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## D5.1 - Implementing metrics for automated FAIR digital objects assessment in a disciplinary context

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Lead Author (Org)	<b>Robert Huber (University of Bremen)</b>
Contributing Author(s) (Org)	<b>Maaïke Verburg (KNAW-DANS), Mike Priddy (KNAW-DANS), Hervé L'Hours (UKDS), Joy Davidson (DCC), Hannah Mihai (DeIC)</b>
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## TERMINOLOGY

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Terminology/Acronym	Description
ACDM	ARIADNE Catalogue Data Model
AUSSI-ESS	Australian Social Survey International-ESS
CARARE	CARARE Metadata Schema
CESSDA	Consortium of European Social Science Data Archives
CLARIN	Common Language Resources and Technology Infrastructure
CMD	Component MetaData
CMDI	Component MetaData Infrastructure
CMM	CESSDA Metadata Model
DC	Dublin Core
DANS-EASY	EASY is the online archiving system of Data Archiving and Networked Services
DCAT	Data Catalog Vocabulary
DDI	Data Documentation Initiative
DIDL	Digital Item Declaration Language
DOI	Digital Object Identifier
EAD	Encoded Archival Description
EDMI	EOSC Datasets Minimum Information
ELSST	the European Language Social Science Thesaurus
ETD-MS	Electronic Theses and Dissertations Metadata Standard
FIP	FAIR Implementation Profile
GESIS	GESIS – Leibniz-Institut für Sozialwissenschaften
HTTP	Hypertext Transfer Protocol
IMDI	ISLE Meta Data Initiative
MARC	Machine-Readable Cataloging
META-SHARE	Metadata Schema for the Description of Language Resources
METS	Metadata Encoding and Transmission Standard
MODS	Metadata Object Description Schema
NFDI	Nationale Forschungsdateninfrastruktur
LIDO	Lightweight Information Describing Objects
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
OLAC	Open Language Archives Community
PID	Persistent Identifier
RatSWD	Rat für Sozial- und Wirtschaftsdaten
SSH	Social Sciences and Humanities
SSHOC	Social Sciences & Humanities Open Cloud
TEI	Text Encoding Initiative
THESOU	Thesaurus Sozialwissenschaften

## Executive Summary

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FAIR-IMPACT aims to realise a FAIR EOSC using proven solutions, tools and methods developed during the FAIRsFAIR and other initiatives. One of the goals of the project is to enable the 'FAIRification' of different research objects such as datasets, software and semantic artefacts originating from a large range of scientific disciplines. This includes the provision and extension of FAIR assessment metrics and associated tools and their adoption to the needs and requirements of a variety of research communities. In particular FAIRsFAIR data object assessment metrics as well as the F-UJI tool are intended to become more disciplinary-context aware and to include more discipline-specific tests in cooperation with FAIR-IMPACT use case partners, domain data repositories, research infrastructures and e-infrastructures.

This deliverable provides the first set of discipline specific tests and metrics developed in cooperation with FAIR-IMPACT Social Sciences and Humanities (SSH) use case partners. We present an analysis of SSH community FAIR-aligned habits and practices carried out using available literature and whitepapers, data collected using standard interfaces provided by the community, as well as FAIR Implementation Profiles (FIPs) from a number of SSH data repositories. Based on this analysis we identified an appropriate SSH sub-community, the social sciences, for which we defined a set of discipline specific metrics and tests derived from the FAIRsFAIR data assessment metrics which are also presented in this deliverable.



# 1 Introduction

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## *Purpose*

During the FAIRsFAIR project<sup>1</sup>, 17 minimum viable metrics<sup>2</sup> were proposed to systematically measure the extent to which research data objects are FAIR using assessment tools which implement these metrics. The FAIRsFAIR metrics have been continuously improved through community review, the latest version (v.0.5) being published on April 14 2022. The metrics are based on the indicators proposed by the RDA FAIR Data Maturity Model Working Group<sup>3</sup>, in addition to prior work conducted by the project partners such as FAIRdat<sup>4</sup> and FAIREnough<sup>5</sup>, and the WDS/RDA Assessment of Data Fitness for Use checklist<sup>6</sup>.

These original assessment metrics were designed for discipline independent assessment and therefore only make very general reference to discipline-specific FAIR community practices. To enable assessment tools to perform discipline-specific FAIR assessments, they need to build on defined metrics that are sensitive to these contexts. Consequently, one of the objectives of the FAIR-IMPACT project is to extend and adapt the FAIRsFAIR data object assessment metrics and corresponding assessment tools to be more disciplinary-context aware and to include more discipline-specific tests. The definition of these metrics will be based on a co-created use case which involves social sciences and humanities (SSH) experts and will implement the SSH perspective in collaboration with the FAIR-IMPACT community use case partner CESSDA. The definition of these discipline-aware metrics and tests will be developed with use case partners, discipline-specific data repositories, research infrastructures, and e-infrastructures.

This document summarises the results of the use-case analysis and the corresponding proposed metrics for the identified target scientific community within the SSH community.

### **1.1 Scope and methodology**

Our methodology consists of the following main approaches:

1. We collected and analysed SSH publications, best-practice documents, and white papers that refer to FAIR implementation or to the fundamentals of the key FAIR principles. These are for example metadata or PID specifications or interoperability requirements.

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<sup>1</sup> FAIRsFAIR: Fostering FAIR Data Practices in Europe <https://fairsfair.eu/>

<sup>2</sup> Devaraju, Anusuriya; Huber, Robert, Mokrane, Mustapha, Herterich, Patricia, Cepinskas, Linas, de Vries, Jerry, L'Hours, Herve, Davidson, Joy, & Angus White. (2022). FAIRsFAIR Data Object Assessment Metrics (0.5). Zenodo. <https://doi.org/10.5281/zenodo.3775793>

<sup>3</sup> RDA FAIR Data Maturity Model Working Group (2020). FAIR Data Maturity Model: specification and guidelines. Research Data Alliance. DOI: 10.15497/RDA00050

<sup>4</sup> Research Data Journal - FAIR Data Review, [https://docs.google.com/forms/d/e/1FAIpQLSd8\\_pd2r2SniCVfCC3CHhEUHZzv2MTRC3RTh0S2YTvbVji87Q/viewform](https://docs.google.com/forms/d/e/1FAIpQLSd8_pd2r2SniCVfCC3CHhEUHZzv2MTRC3RTh0S2YTvbVji87Q/viewform)

<sup>5</sup> FAIREnough is currently no longer available. It was a checklist created by DANS for researchers who are planning to deposit their data in a repository, which covered FAIRness at different levels: the repository, the metadata, the dataset, and files or objects within a dataset.

<sup>6</sup> Austin, C.; Cousijn, H., Diepenbroek, M., Petters, J., Soares E Silva, M. (2019). WDS/RDA Assessment of Data Fitness for Use WG Outputs and Recommendations. DOI: 10.15497/rda00034

2. We investigated the current practice regarding availability and exchange of metadata based on technical interoperability. This included the analysis of metadata formats that are exchanged via community specific interfaces (here: OAI-PMH).
3. Based on the metadata analysis we assessed the FAIR homogeneity of the SSH community in order to more narrow down the target group for FAIR metrics to be developed, if necessary.
4. We collected structured and formalised information on the FAIR practices of individual data repositories and federations within this target group. For this purpose, we used FAIR Implementation Profiles (Table 1) which essentially provide highly standardised forms and templates to describe FAIR practices.
5. Based on the analysis of the target group FAIR habits, we then developed FAIR metrics for the target group.

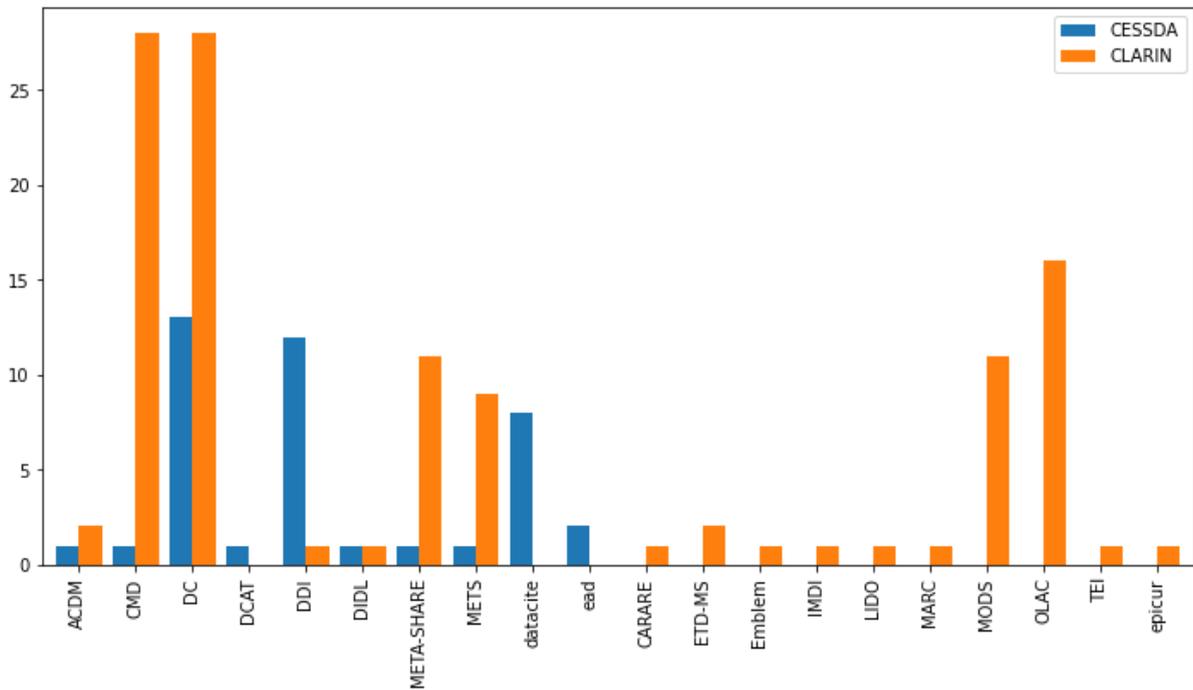
Our overall approach was to define community-specific metrics as an extension of the previously defined FAIRsFAIR metrics. To this end, we have focused on developing the principles and metrics for which we identified different community-specific FAIR habits only. This chosen focus allowed us to define distinct metrics and tests which clearly differ from the original discipline-agnostic FAIRsFAIR metrics. Thus, in individual cases, community-specific criteria may sometimes be stricter - or more lenient - than the discipline-agnostic FAIRsFAIR metrics and tests. These newly developed metrics should therefore be seen as a community specific supplement to the original FAIRsFAIR community-independent metrics. Thus community specific FAIR assessments should also include discipline agnostic metrics (e.g. in parallel) to ensure that FAIR datasets are also discoverable and usable outside their own community 'bubble'. Community specific metrics and tests should therefore be performed in parallel to the discipline agnostic ones.

### ***1.1.1 Analysis of metadata standards using exchange protocols***

We used publicly accessible metadata exchange interfaces based on the OAI-PMH<sup>7</sup> standard to analyse the current practice of metadata exchange in the SSH community. Our initial landscape analysis included the two largest SSH-specific research infrastructures in Europe CESSDA (social sciences ) and CLARIN (language resources). We identified twenty different metadata formats used by these RIs from this analysis.

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<sup>7</sup> Open Archives Protocol: <https://www.openarchives.org/pmh/>

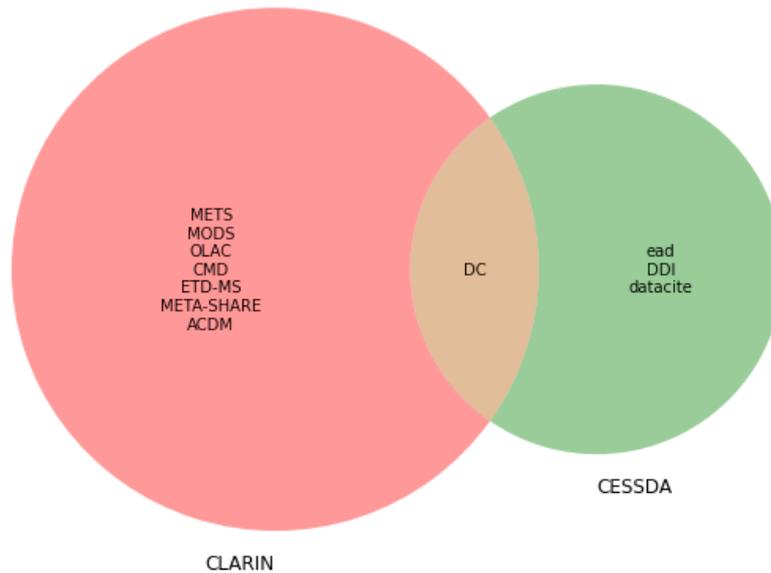


**Figure 1 - Number of metadata standards exposed by the investigated OAI-PMH endpoints of the CLARIN and CESSDA infrastructure.**

ACDM: ARIADNE Catalogue Data Model, CMD: Component MetaData, DC: Dublin Core, DCAT: Data Catalog Vocabulary, DDI: Data Documentation Initiative, DIDL: Digital Item Declaration Language, META-SHARE: Metadata Schema for the Description of Language Resources, METS: Metadata Encoding and Transmission Standard, datacite: DataCite Metadata Schema, ead: EAD (Encoded Archival Description), CARARE: CARARE metadata schema, ETD-MS: Electronic Theses and Dissertations Metadata Standard, Emblem: Emblem XML-Schema, IMDI: ISLE Meta Data Initiative, LIDO: Lightweight Information Describing Objects, MARC: Machine-Readable Cataloging, MODS: Metadata Object Description Schema, OLAC: Open Language Archives Community OLAC Metadata, TEI: Text Encoding Initiative, epicur: xepicur,

Seven out of 20 investigated standards are used by both Research Infrastructures which seems to indicate some overlap with respect to used metadata standards (Fig. 1). However, most of these shared standards are only used by a single data provider. There is only one metadata standard, namely Dublin Core<sup>8</sup>, which is used by more than one provider per infrastructure. However, Dublin Core is required by OAI-PMH as a minimum output and is not otherwise of particular relevance to the social sciences. The Venn diagram presented in Figure 2 clearly illustrates that, with the exception of Dublin Core, each community is using distinctly different sets of metadata standards. While the CESSDA community favours the use of the Data Documentation Initiative family of standards (DDI, 12 out of 14 endpoints) only one out of 34 data providers of CLARIN makes use of DDI. The CLARIN data provider community seems to favour the Component MetaData Initiative (CMDI) standard which is only used by a single provider of the CESSDA community.

<sup>8</sup> Dublin Core Specification: <https://www.dublincore.org/specifications/dublin-core/>



**Figure 2 - Venn diagram illustrating the weak overlap in metadata standards usage between CESSDA and CLARIN. The diagram shows metadata standards which are used by at least two data providers per Research Infrastructure. The discipline agnostic Dublin Core (DC) standard is the only commonly used.**

This lack of overlap in metadata standard usage illustrates how difficult it would be to develop common FAIR metrics for the entire SSH community. Such differences are also evident for other SSH disciplines such as archeology which, for example, provide large amounts of georeferenced data and have a strong overlap with natural sciences due to their high level of interdisciplinarity. Clear divisions between scientific disciplines have also been reported by the SSHOC community<sup>9</sup>.

We therefore decided to limit the target community for the development of the discipline-specific assessment metrics more narrowly. The initial focus of the project and the scope of the current deliverable was put on the social sciences, which is represented by CESSDA in FAIR-IMPACT.

### 1.1.2 FAIR community statements and documentation

Unfortunately, there is currently no published consensus on discipline-specific FAIR requirements. However, some supporting literature from European and national communities exists, which can help to define FAIR in a community-specific context. The German KonsortSWD has published a “*White Paper on implementing the FAIR principles for data in the Social, Behavioural, and Economic Sciences*”<sup>10</sup>, which recommend the use of the DDI metadata standard or discipline-agnostic standards which can be mapped to DDI which confirms our analysis of metadata exchange interfaces given above. A distinctive feature

<sup>9</sup> Broeder, Daan, Trippel, Thorsten, Degl'Innocenti, Emiliano, Giacomi, Roberta, Sanesi, Maurizio, Kleemola, Mari, Moilanen, Katja, Ala-Lahti, Henri, Jordan, Caspar, Alfredsson, Iris, L'Hours, Hervé, & Ďurčo, Matej. (2019). SSHOC D3.1 Report on SSHOC (meta)data interoperability problems (v1.0). Zenodo. <https://doi.org/10.5281/zenodo.3569868>

<sup>10</sup> <https://www.konsortswd.de/aktuelles/publikation/wp274-2020/>

seems to be the recommendation at the national level to use the da|ra metadata schema<sup>10</sup>. The paper recommends the use of OAI-PMH to exchange metadata with catalogues and search engines and explicitly mentions DDI controlled vocabularies<sup>11</sup>, CESSDA topic classification<sup>12</sup> and the European Language Social Science Thesaurus (ELSST)<sup>13</sup> as useful resources. These very specific indications of vocabularies makes it necessary to define community specific metrics for FAIR Principle I2 (semantic resources).

Another relevant document is the CESSDA Metadata Model (CMM)<sup>14</sup>, which gives clear guidelines on which metadata properties are mandatory when provided using the DDI metadata schema. These mandatory properties (translated as Dublin Core) are:

- creator (principal investigator)
- title
- identifier
- publisher
- abstract

In addition, the definition of the language for title and other texts is obligatory. Requiring the definition of language is a key difference between CMM and most data citation or data identification guidelines such as the EOSC Datasets Minimum Information (EDMI)<sup>15</sup>, the DataCite Metadata Schema<sup>16</sup> or the W3C Recommendation Data on the Web Best Practices<sup>17</sup>. This makes it necessary to define community-specific metrics for ‘rich metadata’ (FAIR F2) which address this social science preference.

### **1.1.3 Community input: FAIR Implementation Profiles**

In addition to the analysis of technical metadata exchange interfaces and community statements and documents, we asked representatives of the social sciences community to provide FAIR Implementation Profiles (FIPs)<sup>18</sup> which provide a highly formal, machine-readable way to map FAIR implementations of defined communities. At present it has proved difficult to discover many FIPs, perhaps because they remain relatively scarce, or have not yet been publicly shared. This will certainly improve in the future with the publication of FIPs as nanopublication via FAIR Connect<sup>19</sup>. To obtain information, we have had to directly contact organisations to create or share their information. Further

<sup>11</sup> <https://ddialliance.org/controlled-vocabularies>

<sup>12</sup> <https://vocabularies.cessda.eu/vocabulary/TopicClassification>

<sup>13</sup> <https://elsst.cessda.eu/>

<sup>14</sup> Akdeniz, Esra, & Moilanen, Katja. (2023). CMM CESSDA Metadata Model (3.0). Zenodo. <https://doi.org/10.5281/zenodo.7528240>

<sup>15</sup> Asmi, A.; B. Cordewener, C. Goble, D. Castelli, E. Kühn, F. Pasian, F. Niccolucci, et al. 2017. “D6.6: 2nd Report on Data Interoperability.” EOSCPilot. <https://ec.europa.eu/research/participants/documents/downloadPublic?documentId=080166e5bbdb1165&appId=PPGMS>.

<sup>16</sup> DataCite Metadata Working Group. 2019. “DataCite Metadata Schema Documentation for the Publication and Citation of Research Data. Version 4.3.” DataCite e.V. 2019. <https://doi.org/10.14454/7xq3-zf69>.

<sup>17</sup> Lóscio, B. F., C. Burle, and N. Calegari. 2017. “Data on the Web Best Practices.” W3C Recommendation. The World Wide Web Consortium (W3C). <https://www.w3.org/TR/dwbp>.

<sup>18</sup> Schultes, E.; Magagna, B., Hettne, K.M., Pergl, R., Suchánek, M., Kuhn, T. (2020). Reusable FAIR Implementation Profiles as Accelerators of FAIR Convergence. In: Grossmann, G., Ram, S. (eds) Advances in Conceptual Modeling. ER 2020. Lecture Notes in Computer Science(), vol 12584. Springer, Cham. [https://doi.org/10.1007/978-3-030-65847-2\\_13](https://doi.org/10.1007/978-3-030-65847-2_13)

<sup>19</sup> FAIR Connect <https://fairconnect.pro/about>

developments and encouragement to increase the production and sharing of FIPs would be of great benefit to the community and help realise the initial goal of the FIPs: to allow widespread reuse and accelerate convergence by means of well-tested and trusted information on FAIR implementation.

In cooperation with the project partners, WorldFAIR<sup>20</sup> and ODISSEI<sup>21</sup> project, we collected five FIPs provided by social sciences related data archives mainly from the CESSDA community but also from the German QualiService as well as one from CLARIN. These FIPs provide valuable information to define FAIR metrics beyond metadata standards. Table 1 presents the relevant information that has been extracted from all FIPs to inform the development of the social science discipline-specific metrics.

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<sup>20</sup> <https://worldfair-project.eu/>

<sup>21</sup> <https://odissei-data.nl/en/>



**Table 1 - Overview of main results relevant for community-specific FAIR assessment metrics as provided by the social science community via FAIR Implementation Profiles**

FIP Link	Community	Source	PID	Metadata schema	Registry Catalogue	Metadata protocol s.i.	Linked data	Data format	Vocabularies	License
<a href="https://ip.wizard.de/wizard.org/projects/4867f80e-c9f2-4452-b007-0175c73d474e">https://ip.wizard.de/wizard.org/projects/4867f80e-c9f2-4452-b007-0175c73d474e</a>	SSSR (Social Science Survey Research) GESIS	ODISSEI	DOI	DDI, DARA	DARA, GESIS	OAI-PMH			THESOZ, ELSST	CC
<a href="https://ip.wizard.de/wizard.org/projects/4d584646-b77b-46c5-#f65-059a495d1393">https://ip.wizard.de/wizard.org/projects/4d584646-b77b-46c5-#f65-059a495d1393</a>	SocEduDL	ODISSEI	DOI	DDI, DataCite	Google, Google DS, GESIS	REST, DOIP	JSON, RDF	DDI	THESOZ	CC
<a href="https://docs.google.com/presentation/d/1wR2X5h8v0vG5OR2J8WQ_7217_48153Z04Hm0mFAH8U/edit?usp=sharing">https://docs.google.com/presentation/d/1wR2X5h8v0vG5OR2J8WQ_7217_48153Z04Hm0mFAH8U/edit?usp=sharing</a>	DANS Social Sciences (CESSDA)	FAIR-IMPACT	DOI, ORCID	DC, Dataverse Citation metadata, DDI, CMM	Google DS, BZFIND, OpenAIRE, CESSDA, ODISSEI	OAI-PMH, REST	xml, html, JSON		Dataverse, ISO, DC, ELSST, CESSDA, DDI	CC
<a href="https://ip.wizard.de/wizard.org/projects/016455-1601-4024-9357d8758d508e">https://ip.wizard.de/wizard.org/projects/016455-1601-4024-9357d8758d508e</a>	QualiService	FAIR-IMPACT	DOI	DDI3.2, DARA, DataCite, DC, schema.org	Google DS, BZFIND, OpenAIRE, PNAGAEA	OAI-PMH	XMLS, SKOS	TEI, QDA	THESOZ, ELSST, MESH, CESSDA Topics,	CC, Qualiservice license
<a href="https://docs.google.com/presentation/d/1WU7V7C0VW4R6G41W_sARH8P4H4m_s0ppaB0u/edit?usp=sharing">https://docs.google.com/presentation/d/1WU7V7C0VW4R6G41W_sARH8P4H4m_s0ppaB0u/edit?usp=sharing</a>	UKDS (CESSDA)	FAIR-IMPACT	DOI, ORCID	DDI2.5, DataCite	CESSDA, Qualibank, NESSTAR	OAI-PMH	SKOS		HASSET, CESSDA-VS	CC, OGL, OPL, Bespoke, UKDS
<a href="https://doi.org/10.5281/zenodo.7599163">https://doi.org/10.5281/zenodo.7599163</a>	AUSS-ESS	WorldFAIR	DOI	DDI2.1, DataCite	ADA Dataverse	REST	JSON, XMLS	SPSS, STATA, SAS, R, CSV	DDI, CESSDA	CC-0
<a href="https://doi.org/10.5281/zenodo.7599163">https://doi.org/10.5281/zenodo.7599163</a>	ESS (Sikt)	WorldFAIR	DOI, URN	DDI3.3	EOSC Portal, Collectica	HTTPS	JSON		DDI, CESSDA, ELSST, ISO3166-1, ISO639-2, ISO008, NUTS	CC

The majority of FAIR enabling resources used by the social science community are no different from those used outside the community. For example, Digital Object Identifiers (DOIs) are most often used to uniquely identify datasets, Creative Commons licences are often used, and HTTP(S) based protocols are preferred. With respect to metadata exchange, the community seems to favour OAI-PMH, which is mentioned in three out of eight FIPs, in addition, DANS Social Sciences currently uses DANS-EASY which offers OAI-PMH<sup>22</sup>, AUSSI-ESS uses Dataverse which also provides an OAI interface. Therefore, OAI-PMH seems to be the generally preferred protocol to make metadata available to catalogues or search engines. For CEESDA OAI-PMH is the recommended interface<sup>23</sup>.

As shown in Table 1, the list of metadata schemas confirms a preference for the use of DDI by the social sciences community. Again, in Germany the use of da|ra metadata schema (SSSR GESIS FIP, QualiService FIP) seems to be a distinctive national feature. Regarding semantic resources, there are clear preferences in the social sciences for a comparatively small number of vocabularies in use (THESOZ<sup>24</sup>, CEESDA: CEESDA Vocabulary Service<sup>25</sup>, ELSST).

## 1.2 Analysis conclusions

As mentioned earlier, based on the OAI-PMH metadata analysis, we decided to narrow the target community for the development of the discipline-specific assessment metrics to the social sciences, which are primarily represented by CEESDA in the FAIR-IMPACT project. The further analysis presented above using FAIR Implementation Profiles as well as FAIR documentation shows that there may well be finer grained ways of looking at FAIR. For example, there may be slightly different or complementary FAIR implementations within national associations (e.g. RatSWD), as illustrated by the recommendation of the da|ra schema, which is widely used in Germany. These national FAIR agreements and interpretations may pose a major challenge to the scalability of a recently required FAIR governance, as they could potentiate the number of possible FAIR metrics<sup>26</sup>. However, despite some national distinctive features with respect to FAIR implementations, our analysis clearly indicates community-specific FAIR habits associated with some, but not all, FAIR principles; the specification of social sciences-specific FAIR metrics should focus only on those. Therefore, metadata-specific and vocabulary-specific metrics need to be further specified, as well as the licence information. This implicates the following of the original, discipline-agnostic FAIRsFAIR metrics:

- FsF-F2-01M (Metadata includes descriptive core elements to support data findability);

<sup>22</sup> The DANS Social Science data is in transition from the DANS-EASY environment to a Data Station environment (based on Dataverse). The FIP information provided for this deliverable contains information for both environments, as far as it is known for the new environment already.

<sup>23</sup> <https://datacatalogue.ceesda.eu/documentation/providing-oai-pmh.html>

<sup>24</sup> The Thesaurus for the Social Sciences (TheSoz) is a Linked Dataset in SKOS format <https://lod.gesis.org/thesoz/en/>

<sup>25</sup> The CEESDA Vocabulary Service enables users to discover, browse, and download controlled vocabularies in a variety of language <https://www.ceesda.eu/Tools/Vocabulary-Service>

<sup>26</sup> EOSC Task Force on FAIR Metrics and Data Quality: Community-driven Governance of FAIRness Assessment

<https://www.eosc.eu/sites/default/files/2023-01/Community-driven%20Governance%20of%20FAIRness%20Assessment.pdf>

- FsF-F4-01M (Metadata is offered in such a way that it can be retrieved by machines);
- FsF-I1-02M (Metadata uses semantic resources);
- FsF-R1.3-01M (Metadata follows a standard recommended by the target research community of the data);
- FsF-R1.1-01M (Metadata includes licence information under which data can be reused).

The next section presents the initial draft of these new discipline-specific metrics. This draft will be distributed to the SSH community requesting their review and comment using the FAIR-IMPACT homepage feedback mechanism. We will further distribute the draft via our CESSDA use case partners and national contacts such as NFDI. In an iterative process, we will then try to reach consensus within this group based on suggested changes.

## 2 FAIR Metrics for the social sciences community

### 2.1 Metrics syntax

In the following sections we will use the same notation for the identification of discipline-agnostic metrics as already defined for the FAIRsFAIR metrics<sup>27</sup>, followed by a community-specific or discipline-specific appendix indicator. The FAIRsFAIR metrics are identified according to the following naming convention: the identifier starts with the shortened form of the project’s name (FsF), followed by the related FAIR principle identifier (a letter and one or more numbers, based on the original principle listing coined in Wilkinson et al (2016)<sup>28</sup>, and a local identifier to distinguish multiple metrics per principle. This local identifier is followed by either a ‘D’, ‘M’, or ‘MD’ to distinguish the resource that will be evaluated based on the metric, i.e., data, metadata, or both. The community-specific metrics will be assigned an appendix to this original metric syntax to indicate which community this metric targets. This will usually be expressed in a two or three letter code. For the social sciences community, we will use ‘ss’ as the appendix.

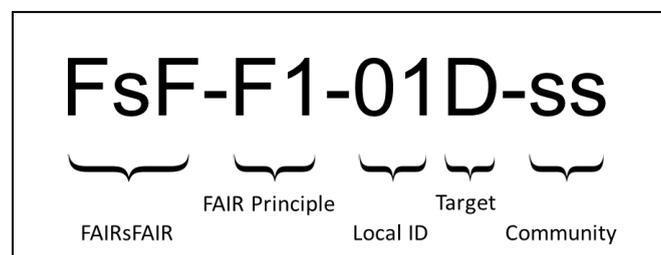


Figure 3 - Anatomy of FAIRsFAIR community metric identifier.

<sup>27</sup> Devaraju, Anusuriya; Huber, Robert, Mokrane, Mustapha, Herterich, Patricia, Cepinskas, Linas, de Vries, Jerry, L'Hours, Herve, Davidson, Joy, & Angus White. (2022). FAIRsFAIR Data Object Assessment Metrics (0.5). Zenodo. <https://doi.org/10.5281/zenodo.3775793>

<sup>28</sup> Wilkinson, M.; Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>

## 2.2 Draft FAIR metrics for the social sciences

The tables below depict all 17 FAIR assessment metrics for digital objects, their identifier, name, and description. As described in the previous section, the identifier syntax indicates whether this metric is or is not specific to the social sciences. For metrics that will remain unchanged from the original FAIRsFAIR metrics, a brief description is shared on why we did not see a need for community-specific supplements to the metric. For metrics that are community-specific, a more extensive table is inputted in line with the original discipline-agnostic metrics. This full table consists of a more thorough description, background information, the related FAIR principle, and related Requirements from the CoreTrustSeal Requirements for Trustworthy Digital Repositories<sup>29</sup>. Assessment information is also presented, indicating which requirement(s) the metric has and the method of assessing the metric. Comments are also added to these metrics to indicate related resources and/or known limitations and constraints.

### Globally Unique Identifier

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-F1-01D
<b>Metric Name</b>	<b>Data</b> is assigned a globally unique identifier.
<b>Description</b>	Since there are no social sciences discipline-specific requirements with respect to globally unique identifiers, FsF-F1-01D is to be applied here.  See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a>

### Persistent Identifier

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-F1-02D
<b>Metric Name</b>	<b>Data</b> is assigned a persistent identifier.
<b>Description</b>	Since there are no social sciences discipline-specific requirements with respect to persistent identifiers, FsF-F1-02D is to be applied here.  See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a>

### Descriptive Core Metadata

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-F2-01M-ss
<b>Metric Name</b>	<b>Metadata</b> includes descriptive core elements relevant for the social sciences to support data findability.

<sup>29</sup> CoreTrustSeal Trustworthy Data Repositories Requirements <https://www.coretrustseal.org/why-certification/requirements/>

<b>Description</b>	Metadata is descriptive information about a data object. Since the metadata required differs depending on the users and their applications, this metric focuses on core metadata. The social science community has defined specific requirements for core metadata and the individual content to be described with it defined in the CESSDA Metadata Model (CMM) <sup>30</sup> . These are community-specific with respect to certain properties but coincide to a large extent with discipline-agnostic specifications such as common data citation guidelines (e.g., DataCite <sup>31</sup> , ESIP <sup>32</sup> , and IASSIST <sup>33</sup> ), and metadata recommendations for data discovery (e.g., EOOSC Datasets Minimum Information (EDMI) <sup>34</sup> , DataCite Metadata Schema, W3C Recommendation Data on the Web Best Practices and Data Catalog Vocabulary).
<b>Background</b>	Following the CESSDA Metadata Model (CMM), necessary metadata properties (translated as Dublin Core) are <i>creator (principal investigator), title, identifier, publisher, abstract (summary)</i> . This differs somehow from commonly accepted data citation guidelines, recommendations for data discovery and core metadata definition and the corresponding FsF-F2-01M core metadata properties which include <i>creator, title, (publication-) date, publisher, identifier</i> . In addition the CMM requires the definition of the <i>language</i> for title and other texts. <b>Core descriptive metadata for social sciences data</b> are therefore <i>creator (principle investigator), title, identifier, publisher, abstract (summary) and language</i> .
<b>FAIR Principle</b>	F2. Data are described with rich metadata
<b>CoreTrustSeal Alignment</b>	Discovery & Identification R12. The repository enables users to discover the digital objects and refer to them in a persistent way through proper citation.
<b>ASSESSMENT</b>	
<b>Requirement(s)</b>	Data identifier (IRI, URL) Machine-accessible and readable metadata
<b>Method</b>	Use the data identifier to access its metadata document. Parse or retrieve core metadata, e.g., through one or more options below, combine the results and then verify presence/absence of the core elements in the metadata. Structured data embedded in the landing page of the identifier (e.g., Schema.org, Dublin Core meta tags or RDFa metadata) Typed Links in the HTTP Link header leading to DDI or compatible metadata; for more information, see <a href="https://signposting.org/conventions/">https://signposting.org/conventions/</a> Content negotiation (including external negotiation services offered by PID providers) to retrieve DDI metadata or a compatible standard.  Check if metadata is available via common methods at all. Check if core descriptive metadata is available.
<b>COMMENTS</b>	

<sup>30</sup> Akdeniz, Esra, & Moilanen, Katja. (2023). CMM CESSDA Metadata Model (3.0). Zenodo. <https://doi.org/10.5281/zenodo.7528240>

<sup>31</sup> DataCite Metadata Working Group. 2019. "DataCite Metadata Schema Documentation for the Publication and Citation of Research Data. Version 4.3." DataCite e.V. 2019. <https://doi.org/10.14454/7xq3-zf69>

<sup>32</sup> ESIP Data Preservation and Stewardship Committee. 2019. "Data Citation Guidelines for Earth Science Data, Version 2." ESIP. <https://doi.org/10.6084/m9.figshare.8441816.v1>

<sup>33</sup> <https://iassistdata.org/community/data-citation-ig/data-citation-resources/>

<sup>34</sup> Asmi, A., B. Cordewener, C. Goble, D. Castelli, E. Kühn, F. Pasian, F. Niccolucci, et al. 2017. "D6.6: 2nd Report on Data Interoperability." EOSCPilot. <https://ec.europa.eu/research/participants/documents/downloadPublic?documentId=080166e5bbdb1165&appId=PPGMS>



**Related Resources**

- DDI Alliance metadata standards definitions <https://ddialliance.org/>
- RatSWD FAIR white paper, [https://www.konsortswd.de/wp-content/uploads/RatSWD\\_WP\\_274.pdf](https://www.konsortswd.de/wp-content/uploads/RatSWD_WP_274.pdf)
- CESSDA metadata model, <https://www.cessda.eu/Training-Resources/Resource-crd-2592>

**Known Limitations/Constraints**

The assessment assumes that the identifier resolves to a landing page (e.g., html) that contains the metadata of the data. Landing page may not necessarily be an html page.  
 The metadata records maintained by a data provider might not be accessible, due to, e.g., broken link of the landing page, proprietary metadata standard used, and restricted metadata.

### *Inclusion of Data Identifier in Metadata*

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-F3-01M
<b>Metric Name</b>	<b>Metadata</b> includes the identifier of the data it describes.
<b>Description</b>	Since there are no social sciences discipline-specific requirements with respect to inclusion of data identifiers in metadata, FsF-F3-01M is to be applied here.  See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a>

### *Searchable Metadata*

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-F4-01M-ss
<b>Metric Name</b>	<b>Metadata</b> is offered in such a way that it can be retrieved by machines for social sciences catalogues.
<b>Description</b>	This metric refers to ways through which the metadata of data is exposed or provided in a standard and machine-readable format. In Europe, the social sciences community catalogues largely rely on the availability of the standard metadata exchange protocol OAI-PMH. Such interfaces are e.g. used by GESIS and CESSDA portals and therefore relevant for the social sciences. Therefore, metadata should be made available via OAI-PMH for the social sciences community.
<b>FAIR Principle</b>	F4. (Meta)data are registered or indexed in a searchable resource
<b>CoreTrustSeal Alignment</b>	Discovery & Identification R12. The repository enables users to discover the digital objects and refer to them in a persistent way through proper citation.
<b>ASSESSMENT</b>	
<b>Requirement(s)</b>	<ul style="list-style-type: none"> <li>Data identifier (IRI, URL) ideally a DOI which links to an associated re3data entry</li> <li>OAI-PMH endpoint</li> </ul>
<b>Assessment</b>	The following methods may be applied to determine if metadata of the data is accessible programmatically: <ul style="list-style-type: none"> <li>Check if a OAI endpoint is listed in the re3data registry for the given data provider based on the DOI</li> </ul>



	<ul style="list-style-type: none"> <li>• Check if the OAI endpoint returns metadata records</li> </ul>
<b>COMMENTS</b>	
<p><b>Known Limitations/Constraints</b></p> <ul style="list-style-type: none"> <li>• *OAI-PMH identifiers used in the GetRecord method are <i>not</i> that of a <i>resource</i>, further the oai-identifier syntax is different from the URI syntax. Therefore a GetRecord call using a DOI will not necessarily retrieve the correct dataset or record. See: <a href="http://www.openarchives.org/OAI/openarchivesprotocol.html#UniqueIdentifier">http://www.openarchives.org/OAI/openarchivesprotocol.html#UniqueIdentifier</a></li> </ul>	

### Data Access Information

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-A1-01M
<b>Metric Name</b>	<b>Metadata</b> contains access level and access conditions of the data.
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to data access information, FsF-A1-01M is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>

### Standard Communication Protocol of Metadata

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-A1-02M
<b>Metric Name</b>	Metadata is accessible through a standardised communication protocol
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to standard communication protocol of metadata, FsF-A1-02M is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>

### Standard Communication Protocol of Data

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-A1-03D
<b>Metric Name</b>	Data is accessible through a standardised communication protocol
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to standard communication protocol of data, FsF-A1-03D is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>

### Formal Representation of Metadata



FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-I1-01M
<b>Metric Name</b>	<b>Metadata</b> is represented using a formal knowledge representation language.
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to formal representation of metadata, FsF-I1-01M is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>

### *Metadata with Semantic Resources*

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-I2-01M-ss
<b>Metric Name</b>	<b>Metadata</b> uses semantic resources relevant for the social sciences research community.
<b>Description</b>	<p>Metadata should incorporate controlled terms from community-specific semantic resources that unambiguously describe the contents so they can be processed automatically by machines.</p> <p>Semantic resources registered in community catalogues (CESSDA and GESIS vocabulary services) relevant for the social sciences community should be preferred, these include e.g. the CESSDA Topic Classification, THESOZ, ELST.</p>
<b>FAIR Principle</b>	I2. (Meta)data use vocabularies that follow FAIR principles
<b>CoreTrustSeal Alignment</b>	Reuse R13. The repository enables reuse of the digital objects over time, ensuring that appropriate information is available to support understanding and use.
<b>ASSESSMENT</b>	
<b>Requirement(s)</b>	<ul style="list-style-type: none"> <li>• Data identifier (IRI, URL)</li> <li>• Optionally a metadata provision endpoint (SPARQL endpoint)</li> <li>• Machine-accessible and readable metadata</li> <li>• Community registry of semantic resources</li> </ul>
<b>Assessment</b>	<p>This assessment is the continuation of the assessment <a href="#">FsF-I1-01M</a>, but focuses on the metadata contents.</p> <ul style="list-style-type: none"> <li>• Extract namespaces declared from the machine-actionable metadata document. Filter out common namespaces (e.g., rdf, rdfs, xsd, owl).</li> <li>• Compare the remaining namespaces with entries from existing (known) ontology registries (see examples listed in Related Resources).</li> </ul>
<b>COMMENTS</b>	
<p><b>Related Resources</b></p> <ul style="list-style-type: none"> <li>○ CESSDA Vocabulary Service, <a href="https://vocabularies.cessda.eu/">https://vocabularies.cessda.eu/</a></li> <li>○ GESIS controlled vocabulary service, <a href="https://lod.gesis.org/de/">https://lod.gesis.org/de/</a></li> </ul> <p><b>Known Limitations/Constraints</b></p>	

- Currently available catalogues of semantic resources do not yet have a commonly accepted API or exchange protocol which requires dedicated tools to retrieve information about listed semantic resources.

### Links to Related Entities

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-I3-01M
<b>Metric Name</b>	<b>Metadata</b> includes links between the data and its related entities.
<b>Description</b>	Since there are no social sciences discipline-specific requirements with respect to links to related entities, FsF-I3-01M is to be applied here.  See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a>

### Metadata of Data Content

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-R1-01MD
<b>Metric Name</b>	<b>Metadata</b> specifies the content of the data.
<b>Description</b>	Since there are no social sciences discipline-specific requirements with respect to metadata of data content, FsF-R1-01MD is to be applied here.  See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a>

### Data Usage Licence

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-R1.1-01M-ss
<b>Metric Name</b>	<b>Metadata</b> includes licence information under which data can be reused within the scope of social sciences.
<b>Description</b>	This metric evaluates if data is associated with a licence preferred by the social sciences community because otherwise users cannot reuse it in a clear legal context. Within the social sciences, the CreativeCommons family of licences is most frequently used and therefore required.  It is highly recommended to use a standard, machine-readable licence such that it can be interpreted by machines and humans. In order to inform users about what rights they have to use a dataset, the licence information should be specified as part of the dataset's metadata.
<b>FAIR Principle</b>	R1.1. (Meta)data are released with a clear and accessible data usage licence
<b>CoreTrustSeal Alignment</b>	Rights Management R02. The repository maintains all applicable rights and monitors compliance.
<b>ASSESSMENT</b>	
<b>Requirement(s)</b>	Data identifier (IRI, URL) Machine-accessible and readable metadata

<b>Assessment</b>	<p>Use the data identifier to access its metadata document.</p> <p>Verify the presence/absence of metadata element(s) corresponding to licence information of the data.</p> <p>Verify that the format of the licence information is in accordance with the requirements of CreativeCommons.</p>
<b>COMMENTS</b>	
<p><b>Related Resources</b></p> <p>SPDX licence registry, <a href="https://spdx.org/licenses/">https://spdx.org/licenses/</a></p> <p>Creative Commons, <a href="https://creativecommons.org/">https://creativecommons.org/</a></p> <p>Creative Commons Rights Expression Language, <a href="https://creativecommons.org/ns">https://creativecommons.org/ns</a></p>	

## Data Provenance

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-R1.2-01M
<b>Metric Name</b>	<b>Metadata</b> includes provenance information about data creation or generation.
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to data provenance, FsF-R1.2-01M is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>

## Community Metadata Standard

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-R1.3-01M-ss
<b>Metric Name</b>	<b>Metadata</b> follows a standard recommended by the social sciences (ss) research community of the data.
<b>Description</b>	<p>In addition to core metadata required to support data discovery (covered under metric <a href="#">FsF-F2-01M</a>), metadata to support data reusability should be made available following community-endorsed metadata standards.</p> <p>For social sciences several well established metadata standards exist in particular the family of standards defined by the DDI (Data Documentation Initiative) Alliance but also other formats are used within the community.</p> <p>A FAIR social sciences repository should support the following standards</p> <ul style="list-style-type: none"> <li>• DDI Lifecycle</li> <li>• DDI Codebook</li> <li>• da ra metadata</li> <li>• A discipline agnostic metadata format which can be mapped to DDI: Schema.org, Dublin Core, DataCite or DCAT for data set level metadata description.</li> </ul>
<b>FAIR Principle</b>	R1.3. (Meta)data meet domain-relevant community standards
<b>CoreTrustSeal Alignment</b>	Reuse R13. The repository enables reuse of the digital objects over time, ensuring that appropriate information is available to support understanding and use.

FIELD	DESCRIPTION
<b>ASSESSMENT</b>	
<b>Requirement(s)</b>	<ul style="list-style-type: none"> <li>• Data identifier (IRI, URL, PID)</li> <li>• Metadata access via:               <ul style="list-style-type: none"> <li>○ Provision endpoints such as OAI-PMH offering metadata in community specific format</li> <li>○ Community specific metadata links provided in the landing page via signposting or typed links or via content negotiation.</li> <li>○ Namespaces listed in community specific documentation or at registries such as FAIRsharing or the RDA metadata standards catalogue</li> </ul> </li> </ul>
<b>Assessment</b>	Gather all metadata standards used by a data repository; this list can be requested, e.g., from the metadata endpoint (e.g., OAI-PMH), via namespace URI or XSD URI detection using content retrieved via embedded landing page metadata, signposting links or content negotiation. Identify discipline-specific standards (such as DDI) from the list specified above.
<b>COMMENTS</b>	
<p><b>Related Resources</b></p> <ul style="list-style-type: none"> <li>• DDI Alliance metadata standards definitions <a href="https://ddialliance.org/">https://ddialliance.org/</a></li> <li>• RDA Metadata Standards Catalog, <a href="https://rdamsc.bath.ac.uk/">https://rdamsc.bath.ac.uk/</a> RatSWD FAIR white paper, <a href="https://www.konsortswd.de/wp-content/uploads/RatSWD_WP_274.pdf">https://www.konsortswd.de/wp-content/uploads/RatSWD_WP_274.pdf</a> CESSDA metadata model, <a href="https://www.cessda.eu/Training-Resources/Resource-crd-2592">https://www.cessda.eu/Training-Resources/Resource-crd-2592</a></li> </ul> <p><b>Known Limitations/Constraints</b></p> <ul style="list-style-type: none"> <li>• *The data identifier provided (e.g., PID) may not be the same as the identifier used in the metadata record harvested. For example, in OAI-PMH, the nature of a record identifier is outside the scope of the harvesting protocol; for more information, see <a href="http://www.openarchives.org/OAI/openarchivesprotocol.html#UniqueIdentifier">http://www.openarchives.org/OAI/openarchivesprotocol.html#UniqueIdentifier</a></li> </ul>	

## Data File Format

FIELD	DESCRIPTION
<b>Metric Identifier</b>	FsF-R1.2-01M
<b>Metric Name</b>	<b>Metadata</b> includes provenance information about data creation or generation.
<b>Description</b>	<p>Since there are no social sciences discipline-specific requirements with respect to data file formats, FsF-R1.2-01M is to be applied here.</p> <p>See: <a href="https://doi.org/10.5281/zenodo.3775793">https://doi.org/10.5281/zenodo.3775793</a></p>