

Results of an Analysis of Existing FAIR assessment tools

V0.02, created 13 March 2019, by the Editorial team

Background

This document was created as an initial product for the Research Data Allliance FAIR data maturity model working group. Comments were welcomed and collected through Github: https://github.com/RDA-FAIR/FAIR-data-maturity-model-WG/tree/master/results%20of%20preliminary%20analysis/v0.02

These comments were fed into the next phase of the development of a set of indicators.

Index

This document consists of slides listing the aspects broken down according to the dimensions:

- Findable
- Accessible
- Interoperable
- Reusable
- Beyond FAIR

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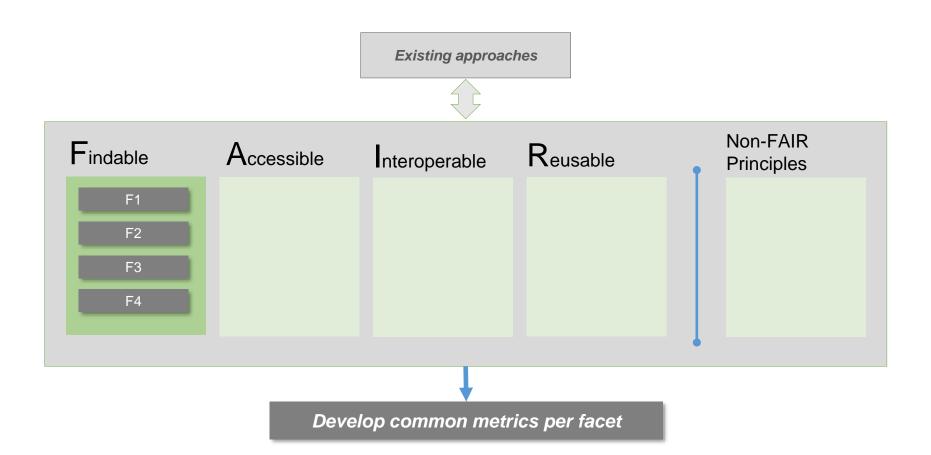




Findable

Analysis of existing approaches v0.02







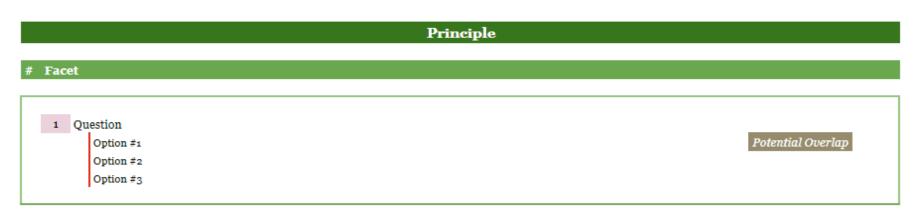
To be findable:

- 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



LEGEND

1	ANDS-NECTAR-RDS-FAIR data assessment tool	ARDC	[Link]
2	DANS-Fairdat	DANS	[Link]
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F1 (meta)data is assigned a globally unique and eternally persistent identifier

1 Does the dataset have any identifiers assigned?

No identifier

Web adress (URL)

Local identifier

2 Does the dataset have a persistent identifier (PID)?

No

Yes

3 Will your dataset have a Persistent Identifier after deposit?

No

Yes

4 Citable - denoted using a formal identifier

Not citeable

Local identifier

Web address (URL - not guaranteed stable)

Persistent web identifier (URI)

4 Citable - denoted using a formal identifier

Not citeable

Local identifier

Web address (URL - not guaranteed stable)

Persistent web identifier (URI)

- 5 Please provide the IRI for a registered identifier schema for your resource's IRI (e.g. DOI, HTTP)
- 5 Please provide the IRI to the document describing the persistence policy for the identifier of this (meta)data
- 7 Whether there is a scheme to uniquely identify the digital resource.
- 7 Whether there is a policy that describes what the provider will do in the event an identifier scheme becomes deprecated.

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9 Citation exists, including authorship, year, comprehensive title, persistent identifier (e.g. DOI) No Somewhat Yes 9 Persistent identification of the dataset and related work (related literature and data, authors, projects, terms) No Somewhat Yes 9 Citation exists, including authorship, year, comprehensive title, persistent identifier (e.g. DOI) Somewhat Yes 10 Are each data/dataset identified by an indexed and independant identifier? Never /NA If mandatory Sometimes Always 10 Are the data identifiers unique, global and persistent? Never /NA If mandatory Sometimes Always 10 Has any identifying schema been used for data (e.g. DOI) Never /NA If mandatory Sometimes Always 10 Are all datasets linked to an authority (legal entity) through a unique and persistent identifier over time (e.g. institution, association or established body): Never /NA If mandatory Sometimes Always 10 Are the metadata of each dataset linked to a unique authority (responsible for the datasets at a given time)? Never /NA If mandatory Sometimes Always





F2 data is described with rich metadata 2 How is the data described with metadata? The data is not described Brief title and description Comprehensively, but in a text-based, non standard format Comprehensively, using a recognized formal machine readable metadata schema 2 Please provide the IRI to a document that contains machine-readable metadata for the digital resource 2 Are the metadata accessible? F4, A2 No Yes 4 Described - tagged with metadata? No metadata Abstract and keywords Basic metadata (e.g. Dublin Core) Specialized metadata (e.g. Darwin Core, ISO 19115/19139, schema.org scientific data profile) Rich metadata using multiple standard RDF vocabularies (e.g. DCAT, PROV, ADMS, GeoDCAT, FOAF, ORG, GeoSPARQL) 7 The availability of machine-readable metadata that describes a digital resource. 9 Dataset is provided in a widely-used or community-accepted machine-readable format and using standard terminologies for nominal data and available No Somewhat Yes 10 Are the types and formats of data generated / collected well described? Never /NA If mandatory Sometimes Always 3 Did you provide rich additional documentation? No

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Yes



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9 Description of methods used to create this dataset are appropriate for the con-	ontext and discipli	ne
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No

Somewhat

Yes

10 Does the researcher use efficient and rich services to access data (various formats, visualisations, practical tools and systems adapted to different types of use an

Never /NA

If mandatory

Sometimes

Always

6 Data Quality Assurance

Data quality assurance (DQA) procedure unknown or none

Ad Hoc and random / DQA procedure not defined and documented

DQA procedure defined and documented and partially implemented

DQA procedure well documented, fully implemented and available online with master reference data / Limited data quality assurance metadata

DQA procedure monitored and reported / Conforming to community quality metadata & standards / External review

6 Data Integrity

Unknown or no data ingest integrity check

Data ingest integrity verifiable (e.g., checksum technology)

Data archive integrity verifiable

Data access integrity verifiable / Conforming to community data integrity technology standard

Data authenticity verifiable (e.g., data signature technology) / Performance of data integrity check monitored and reported

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11 Quality Assurance & Control

 X_4

Ad hoc or no data quality assurance (QA) & control (QC) procedure or information unknown.

 $\ensuremath{\mathsf{QA/QC}}$ procedure are defined, documented, and partially implemented.

QA/QC procedure are well-defined according to community best practices, documented and fully applied.

Previous + provision of error statistics published or tracked with results made available online and communicated to data providers; Procedure for user feedback, improveme

Previous + detailed analysis of errors and gaps at space-time unit level: (Station, grid-points, daily, monthly and or annual time-scale, etc.); QA/QC procedure monitored; Re

11 Data Integrity

Unknown or no data integrity check.

Random data integrity check.

Data integrity verified systematically but methodology not commonly known.

Data integrity systematically verified and following well known practices but not necessarily consistent across platforms.

All steps in data integrity check systematically verified and adhering to well-known practices.



F3 metadata clearly and explicitly includes the identifier of the data it describes

1 Is the dataset identifier included in all metadata records/files describing the data?

No

Yes

- 5 Please provide the IRI of the metadata
- 7 Whether the metadata document contains the globally unique and persistent identifier for the digital resource
- 10 Are the metadata linked to the dataset through a persistent identifier?

Never/NA

If mandatory

Sometimes

Always



F4 (meta)data is registered or indexed in a searchable resource

1	How acces	sible	is th	e data?

No access to metadata or data

Access to metadata only

Unspecified conditional access (e.g contact the data custodian for access)

Embargoed access after a specified date

A de -identified / modified subset of the data is publicly accessible

Publicly accessible

Fully accessible to persons who meet explicity stated questions (e.g. ethics approval for sensitive data)

2 Are the metadata accessible?

No

Yes

2 Is the dataset available for public access? (i.e. the restriction is only registration on a website before the person has access the data)

A1.1

No

Yes

3 Is the metadata publicly accessible?

No

Yes

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4 Findable - Indexed in a discovery system

No

Local or internal system only

Community wide or jurisdictional system

Highly ranked in general purpose index (Google, Bing etc)

- 5 Please provide the URL to a search engine, and the query that will be executed to discover your RESOURCE ID
- 7 The degree to which the digital resource can be found using web-based search engines
- 11 Discoverability

By personal contact only; Dataset information not discoverable.

Limited dataset information, such as scientific description of the methodology, in the literature.

Minimal catalogue-level metadata; Dataset searchable online.

Complete set of collection-level discovery metadata + minimal granular metadata.

Previous + available on an international catalogue, prominently displayed online and routinely updated.

12 Data Discoverability

Information not published for public discovery; Internal or person-to-person sharing information exchange only

Minimal product information published for public users; Product findable on local product website

Product described with standards-based discovery metadata and published to discovery catalogs

Previous + Metadata attributes included in HTML/other objects for indexing by web search engines (e.g., schema.org metadata); Product granules described with standards-

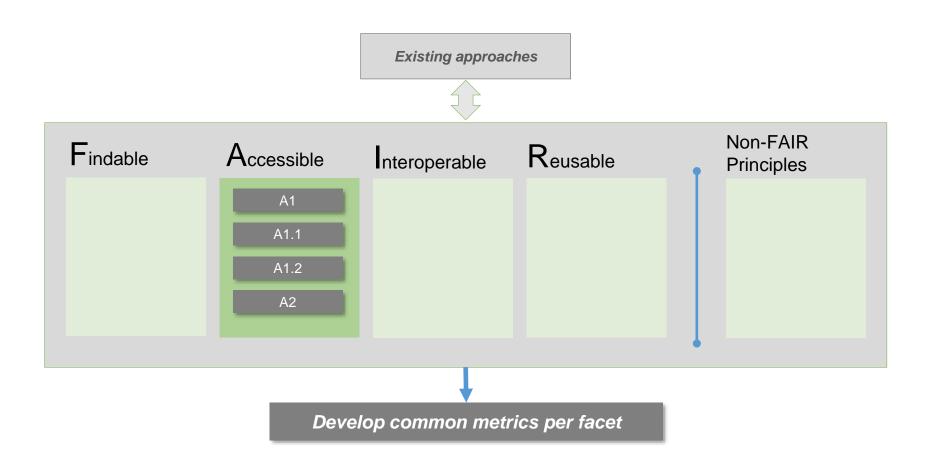
Previous + Web services supporting product are described with standards-based rich metadata and published to discovery catalogs a searchable resource; Product relationshi



Accessible

Analysis of existing approaches v0.02







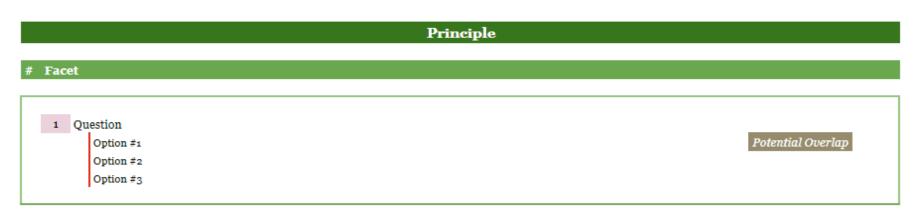
To be accessible

- A1. (meta)data is retrievable by their identifier using a standardised 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 is accessible, even when the data are no longer available



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A1 (meta)data is retrievable by their identifier using a standardised communications protocol

1 Is the data available online without requiring specialised protocols or tools once access has been approved?

No access to data

By individual arrengement

File download from online location

Non standard web service

Standard web service API

4 Published -Is the data accessible to users other than the creator or owner?

No

By individual arrangement

File download

Institutional or community repository

Bespoke web service (informal API)

Bespoke web service (OpenAPI/Swagger)

Standard web service API (e.g. OGC)

7 The nature and use limitations of the access protocol

. . .



- 7 The nature and use limitations of the access protocol
- 6 Accessibility

Not publicly available / Person-to-person

Publicly available / Direct file download (e.g., via anonymous FTP server) / Collection/dataset level searchable online

Non-standard data service Limited data server performance Granule/file level searchable Limited search metrics

Community-standard data service / Enhanced data server performance / Conforming to community search metrics / Dissemination report metrics defined and implemented

 $Dissemination\ reports\ available\ online\ /\ Future\ technology\ and\ standard\ changes\ planned$

11 Accessibility

Data not available publicly; Person-to-person contact needed.

Basic online services available for data access (e.g. FTP/HTTP direct download).

Non-standard data services.

Standard-based interoperability data services.

Previous + Full capability of sub-setting, aggregation and visualization.F7



A1.1 the protocol is open, free, and universally implementable

2 Is the dataset available for public access? (i.e. the restriction is only registration on a website before the person has access the data)

Yes

5 Please provide a URL to the description of the protocol.

5 Is the propotocol open (technical details are provided)?

FALSE

TRUE

5 Is the protocol free?

FALSE

TRUE

A1.2 the protocol allows for an authentication and authorization procedure, where necessary

Authorization is required to access the content of my RESOURCE ID

No

Yes

5 Please provide a IRI that resolves to a description of the process to obtain access to restricted content

7 Specification of a protocol to access restricted content.

10 In case of a non legal restricted access, is the restriction properly justified by the researcher?

Never /NA

If mandatory

Sometimes

Always



A2 metadata is accessible, even when the data are no longer available

1 Will the metadata record be available even if the data is no longer available?

No

Unsure

Yes

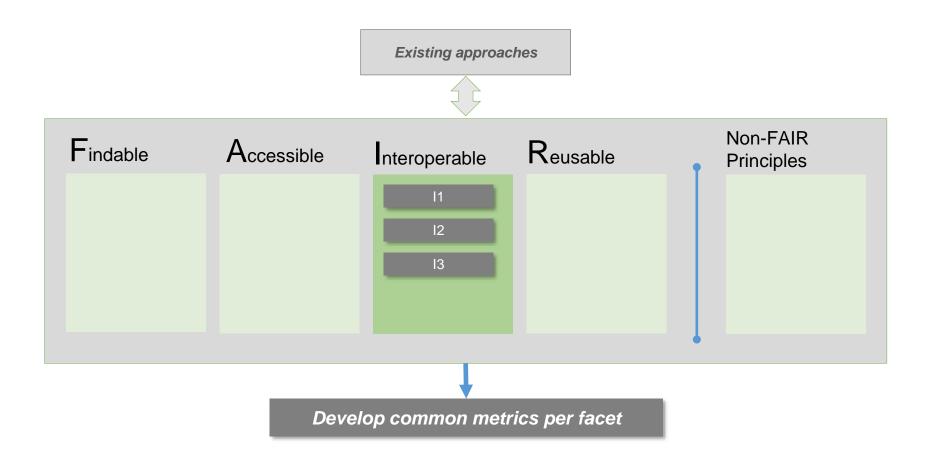
- 5 Please provide the URL to a metadata longevity plan
- The existence of metadata even in the absence/removal of data



Interoperable

Analysis of existing approaches v0.02







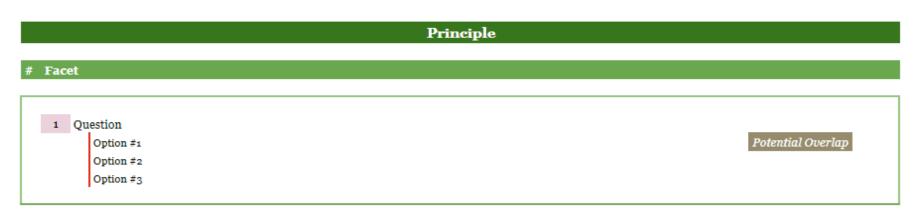
To be interoperable:

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



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I1 (meta)data uses a formal, accessible, shared, and broadly applicable language for knowledge representation

1 What (file) format(s) is the data available in?	
No access to data By individual arrengement	
File download from online location	
Non standard web service	
Standard Web Service API	
1 What best describes the types of vocabularies/ontologies/tagging schemas used to define the data elements?	
Data elements not described	
No standards have been applied in the description of data elements. Standardised vocabularies/ontologies/tagging schemas without global indentifiers	
Standardised open and universal using resolvable global identifiers linking to explanations	
Is the data file in a proprietary format? No Yes	
2 Are all of the data files in a proprietary format? No Yes	
2 Please indicate which of these statements is the most applicable to the dataset:	
Most of the data files are proprietary	
Around half of the data files are proprietary	
Few of the data files are proprietary None of the data files are proprietary, they are all in a preferred format	
	R1.3
3 Are the data stored and archived in preferred archival formats?	K1.3
Yes	
5 Please provide the URL to the specification of the language	

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7 Use of a formal, accessible, shared, and broadly applicable language for knowledge representation.
8 Will you be using common ontologies?
No
Yes
9 metadata includes community accepted keywords and/or terms associated with relevant standards or terminologies
No
Somewhat
Yes
10 Are standard vocabularies, thesaurus or ontologies used for all data types present in datasets, to enable interdisciplinary interoperability between well defined
Never /NA
If mandatory
Sometimes
Always
10 Are the interoperability criteria explained?
Never /NA
If mandatory
Sometimes
Always
11 Data Portability
Non-machine readable
Basic machine readable
Standards-based machine readable
Machine independent, self-describing, interoperable format
Previous + capability of providing user required format



12 (meta)data uses vocabularies that follow FAIR principles

3 Did you use standardized vocabulary?

No

Yes

4 Comprehensible - supported with unambiguous definitions for all internal elements

Local field codes or labels

Labels with full text explanations

Community standard labels (e.g. CF Conventions, UCUM units)

Some fields linked to externally managed definitions

All fields linked to standard, externally managed definitions

- 5 Please provide one or more (max 3) IRIs representing the vocabularies used within the (meta)data that is returned by resolving the RESOURCE ID
- 7 The metadata values and qualified relations should themselves be FAIR



(meta)data includes qualified references to other (meta)data

2 Is there extensive metadata and rich additional documentation available?

R1. R1.2

No

Yes

3 How is the metadata linked to other data and metadata (to enhance context and clearly indicate relationships)?

There are no links to metadata

The meta data records includes URI links to related metadata, data, definitions

Metadata is represented in a machine readable format e.g. in a linked data format such as RDF

4 Linked - to other data and definitions using public identifiers (e.g URIs)

No links

In-bound links from a catalogue or landing-page

Out-bound links to related data and definitions

- 5 Please provide the URL to a formal Linkset or copy/paste the content of a formal linkset that describes at least a portion of the content at RESC R1.2

- Relationships within (meta)data, and between local and third-party data, have explicit and 'useful' semantic meaning
- 11 Usage

No or weak citations in scientific publication in peer-review journal or as institutional reports.

Intermediate citations + referenced in institutional climate assessment reports (e.g., by NOAA).

Strong citations + referenced in national climate assessment reports (e.g., by USGCRP).

Previous + referenced in international climate assessment reports (e.g., by IPCC).

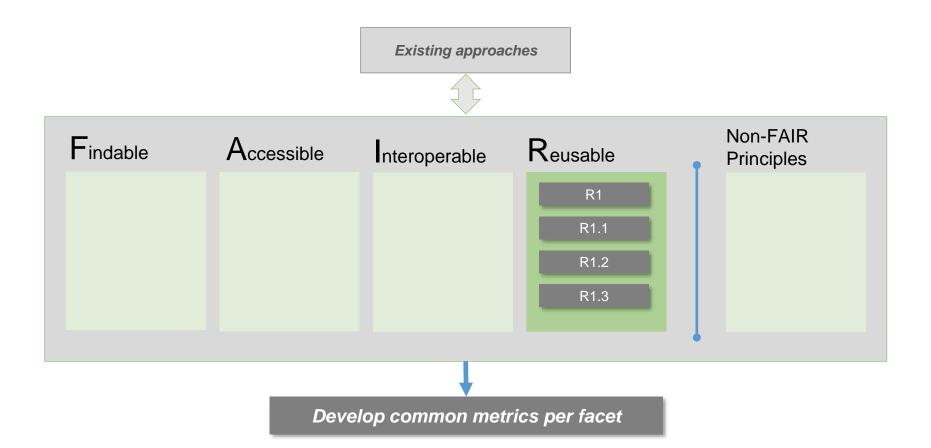
Previous + referenced in international decision/policy making published reports (e.g., by UNFCCC, UN-ISDR, World Bank, etc.).



Reusable

Analysis of existing approaches v0.02







To be reusable:

R1. meta(data) is richly described with a plurality of accurate and relevant attributes

R1.1. (meta)data is released with a clear and accessible data usage licence

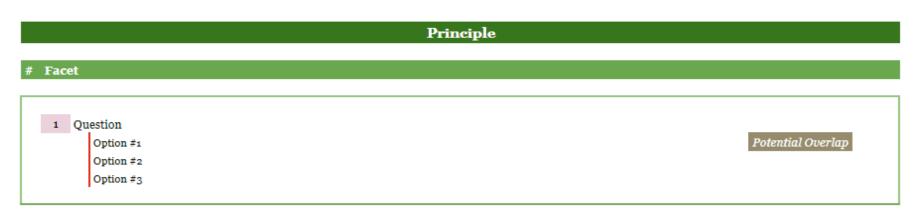
R1.2. (meta)data is associated with detailed provenance

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



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R1 meta(data) is richly described with a plurality of accurate and relevant attributes	
2 Is there sufficient metadata available? No Yes	
How is the data described with metadata? The data is not described Brief title and description Comprehensively, but in a text-based, non standard format Comprehensively, using a recognized formal machine readable metadata schema	F2
2 Is there extensive metadata and rich additional documentation available? No Yes	R1.2, I3
3 Did you provide enough information (metadata) about your data for others to understand and reuse your data? No Yes	
Granularity of data entities in dataset is appropriate in Respect of Meta-Data Granularity No Somewhat Yes	
Structure, size and MIME type of the dataset agrees with description of the dataset content No Somewhat Yes	

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9 Co	ntent of the dataset agrees with description of the dataset content
	No
	Somewhat
	Yes
9 Co	verage (spatial, temporal, or other dimensions) adequate
_	No
	Somewhat
	Yes
10 W	nich relevant actions have been undertaken by the researcher to enhance the data reuse potential
	Never /NA
	If mandatory
	Sometimes
	Always
10 Do	es the researcher provide information on methods and tools that permit the understanding, integrity, value and readability of data intended to be kept on the
_	Never /NA
	Sometimes
	Always
11 Do	cumentation
	Product information not publicly available online.
	Limited online documentation (e.g., User Guide).
	Document on how the data product was created and how to use it, is available online.
	Full documentation based on a standard template and available online.
	Previous + Online tutorial on using and analyzing the dataset; Complete production system information available online.

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12 Data Use

No use or usability metadata/documentation is available to help users understand and use the data

Use or usability metadata/documentation is available from local systems (e.g., product website)

Standard-based use/usability metadata/documentation is available from enterprise systems

Enterprise systems include online use/usability support services (online help, hints, etc.)

Enterprise systems include advanced use/usability support service such as interactive visualizations of relationships (e.g., to papers, other products, researchers, etc.)

11 Metadata

R1.2, R1.3

Metadata not publicly available and/or not usable.

Limited Metadata publicly available; Conforming to community-standard; Basic characteristics of dataset.

Previous + Conforming to international standards in most aspects; limited quality and provenance metadata.

Fully compliant with international standards; Rich metadata content; Basic granular-level metadata; Support dataset provenance.

Previous + complete granular-level metadata; Metadata QC-ed and Regularly updated



R1.1 (meta)data is released with a clear and accessible data usage licence

1 Which of the following best describes the license/usage rights attached to the data?	
No licence	
Non standard text based licence	
Non standard machine readable licence (e.g.clearly indicatingunder what conditions the data may be used)	
Standard text based licence	
Standard machine-readable licence (e.g. Creative Commons)	
2 Does the user license have any user restrictions for accessing the data?	
No	
Yes	
2 Does the dataset have a user license?	
No	
Yes	
3 Does the dataset have a usage licence?	
No	
Yes	
4 Licensed - conditions for re-use are available and clearly expressed	
No	
License described in text	
Link to a standard license (e.g. Creative Commons)	
5 Please provide the IRI for you usage license regarding the content returned from RESOURCE ID	
7 The existence of a license document, for BOTH (independently) the data and its associated metadata, and the ability to retrieve those documents	
9 Terms of usage (licenses, other conditions of reuse, data protection, ethical issues)	
No	
Somewhat	
Yes	



R1.2 (meta)data is associated with detailed provenance

	No provenance information is recorded	
	Partially recorded	
	Fully recorded in a text format	
	Fully recorded in a machine readable format	
is ti	here extensive metadata and rich additional documentation available?	R1,
	No	
ŀ	Yes	
Did	you give detailed provenance information for the data?	
	No	
1	Yes	
Γru	sted - accompanied by, or linked to, information about how the data has been used, by whom, and how many times	
	No information about usage	
	Usage statistics available	
	Clearly endorsed by reputable organization or framework	
Ass	essable - accompanied by, or linked to, a data-quality assessment and description of the origin and workflow that produced the data	
	No quality or lineage information	
	Text lineage statement	
	Formal provenance trace (e.g. PROV-O)	
	ase provide the IRIs (maximum 3) for the vocabularies being used to describe the provenance of the content resolved from RESOURCE ID	

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7 That there is provenance information associated with the data,

9 Citation exists, including authorship, year, comprehensive title, persistent identifier (e.g. DOI)

 F_1

No

Somewhat

Yes

10 Are the provenance and type of all data properly specified (origin of raw, primary, transformed, secondary..)

Never /NA

If mandatory

Sometimes

Always

8 How will you be making sure there is good provenance of the data analysis?

We use lab notebooks

We use an electronic lab notebook

We use other arrangements

6 Transparency / traceability

Limited product information available / Person-to-person

Product information available in literature

Algorithm Theoretical Basis Document (ATBD) & source code online / Dataset configuration managed (CM) / Unique Object Identifier (OID) assigned (dataset, documentation)

Operational Algorithm Description (OAD) online, OID assigned, and under CM

System information online / Complete data provenance online

11 Metadata

R1, R1.3

Metadata not publicly available and/or not usable.

Limited Metadata publicly available; Conforming to community-standard; Basic characteristics of dataset.

Previous + Conforming to international standards in most aspects; limited quality and provenance metadata.

Fully compliant with international standards; Rich metadata content; Basic granular-level metadata; Support dataset provenance.

Previous + complete granular-level metadata; Metadata QC-ed and Regularly updated



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

3 Are the data stored and archived in preferred archival formats?

 I_1

No

Yes

3 Do you make use of relevant community standards?

No

Yes

4 Loadable - represented using a common or community-endorsed (i.e. standard) format

Bespoke format (text, binary)

One standard format, denoted by a MIME-type

Multiple standard formats

4 Usable - structured using a discoverable, community-endorsed (standard?) schema or data model

No formal schema

Explicit schema or data model, formalized in DDL, XSD, DDI, RDFS, JSON-Schema, data-package or similar

Community-shared schema or data model, available from a standard location

5 Please provide the IRI that represents the certification from a recongized authority in your community or domain, indicating that the content of RESOURCE ID

- 7 Certification, from a recognized body, of the resource meeting community standards.
- 10 Do the data reuse control and data sharing arrangements meet the data protection and "local/national ethics requirements?

Never /NA

If mandatory

Sometimes

Always

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. . .

10 If relevant, has the researcher used valid and updated standards for data describing? If so, are the data standards and particularly versioning data standards re

Never /NA

If mandatory

Sometimes

Always

9 Additional metadata adequate to respective research domain (if applicable)

No

Somewhat

Yes

6 Usability

Extensive product-specific knowledge required / No documentation online

Non-standard data format / Limited documentation (e.g., user's guide) online

Community standard-based interoperable format & metadata / Documentation (e.g., source code, product algorithm document, processing or/and data flow diagram) online

Basic capability (e.g., subsetting, aggregating) & data characterization (overall/global, e.g., climatology, error estimates) available online

Enhanced online capability (e.g., visualization, multiple data formats) / Community metrics of data characterization (regional/cell) online / External ranking

11 Metadata

R1, R1.2

Metadata not publicly available and/or not usable.

Limited Metadata publicly available; Conforming to community-standard; Basic characteristics of dataset.

Previous + Conforming to international standards in most aspects; limited quality and provenance metadata.

Fully compliant with international standards; Rich metadata content; Basic granular-level metadata; Support dataset provenance.

Previous + complete granular-level metadata; Metadata QC-ed and Regularly updated

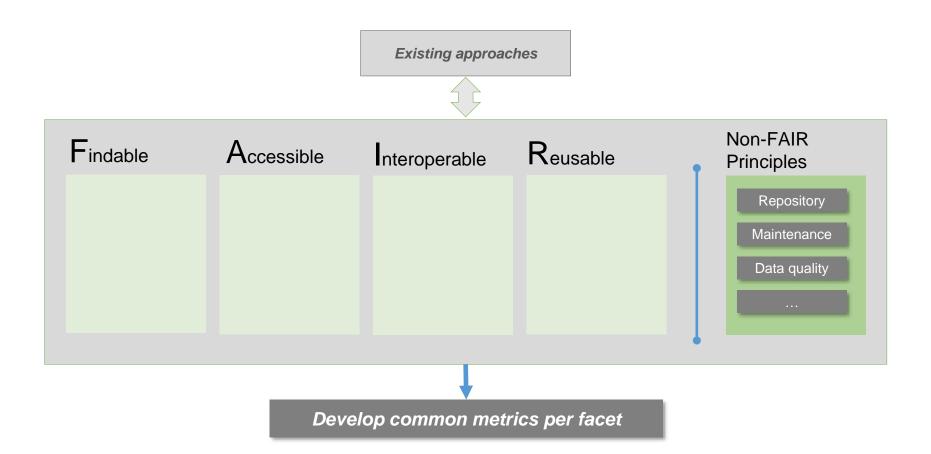


FAIR Principles

Beyond FAIR

Analysis of existing approaches v0.02







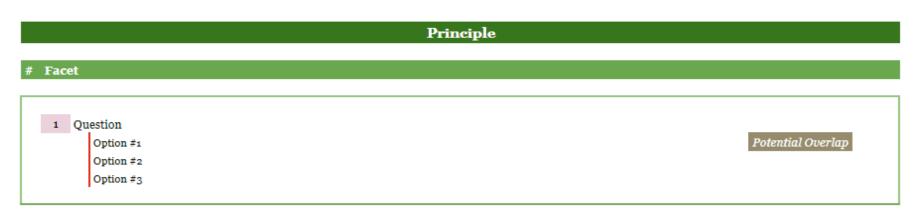
Non-FAIR Principles

Data repository
Curation and maintenance
Open data
Data quality
Others



LEGEND

1	ANDS-NECTAR-RDS-FAIR data assessment tool	ARDC	[Link]
2	DANS-Fairdat	DANS	[Link]
3	DANS-Fair enough?	DANS	[Link]
4	The CSIRO 5-star Data Rating tool	CSIRO	[<u>Link</u>]
5	FAIR Metrics Questionnaire	The FAIR Metrics Group	[Link]
6	Stewardship Maturity Mix	NOAA's CICS-NC, NOAA's NCDC	[Link]
7	FAIR Evaluator	GO FAIR, LUMC CBGP, IDS, OeRC, IQSS	[Link]
8	Data Stewardship Wizard	ELIXIR NL/CZ	[Link]
9	Checklist for Evaluation of Dataset Fitness for Use	Assessment of Data Fitness for Use WG (WDS/RDA)	[Link]
10	RDA-SHARC Evaluation	SHARC IG (RDA)	[Link]
11	WMO-Wide Stewardship Maturity Matrix for Climate Data	The SMM-CD WG	[Link]
12	Data Use and Services Maturity Matrix	The MM-Serv WG	[Link]





X1 Data repositiory

1 What type of repository or registry is the metadata record in ?
The data is not described in any repository
Local institutional repository
Domain-specific repository
Generalist public repository
Data is in one place but discoverable through several registries
3 Is the data repository you have chosen trustworthy
No No
Yes
9 Is dataset located within a CoreTrustSeal-certified repository?
No No
Yes
9 Is dataset located within a World Data System or Data Seal of Approval certified repository?
No
Yes
g Repository representative stipulates that structure, harmonization, completeness, and correctness of the dataset comports with typical data curation activities
No
Somewhat
Yes
10 Does the researcher use data repositories for the storage of data?
Never /NA
If mandatory
Sometimes
Always

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6 Preservability

Any storage location / Data only

Non-designated repository / Redundancy / Limited archiving metadata

Designated archive / Redundancy / Community-standard archiving metadata / Conforming to limited archiving standards

Conforming to community archiving standards

Archiving process / Performance controlled, measured and audited / Future archiving standard changes planned

11 Preservation

Any storage location; Data only; Data not backed up.

Non-designated repository; A backup copy of electronic data is made.

Designated archive; Basic retention policy publicly defined. Routine backups made, including offsite copy.

Previous + Conforming to community archiving standards. Comprehensive retention policy defined and implemented.

Previous + Archiving process performance controlled, measured, and audited; Future archiving standard changes planned.



X2 Curation and maintenance

4 Updated - part of a regular data collection program or series, with clear maintenance arrangements and update schedule

one-time dataset

part of series - occasional/irregular update

part of series - regular scheduled updates

4 Curated - commitment to ensuring the data is available long term

Once-off dump, no ongoing commitment

Best effort, project website

Public or institutional repository (e.g. CKAN, GitHub)

Certified repository

11 Governance

Responsibility is not defined; No person is assigned.

Responsible entity is identified; Accountability and competency are not well-defined.

 $Responsibility/accountability\ and\ compliance\ mechanisms\ are\ defined;\ Good\ competency;\ Processes\ established\ conforming\ to\ community\ standards$

Previous + Competency defined; Conforming to international standards; auditable.

Previous + Accountability and responsibility well defined and fully compliant with international standards; transparent; monitored and audited.

X3 Open data

3 FAIR enough, but also Open? Will your data be published as open as possible and as protected as necessary?

No

Yes

8 Will you be working with the philosophy 'as open as possible' for your data?

No

Yes



K4 Data quality

6 Data Quality Control / Monitoring

None or Sampling unknown or spotty / Analysis unknown or random in time

Sampling and analysis are regular in time and space / Limited productspecific metrics defined & implemented

Sampling and analysis are frequent and systematic but not automatic / Community metrics defined and partially implemented / Procedure documented and available online Anomaly detection procedure well-documented and fully implemented using community metrics, automatic, tracked and reported / Limited quality monitoring metadata

6 Data Quality Assessment

Algorithm/method/model theoretical basis assessed (methods and results online)

Research product assessed (methods and results online)

Operational product assessed (methods and results online)

Quality metadata assessed / Limited quality assessment metadata

Assessment performed on a recurring basis Conforming to community quality metadata & standards External ranking

11 Quality Assurance & Control

Ad hoc or no data quality assurance (QA) & control (QC) procedure or information unknown.

QA/QC procedure are defined, documented, and partially implemented.

QA/QC procedure are well-defined according to community best practices, documented and fully applied.

Previous + provision of error statistics published or tracked with results made available online and communicated to data providers; Procedure for user feedback, improvement Previous + detailed analysis of errors and gaps at space-time unit level: (Station, grid-points, daily, monthly and or annual time-scale, etc.); QA/QC procedure monitored; Re

11 Quality Assessment

Product quality assessment not done or done internally and information not available.

Assessed by Principal Investigator (PI) or data producer; Assessment results available online.

Previous + Product validation and evaluation done by PI published in peer-reviewed journal.

Previous + Independent product validation and evaluation published in peer-reviewed journal.

Previous + The complete product provenance is captured and publicly available.



X₅ Others

8 Will data interpretation and modeling require significant compute infrastructure capacity?

No

Yes

8 Will you be doing (automated) knowledge discovery?

No

Yes

11 Uncertainty Analysis

Uncertainty estimates not available.

Uncertainty estimates presented without explanation.

Uncertainty estimates presented with partial explanation.

Full uncertainty budget available with all assumptions; Estimates of accuracy of trend available.

Full uncertainty assessment published in peer reviewed journal.