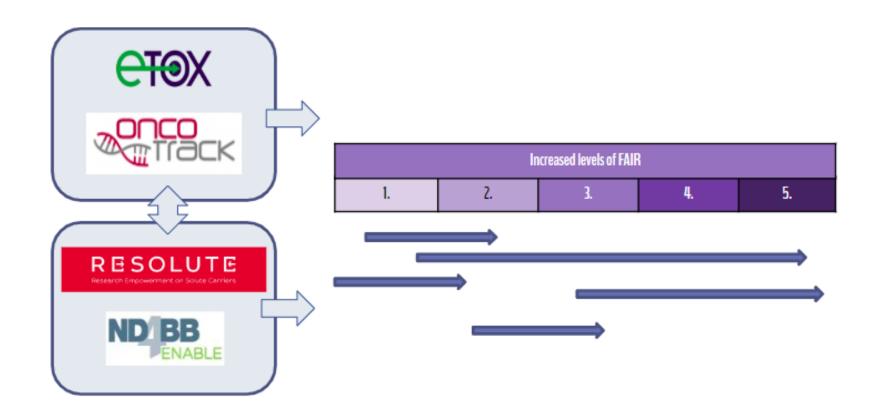
FAIR Cookbook

https://fairplus.github.io/the-fair-cookbook/intro

- Publish FAIR datasets from
- >20 projects for access and reuse
- •FAIRified internal EFPIA datasets
- •SME engagements, hackathons and fellowships



FAIRification of First 4 pilot Datasets







Motivation: Identify Ambiguous Indicators

- Measure FAIRness before the FAIRification (RESOLUTE)
 - We applied <u>RDA FAIR Maturity Metrics</u> to measure the initial FAIRness level of the RESOLUTE data set
 - Two experts collectively discussed each metric and decided on a score
 - They reported that they found some of the metrics difficult to assess, since it might depend on interpretations
- Observe which metrics could potentially depend on evaluators interpretation
 - Manual Assessment: a systematic assessment for the ETOX and ND4BB data sets
 - > Automated Assessment: with the FAIRevaluator tool



Method

ETOX Dataset

- Three independent evaluators
- Applied RDA FAIR Metrics v0.2
- Recorded outcomes separately (average time 90 min

- Two independent evaluators
- Applied RDA FAIR Metrics v0.3

ND4BB Dataset

Recorded outcomes separately (average time 45 min)

Dedicated squad sessions are conducted for each dataset to compare scores of the independent evaluators and record feedback regarding the encountered challenges during assessment

Out of 54 metrics **9** of them are evaluated differently

Out of 50 metrics **6** of them are evaluated differently

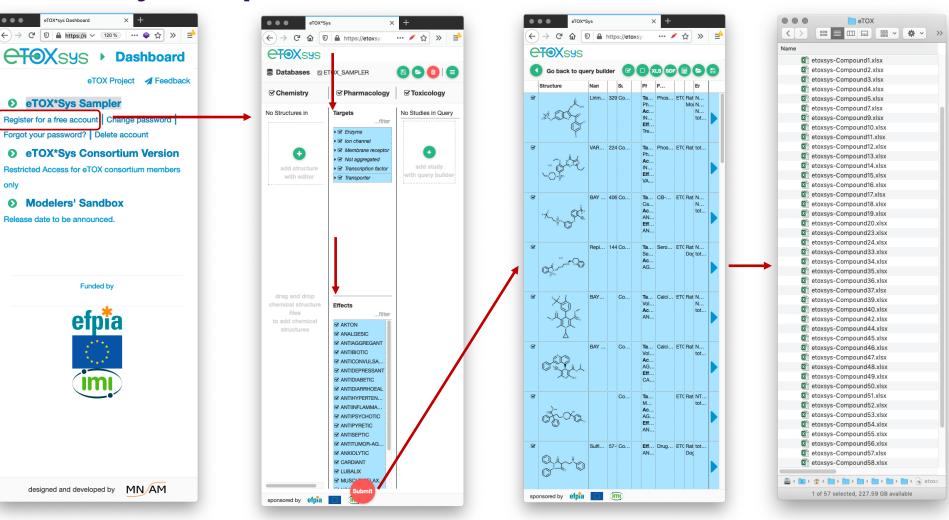


(*) FAIRevaluator returned a fail report, since the assessment applied before any FAIRification and data sets did not provide a machine access and authentication



Data Set 1: ETOX

eTOX*Sys Sampler - https://etoxsys.eu/etoxsys.v3-demo-bk/dashboard/



Ask for login

Tick all filters

Select XLS format

1 file per compoun



Data Set 2: ND4BB TRANSLOCATION

https://www.dsf.unica.it/translocation/abdb/

HOMEPAGE



- Protocol
- Disclaimer

Tools

- Amber
- Gaussian
- ChemAxon
- ALOGPs
- Platinum
- VMD
- PyMOL
- Open Babel
- Vim
- Plumed

ANTIMICROBIAL COMPOUNDS DATABASE

Aminoglycosides

Amikacin

Beta-lactamase inhibitors

- Clavulanic Acid
- Sulbactam
- Avibactam
- Tazobactam
- BAL29880

Efflux pumps inhibitors

- Amitriptyline
- NMP (1-(Naphthalen-1-ylmethyl)piperaz ne)

Oxazolidinones

- Linezolid
- Sutezolid

Tetracyclines

- Minocycline
- Tigecycline

Maintained by G. Malloci

	FORCE-FIELD PARAMETERS
GAFF files	[pdb] [frcmod] [prep_chelpg] [prep_mk]
	[prep_mk_hf]
	GENERAL PROPERTIES
Molecular Formula	C ₁₅ H ₁₉ N ₂
Molecular Weight (Da)	227.32476
# Atoms, heavy atoms, rotatable bonds	36 17 2
# H-bond donors / acceptors	1 1
Physiological charge	+1
soelectric point	undefined [data] [plot]
Van der Waals volume (ų)	228.18
ogP (XLOGP3 CHEMAXON ALOGPS)	2.35 [data] 2.37 2.00
logS (CHEMAXON ALOGPS)	-2.69 -3.08
Molecular surface (Å ²)	pol=XX.XX nonpol=XX.XX tot=XX.XX [fig]
	COMPUTED QM PROPERTIES
Optimized geometry	[xyz] [sdf]
HOMO, LUMO, GAP (eV)	-1.22 -5.97 4.75/td>
Orbital data	[data] [plot]
Vibrational properties	[data] [plot]
Rotational constants (GHz)	A=0.8359305 B=0.2927145 C=0.2486831
Dipole in vacuum (Debye)	15.75 [fig]
	COMPUTED MD PROPERTIES
First and second water shells	[data] [plot]
Intramolecular / water H-bonds	[data] [data]
Cluster analysis	[txt] [pdb] [tgz]
Root mean square fluctuation (nm)	mean=0.118 [data] [plot]
Minimal projection area (Ų)	mean=XX.XX [data] [plot]
Asphericity	mean=2.554 [data] [plot]
Acylindricity	mean=1.228 [data] [plot]
Kappa2	mean=0.293 [data] [plot]



Findability Indicators

Different levels (granularities) of metadata: data provenance, data protocol, properties of dataset ..

> F1-01M Metadata is identified by a persistent identifier

Identifier persistently points to the data set vs the ability of identifier to persistently identify the same data over time

> F1-01D Data is identified by a persistent identifier

Sufficient for which purpose? to find.. to reuse ... for humans ... for machines..

> F2-01M <u>Sufficient</u> metadata is provided to allow discovery, following domain/discipline-specific metadata standard



How to refer to a domain-specific standard? could it be multiple domains?



Accessibility Indicators

What is a metadata record? Should it be separate from the data set? How it resolves?

- > A1-02M Metadata identifier resolves to a metadata record
- > A1-03M Metadata is accessed through standardised protocol
- > A1.1-01M Metadata is accessible through a free access protocol
- > A1.1-01D Data is accessible through a free access protocol
- > A1.1-02M Metadata is accessible through an open-source access

protocol

Protocols (what is the definition):

- standardized: http, ftp, csv, html?
- free access: no key?
- Open source ?





Accessibility Indicators

What type of information: who to contact? licence? what if data is openly accessible, should it state explicitly that everyone can use?

- > A1-01M Metadata includes <u>information</u> about access conditions
- > A1.1-03D Actions to be taken by a reuser to get access to the data are well documented
- > A1-02D Data is available for <u>automatic download</u>

What does automatic mean: cron job? API? what if it requires parsing or extraction?





Interoperability Indicators

Exclusively ontologies?

- > 1-01M Metadata uses knowledge representation expressed in standardised format
- I1-01D Data uses knowledge representation expressed in standardised

<u>format</u>

Does controlled

vocabularies included

(defined within the project)

> I2-01D Data uses <u>standard</u> vocabularies

Only RDF?

- > I1-03M Metadata uses self-describing knowledge representation
- > 12-02M Metadata uses FAIR-compliant vocabularies



Required to assess vocabularies, can not be accomplished during evaluation of data sets



Reusability Indicators

how to recognize a community standard?

R1.3-01D Data complies with a community standard

what if data is publically available? is that license on the original data, or on data from the hosting repository?

- > R1.1-01M Metadata includes information about the <u>licence</u> under which the data can be reused
- > R1.2-02M Metadata includes provenance information according to a <u>cross-domain language</u>

 Needs reference?
- > R1.3-02D Data is expressed in compliance with a <u>machine-understandable community standard</u>



xml, json , rdf, html ... ?
Is it the same as machine readable



Common confounding 'concepts'

- 'Sufficient': (5) required thought but did not result in scoring discrepancy
- 'Protocol': (11) discussions on most; score discrepancy ~ 50%
 - discussion on free (cost?), level of detail of what 'protocol' means (technical term or access methodology)
- 'Persistence': (2) discussion on meaning of persistence (identifier, resolver, the link between both, resource host policy); score discrepancy ~ 50%
- 'Metadata': (34) discussion on where to separate data/metadata, and what 'level' of metadata (dataset vs records or headings); score discrepancy ~ 5%





Common confounding 'concepts'

- 'Self-describing': (2) does this dictate RDF, machine processable vs human readable; no score discrepancy
- Data is available for 'automatic download' (1)
- 'Standard vocabularies' (4) are controlled vocabularies included? 25% discrepancy
- 'FAIR compliant' (2) creates a circular discussion/assessment burden
- 'Metadata to allow reuse': (1) hard to ascertain as the purpose (metadata) not known in advance
- > Appropriate 'community/domain standards': (5) how to choose where multiple may be applicable



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Suggestions

- Definitions of concepts such 'metadata', 'automated', 'standardized, free and open source protocol', 'persistency' should be provided
- Community data and metadata standards should be referenceable via a community resource as FAIRsharing.org, which covers all disciplines
- Evaluators needs a guideline with some examples
- Different ways of publishing data (controlled access, openly available... / separate metadata, metadata embedded to data) may lead to different interpretations. Examples should be provided
- > FAIRification for a specified purpose has an impact on interpretation (e.g. what is sufficient, what is metadata)



FAIRplus



Get in touch

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Newsletter:

Sign-up: http://eepurl.com/ghuHeT

Archive: http://bit.ly/2UG6mZI

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Discussion



Discussions about testing results

- 1
- Should we define compliances scales instead of yes/no evaluation? E.g.:
 - 0= does not comply to indicator
 - 1= does not yet comply, under development
 - 2= fully complies to indicator

- 2
- How does 'Open by default' fit with FAIR, especially for indicators related to access conditions and re-use licences?
- 3
- How can we address **improving terminology** in some of the indicators and how can we get **examples of good practices**?
- 4
- Should the evaluation of metadata concern the **metadata attached to the data item** and/or **data collection**?



Development Next steps



Draft guidelines

GUIDELINES	INTRODUCTION	IntroductionObjectivesUse of the document
	FRAMEWORK	IndicatorsMaturity levelsPrioritizationIndicators description
	IMPLEMENTATION	• How to evaluate



Indicator description

- Description of each indicator and its respective assessment details
- Indicators ordered by their priorities

EXAMPLE

F1-01M Metadata identified by a persistent identifier

Principle – as defined by GO FAIR – to which the indicator relates

This indicator is linked to the following principle: F1 (meta)data are assigned a globally unique and eternally persistent identifier. More information about that principle can be found <u>here</u>.

Description of the indicator F1-01M

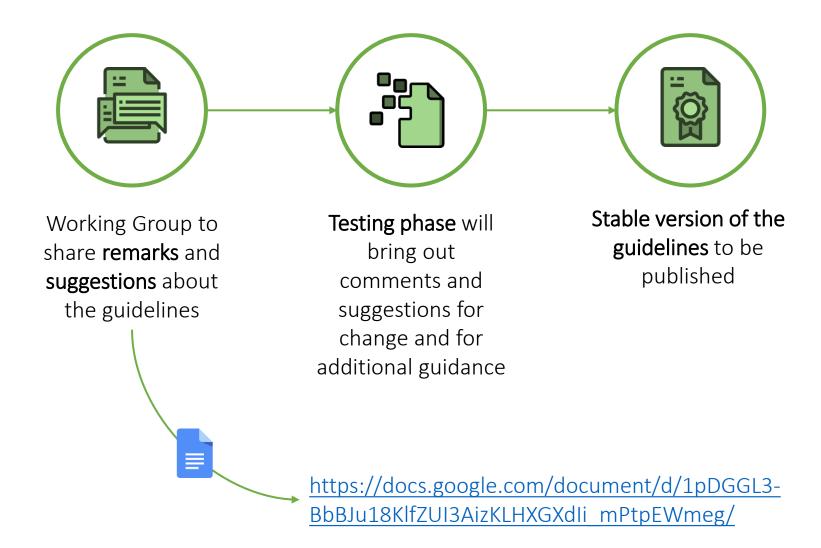
This indicator evaluates whether or not the metadata is identified by a persistent identifier. A persistent identifier ensures that the metadata will remain findable over time, and reduces the risk of broken links.

Assessment details

The persistence of an identifier is determined by the commitment of the organisation that assigns and manages the identifier, so the evaluation of this indicator needs to take into account the persistence policy of that organisation. Such a commitment could be expressed by a university or research institute, by a research infrastructure or by an organisation that issues formal identifiers, such as the International DOI Foundation. A possible way to evaluate this indicator is to verify that the identifier used for the metadata is listed in a registry service like FAIRsharing.



Draft guidelines | Development

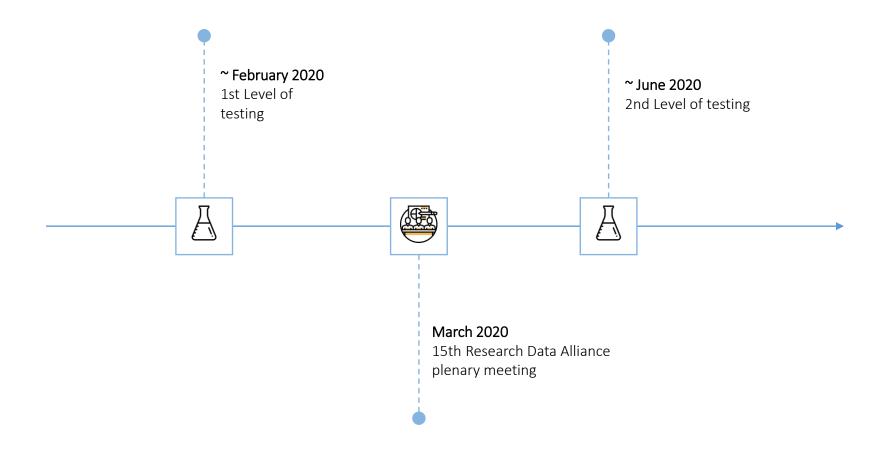




Next steps



Testing timeline





Testing framework

In the coming week(s), the editorial team will share a *template document* allowing to individually report on the results.



- ID card of the **evaluator** (e.g. discipline, community, profile(s), etc.)
- ID card of the collection of digital object/resource
- Methodology followed
- Observations per indicator (e.g. ambiguity, misunderstanding, priority relevancy, etc.)
- General recommendations



Action item and next steps

- > Share feedback comments, remarks & suggestions on the Guidelines
- Volunteers for testing

WORKSHOP #7 13 February 2020

09.00 - 10.30 CET | Morning session 17.00 - 18.30 CET | Afternoon session



Resources

RDA FAIR data maturity model WG

https://www.rd-alliance.org/groups/fair-data-maturity-model-wg

> RDA FAIR data maturity model WG – Case Statement

https://www.rd-alliance.org/group/fair-data-maturity-model-wg/case-statement/fair-data-maturity-model-wg-case-statement

RDA FAIR data maturity model WG – GitHub

https://github.com/RDA-FAIR/FAIR-data-maturity-model-WG

RDA FAIR data maturity model WG – Collaborative document

https://docs.google.com/spreadsheets/d/1gvMfbw46oV1idztsr586aG6-teSn2cPWe RJZG0U4Hg/edit#gid=0

> RDA FAIR data maturity model WG – Indicators prioritisation

https://docs.google.com/spreadsheets/d/1mkjElFrTBPBH0QViODexNur0xNGhJqau0zkL4w8RRAw/edit

> RDA FAIR data maturity model WG – Indicators prioritisation survey results

https://drive.google.com/open?id=11hyAYCKz_NVoOb9-vlPqjN9LCarOFmc3

➤ RDA FAIR data maturity model WG — Guidelines

https://docs.google.com/document/d/1pDGGL3-BbBJu18KlfZUI3AizKLHXGXdIi mPtpEWmeg/

RDA FAIR data maturity model WG – Mailing list

fair_maturity@rda-groups.org



Thank you!