Open Access Indicator for 2015

Part 2

Technical Description of Data Foundation, Processes and Output

0 Preface

The National Steering Group for Open Access[1] has proposed the Danish Agency for Science, Technology and Innovation and Denmark's Electronic Research Library, to develop a Danish Open Access Indicator. The intention is to support the implementation of the national Open Access strategy[2] - cf. the strategy's statement on monitoring: "*The implementation of Open Access is to be monitored on an ongoing basis to ensure that all parties make a maximum effort to develop and disseminate free accessibility to Danish research findings.*"

The Open Access Indicator is calculated once per year with the target field: *Scientific and peer reviewed articles and conference contributions in journals and proceedings with ISSN.*

In the context of Horizon 2020[3], EU requires that Open Access be established within at most 6 months after publication for the areas of science, technology and health and within at most 12 months for the social sciences and humanities. This delay is caused by many journals maintaining so-called embargo periods, where they exclude researchers from establishing Open Access to the articles before the end of the embargo period.

As the OA Indicator is calculated once annually for all publications within its target field, it is designed to accept a one-year delay in Open Access to the publications. Consequently, the OA Indicator for 2015 is calculated early March 2017 in order to accommodate a full year embargo period also for publications from December 2015. In practice this means that publications from January 2015 could have embargo periods all the way up to 24 months and still be credited by the OA Indicator.

The description of the Open Access Indicator is organized in two parts:

- Part 1: Overview of data foundation, processes and output
- Part 2: Technical description of data foundation, processes and output

Note: In Part 2, the technical description, the notion of the indicator's "target field" is expressed using the term "set of scoped records".

Queries regarding the indicator may be directed to

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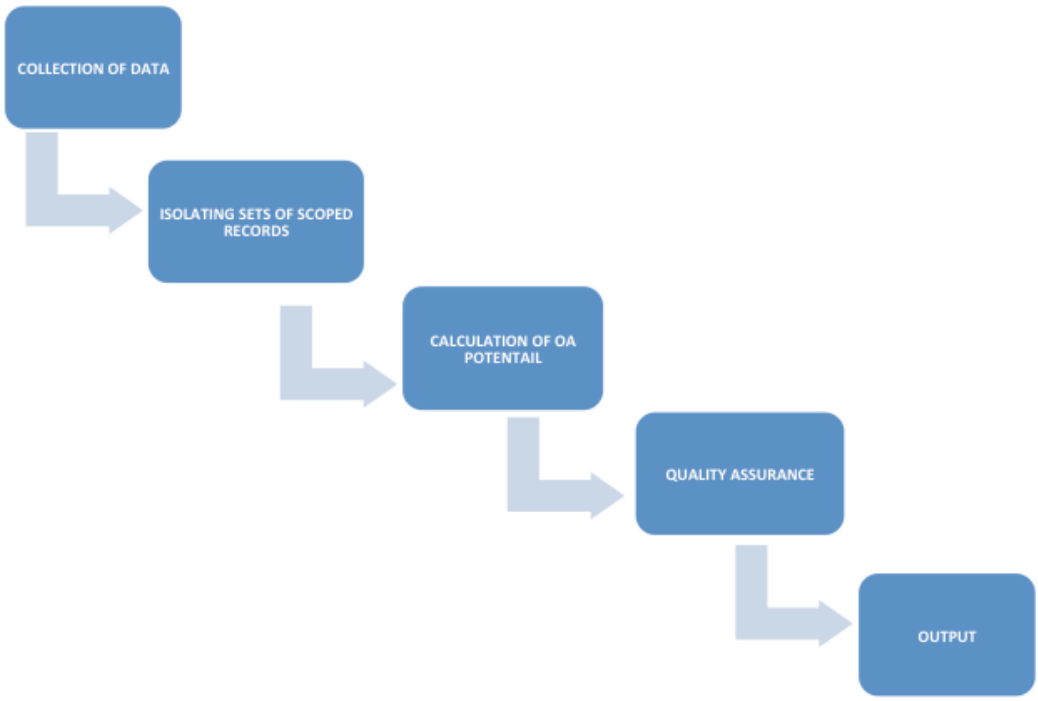
[1] http://ufm.dk/en/research-and-innovation/cooperation-between-research-and-innovation/open-access
[2] http://ufm.dk/en/research-and-innovation/cooperation-between-research-and-innovation/open-access/Publications/denmarks-national-strategy-for-open-access
[3] https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf

1 Introduction and Main Processes

The activities of the OA Indicator can be broken down into these five main processes.



The five main processes are described in further detail in the sections below.

This description of the Open Access Indicator is aimed for a technically inclined audience and aims to describe in depth how the Indicator works – overall as well as in detail.

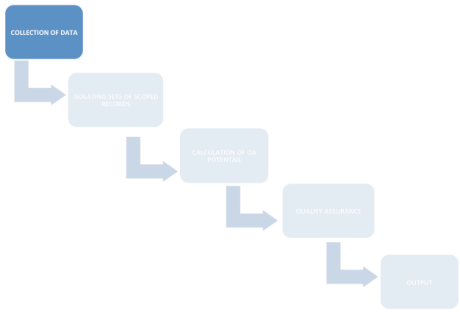
The description assumes that the reader has familiarity with basic XML[4] and basic parts of the XPath[5] notation for refering to XML elements of an XML document conforming to a certain XML Schema. It also assumes that the reader is familiar with visualisation of processes af workflow diagrams[6].

[4] https://www.w3.org/TR/xml/

[5] https://www.w3.org/TR/xpath-30/

[6] https://en.wikipedia.org/wiki/Flowchart

2 Process 1: Collection of The Data



The first activity in the OA Indicator is the collection of the complete data foundation used by the indicator. This includes importing six national and international sources. The data foundation is composed of metadata describing the publications of the universities, as well as authority- and auxiliary data.

2.1 The Universities Publication Data

Metadata describing the publications of the universities are used to establish the set of publications in scope of the OA Indicator.

Metadata describing the publications of the universities are collected for the OA Indicator once annually. Collection is done directly from the universities, using an XML-based nationally agreed exchange format and a nationally agreed exchange protocol.

For fulltexts registered in the collected publication metadata, collection (download) are attempted.

2.1.1 Requirements on Universities – Metadata Format and Method of Collection

A university can be included in the OA Indicator if it meets the following minimum requirements:

- Publications published by researchers employed at the university are collected in a university research database containing publication data, person data, project data etc of that particular university only.
- This research database of the university must expose its publication data using OAI-PMH (http://www.openarchives.org/OAI/openarchivesprotocol.html).
- The research database must support OAI-PMH *selective harvesting* using *Sets*, characterised by their *setSpec* (code), to harvest only parts of the database.
- A dedicated OAI-PMH Set exposing all publication data held in the research database must exist.
- For this dedicated set, OAI-PMH metdataPrefix ”ddf_mxd” must be supported.
- When an OAI-PMH client harvest this dedicated set using metadataPrefix ”ddf_mxd”, metadata records must be valid DDF-MXD (http://mx.forskningsdatabasen.dk/mxd/).

2.1.2 This Years Universities and Their Research Databases

The following 8 universities – and associated research databases – are included in the OA Indicator for 2015:

University	Research Database - OAI-PMH server	OAI-PMH setSpec
AAU	http://vbn.aau.dk/ws/oai	publications:all
AU	https://pure.au.dk/ws/oai	publications:all
CBS	http://research.cbs.dk/ws/oai	publications:all
DTU	http://orbit.dtu.dk/ws/oai	publications:all
ITU	https://pure.itu.dk/ws/oai	publications:all
KU	http://curis.ku.dk/ws/oai	publications:all
RUC	http://rucforsk.ruc.dk/ws/oai	publications:all
SDU	http://heinz.sdu.dk:8080/ws/oai	publications:all

2.2 Authority and Auxiliary Data

Authority and Auxiliary Data are collected for the OA Indicator from various sources. For each of these sources, the collection is done once annually. Collection method and data formats vary across sources.

2.2.1 Directory of Open Access Journals (DOAJ)

DOAJ is used by the OA Indicator as an authorative list of Golden Open Access Journals.
Parameters of the data collection:

- Protocol: OAI-PMH (server http://www.doaj.org/oai/)
- metadataPrefix: oai_dc
- Dataformat: Dublin Core (http://dublincore.org/documents/dces/)

2.2.2 Sherpa/Romeo (Sh/Ro)

Sh/Ro is used by the OA Indicator to determine the policy for Green Open Access by journals, and thereby the Open Access potential of individual journal articles.
Parameters of the data collection:

- Protocol: HTTP (GET from http://www.sherpa.ac.uk/downloads/)
- Dataformat: Proprietary XML-based format (http://sherpa.ac.uk/news/2012-10-08-RoMEO-API-News.html)

2.2.3 The Danish Bibliometric Research Indicator (BFI)

Data from BFI are used by the OA Indicator for three purposes:

- To identify duplicate publication data across universities (exists for collaborative publications with coauthors employed at different universities and therefore registered in multiple research databases)
- To resolve potential conflicts wrt. Main Research Areas registered in the metadata for the publications
- To ensure that articles published in DOAJ-validated journals can be considered scientific and peer-reviewed (BFI-level 1 or 2).

Parameters of the data collection:

- Protocol: HTTPS (GET from https://bfi.fi.dk/AnnualReport)
- Format: Compressed Excel spreadsheet – undocumented template

2.2.4 Authority List: Accepted External Repositories ("The Whitelist")

For fulltexts deposited in external repositories, this authority list is used by the OA Indicator to only allow fulltexts deposited in accepted external repositories to demonstrate Realised Open Access Potential.

- Protocol: Mail (from Authority list maintainers)
- Format: Excel Spreadsheet – undocumented template

2.2.5 Authority List: Journals with extended Embargo ("The Blacklist")

The authority list is used by the OA Indicator to reclassify from Unused to unclear Open Access Potential for journals registered on the list.

- Protocol: Mail (from Authority list maintainers)
- Format: Excel Spreadsheet – undocumented template

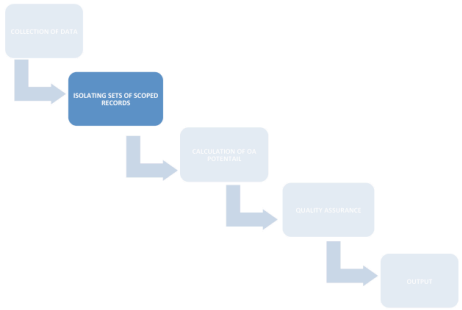
2.3 This Years Complete Data Collection

Summary of the data collection for the OA Indicator for 2015:

Source	Protocol	Ver.	Format	Ver.	Collection Date	Records
AAU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	7248*
AU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	13221*
CBS	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	2118*
DTU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	7740*
ITU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	280*
KU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	13845*
RUC	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	1550*
SDU	OAI-PMH	2.0	DDF-MXD	1.3.0	6/3 – 2017	7327*
DOAJ	OAI-PMH	2.0	DC	%	6/3 – 2017	13515
Sh/Ro	HTTP	%	Proprietary	%	6/3 – 2017	27032
BFI	HTTPS	%	Proprietary	%	6/3 - 2017	25044
Whitelist	Mail	%	Proprietary	%	26/1 - 2017	15
Blacklist	Mail	%	Proprietary	%	14/12 - 2016	2945

* With Submission Year 2015

3 Process 2: Defining the Set of In-Scoped Publications



After the collection of all data for the OA Indicator, a number of activities are initiated in order to isolate the publication records which are in scope for the OA Indicator. Not all publications are in scope – only a subset of the publications of the universities.

The scope is defined as:

- *Scientific, peer-reviewed articles and conference contributions published in journals or proceedings with ISSN*

Thus, the subset of publication metadata records representing this scope must be isolated from the total set of publication metadata collected. Ths is done in two ways, in order to facilitate statistics on the national level and on the university level:

- **Scoped records including duplicates – for statistics on the university level**
  For collaborative articles across universities, all registrations from all participating universities are kept
- **Scoped records excluding duplicates – for statistics on the national level**
  For collaborative articles across universities, only one registration is kept.

3.1 The Set of Scoped Records Including Duplicates

Each of the requirements in the definition of the scope maps nicely to a corresponding rule regarding DDF-MXD data elements and their content.

The set of scoped publication metadata records are therefore the set that complies to all the rules. The rules are described below.

First of all, the set of scoped records must represent records with a given submission year. Initial rule is therefore:

0) The ***submission year (indberetningsår)*** must be marked up in the publication metadata record with the given value.
   Rule applied: Attribute /ddf_doc/@doc_year have the value (year) for the OA indicator calculation

Subsequently, the following four rules are applied on all records:

1) The ***type*** of the publication must be marked up in the publication metadata record as ”Journal Article” ”Review article” or ”Conference Contribution” (same definition of “article” as used by BFI).
   Rule applied: Attribute /ddf_doc/@doc_type has value “dja”, “djr” or “dcp”.
2) The ***review-status*** of the publication must be marked up in the publication metadata record as “Peer-review” (similar demand as for BFI).
   Rule applied: Attribute /ddf_doc/@doc_review has value “pr”.
3) The ***scientific level*** of the publication must be marked up in the publication metadata record as “Scientific” (similar demand as for BFI).
   Rule applied: Attribute /ddf_doc/@doc_level has value “sci”
4) The ***publication channel*** of the publication must be marked up in the publication metadata record ***with an ISSN***.
   Rule applied: Element /ddf_doc/publication/*/issn has value.

3.2 The Set of Scoped Records Excluding Duplicates

For collaborative publications between the universities, multiple publication metadata records may represent the same publication. As this is impractical when producing statistics on the national level, a set of scoped records without duplicates are produced.

This set is produced by exposing the set of scoped records with duplicates to a deduplication process. The ambition of this process is to ensure, that for each publication in the scope of the OA Indicator and for which there is *at least one* record in the set of scoped records including duplicates, there is *exactly one* record in the set of scoped records excluding duplicates.

The deduplication proces creates clusters of records. A cluster contains records that represents the same publication. The full set of scoped records excluding duplicates is ultimately established by producing one record per cluster.

The algorithm for producing clusters is:

1) Records that were part of the BFI calculation for the same submission year and were identified by the BFI process as being duplicates, are added to the same cluster
2) Records for which significant metadata elements (DOI, title, sub title, ISSN, publication year, etc.) matches sufficiently well, are considered to represent the same publication and are added to the same cluster

This algorithm respects BFI's deduplication algorithm: Rule (1) ensures that any records identified by BFI as duplicates are also identified by the OA Indicator as duplicates.

The scope of BFI and the scope of the OA Indicator differ. This makes it realistic that other non-BFI-scoped records are part of the OA Indicator scope and are indeed duplicates to other records. Rule (2) ensures, that these records are in fact (best effort) being fathomed into clusters as well.

Thus, clusters may include

a. Only records which were part of BFI,
b. Both records which were part of BFI and records which were not, or
c. Only records which were not part of BFI.

A subtle but important remark: For clusters containing BFI records - (a) and (b) above – the BFI records clustered by rule (2) above may stem from different BFI clusters. OA Indicator clusters may contain BFI records which were not joined by the BFI deduplication algorithm.

Conflict Resolution

The results of the OA Indicator are distributed on Main Research Area (MRA). In order to be able to do this distribution, each cluster must have a unique Main Research Area.

BFI's definition of MRA is used by the OA Indicator:

- Science (sci)
- Social Science (soc)
- Humanities (hum)

- Medicine (med)

All DDF-MXD records contain a unique MRA.

For records in the set of scoped records including duplicates, these MRA's are used.

For records in the set of scoped records excluding duplicates, records in the underlying clusters may disagree on MRA. Using BFI terminology, such a situation is called an MRA-conflict. Such MRA-conflicts must be resolved so each cluster has a unique MRA.

The algorithm for resolving MRA-conflicts in a cluster are:

1) If all the records in a cluster have the same MRA, this is used for the cluster (no conflict)
2) Otherwise, if one or more of the records in the cluster were part of a BFI cluster, the BFI MRA for that cluster is used.
3) If none of the records in the cluster were part of the BFI calculation – or if multiple records were part of different BFI clusters diagreeing on their BFI MRA for those BFI-clusters – majority wins: The MRA of the cluster is the MRA represented by most of the records in the cluster.
4) If two or more MRA's are represented by the same number of records in the cluster, the MRA with the highest representation in the entire set of scoped records is chosen for the cluster.

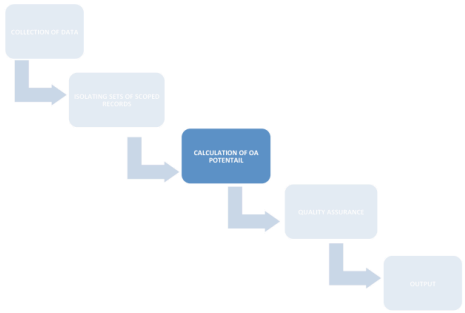
This algorithm ensures, that the OA Indicator solves potential MRA-conflicts respecting to the largest extend possible the corresponding MRA-conflict resolutions done by BFI.

3.3 This Years Sets of Scoped Records

Dataset	Records
Total number of publication records collected from the universities	53.429
Set of scoped records including duplicates	25.070
Set of scoped records excluding duplicates	22.666

For further details, see section on Data reports.

4 Process 3: Calculation of OA Realization and Potential



The calculation of OA realisation and potential are done respecting Green and Golden Open Access. The calculation is done nationally, distributed on Main Research Area (MRA) and distributed on universities.

The Open Access potential – and the realisation of that – is initially calculated per university, using a per-publication approach based on the set of scoped records including duplicates. Subsequently, it is also calculated for the national level and MRA level, also using a per-publication approach, but based on the set of scoped records excluding duplicates

For both sets, each record/publication belonging to the set is classified according to how the publication realise its Open Access potential.

There are three values for this classifications, and they are color coded using green, yellow and red (traffic light):

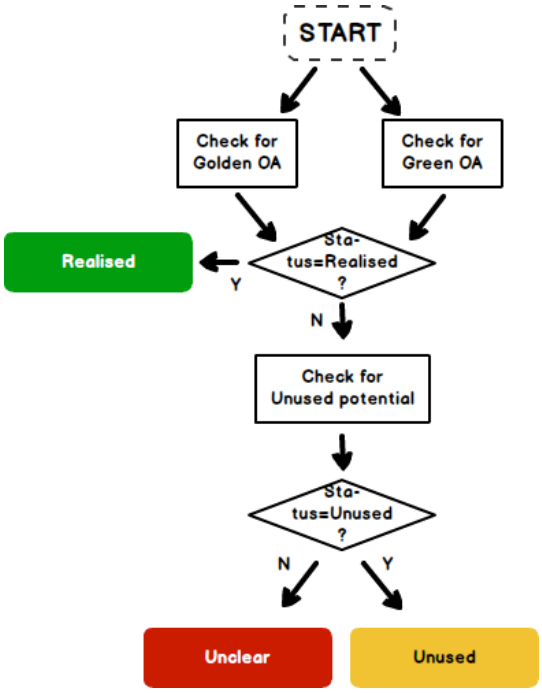
- **Realised** Open Access potential
- **Unused** Open Access potential, and
- **Unclear** Open Access potential

For some in-scoped records, the classification includes attempting a download of a fulltext registered in the record. For technical reasons, the actual download attempts of all potential fulltexts are the first sub process. Please refer to Appendix A for technical details on how this is done.

4.1 Open Access Classification – University Level

For any record in the set of scoped records including duplicates, the Open Access potential is established through a number of validation steps.

As an overview, the classification proces scan be illustrated as follows:



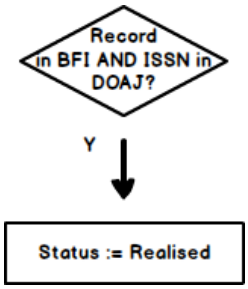
Please note, that although the diagram above indicates that validation for Golden and Green Open Access takes place in parallel, the actual implementation is, that Golden is validated before Green.

Each of the steps illustrated above are workflows of their own. They are described individually below.

4.1.1 Checking for Golden Open Access Potential

First, the journal registered in the publication metadata record is checked against DOAJ. If present, and if the publication record achieved a level 1 or level 2 BFI classification, the publication is considered one with a (Golden) Open Access potential, and the potential is considered to be Realised.

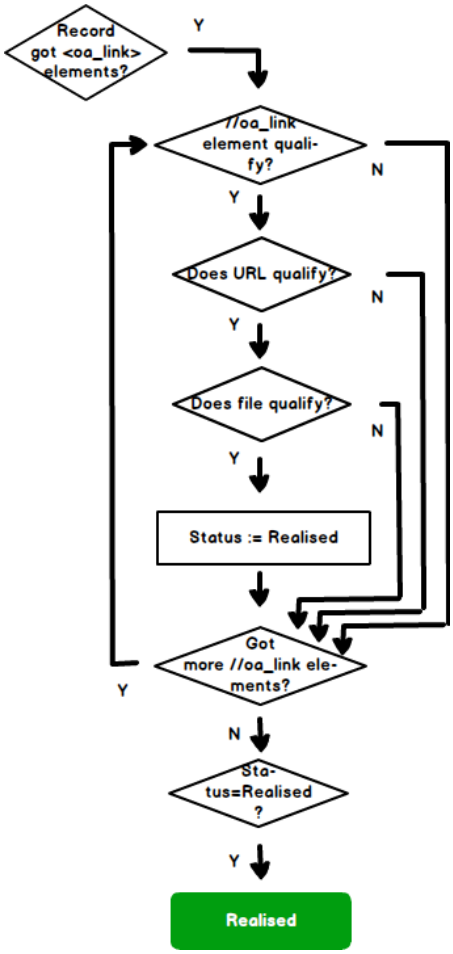
The associated – simple - workflow can be depicted as follows:



4.1.2 Checking for Green Open Access Potential

Green Open Access validation of a publication record involves inspecting the element /ddf_doc/oa_link. Below, it will be referred to with the shorthand notation //oa_link.

Records may contain zero, one or more //oa_link elements. The combined worflow for validating Green Open Access is as follows:



Three decisions in this workflow has to do with qualification. These three decisions are made following sub-workflows:

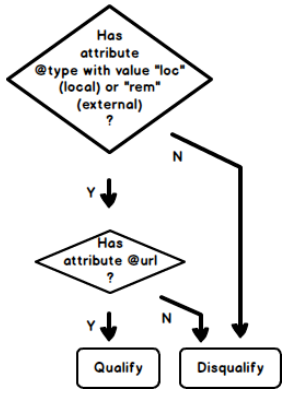
Decision: //oa_link element qualify?

A *qualified //oa_link element* is a //oa_link element

- with attribute @type having an acceptable value (”loc” for local or ”rem” for remote” – not ”doi” for DOI), and
- with a @url attribute that has a value.

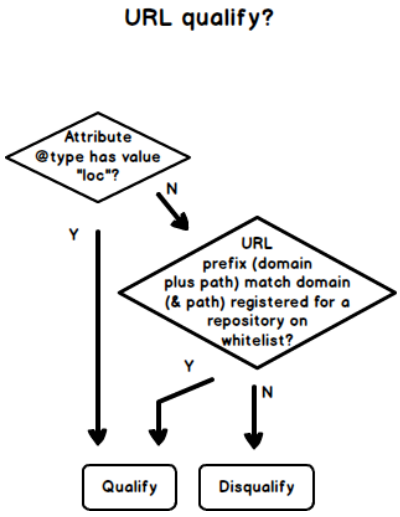
Checking for qualification can be illustrated with the following workflow:

//oa_link element qualify?



Decision: Does URL qualify?

A *qualified URL* is either a URL to a local repository or a URL to an external repository that has a prefix (domain name and potentially also path) registered for a repository on the list of accepted external(/remote) repositories (the Whitelist). Checking for qualification can be illustrated with the following workflow:

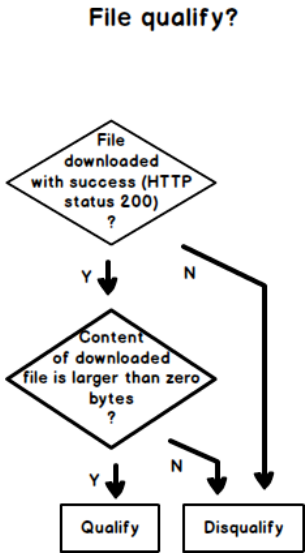


Decision: Does File qualify?

A *qualified file* is a file that

- can be downloaded by a computer
- where the content of the downloaded file has size bigger than zero

Checking for qualification can be illustrated with the following workflow:



4.1.3 Checking for Unused & Unclear Potential

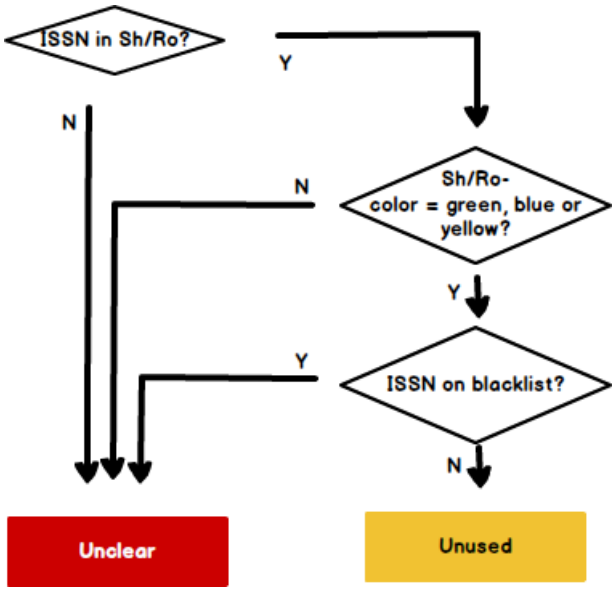
If the record has no Realised Open Access Potential, the record is examined to determine if the potential is Unused or Unclear.

The Open Access potential of the publication is derived from the the Open Access potential of the journal registered in the publication metadata record, as registered in the Sherpa/Romea dataset (c.f. http://www.sherpa.ac.uk/romeoinfo.html).

Rules applied:

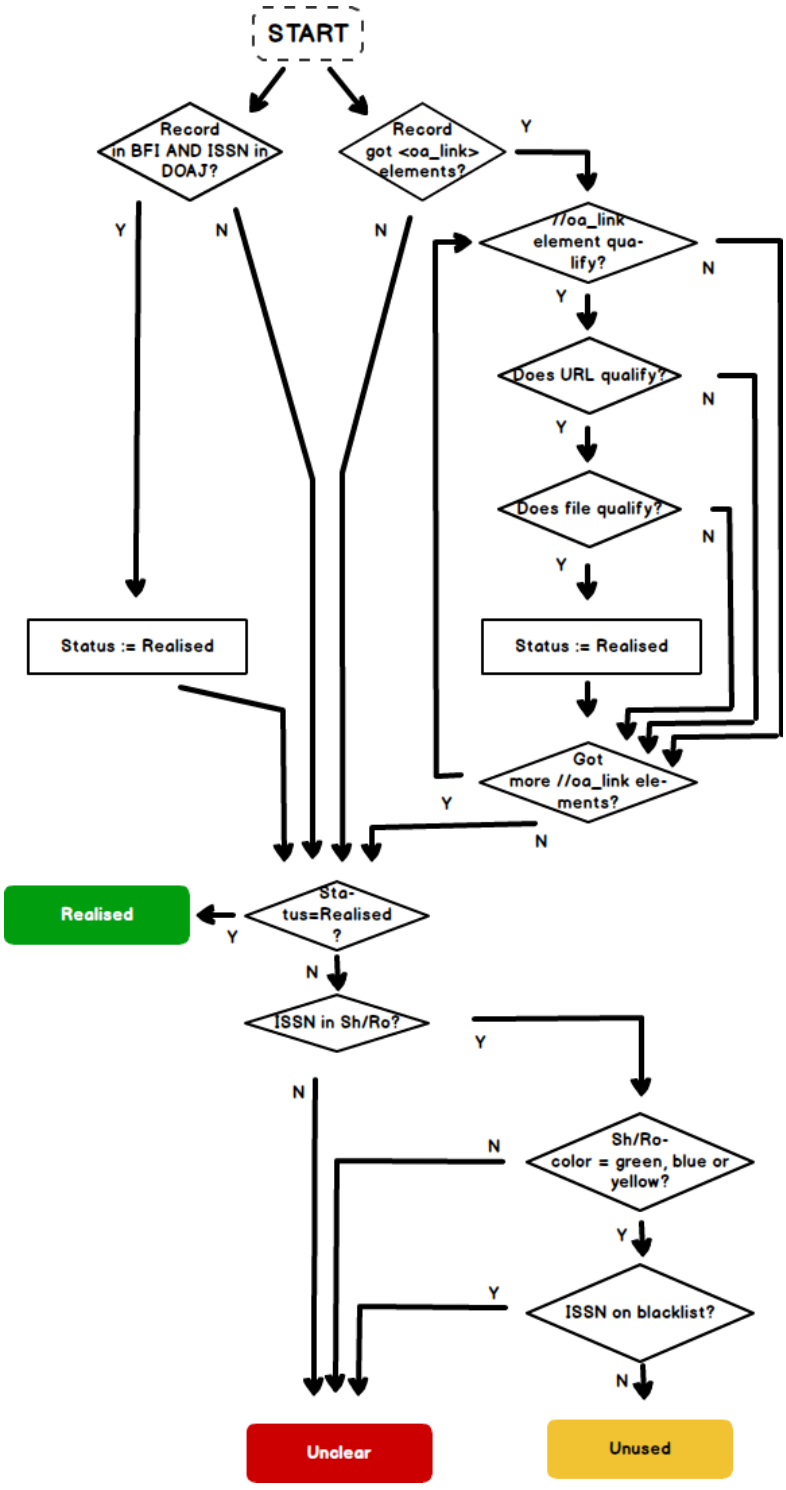
- If the ISSN of the journal is registered in Sherpa/Romeo with color code green, blue or yellow, the journal is considered one with Open Access Potential, and the publication metadata record is considered one with an **Unused** Open Access potential.
    - An Exception to this rule is, if the ISSN is registered on the list of accepted journals with extended embargo periods (the Blacklist). If so, the record is reclassified to Unclear
- If the journal is registered in Sherpa/Romeo with a different color code or not registered at all, the journal does not have a clear Open Access potential, and the publication metadata record is considered to be one with an **Unclear** Open Access potential.

This validation can be depicted as follows:



4.1.4 Checking Open Access Potential – Combined

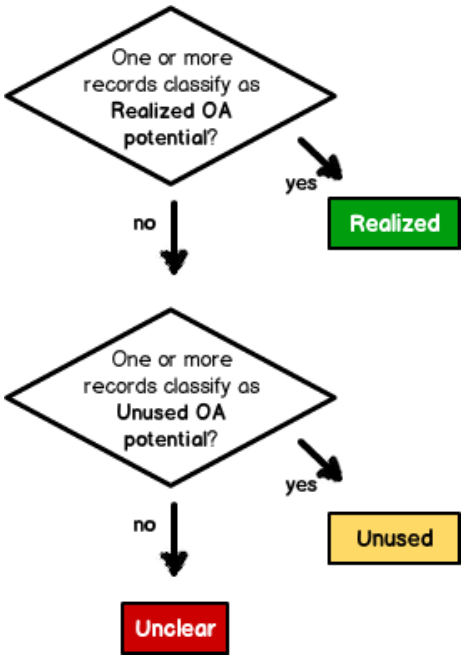
Thus, the combined decission workflow for determining the Open Access potential of a record is:



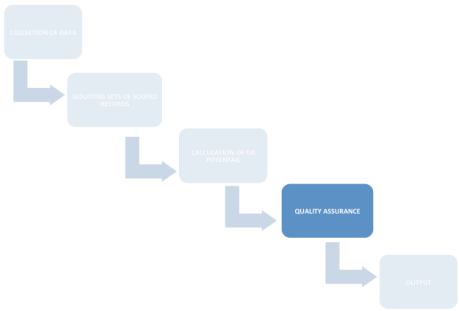
4.2 Open Access Classification – National and Main Research Area Level

Publication metadata records in the set of scoped records excluding duplicates correspond to clusters of one or more records from the set of scoped records including duplicates.

After classifying each of the records of the set of scoped records including duplicates according to Open Access potential and its realization, clusters inherit classifications according to a ”best-classification-wins” algorithm, using the following decision workflow:



5 Process 4: Quality Assurance



The results of the Open Access Indicator have been subjected to the following quality assurance measures:

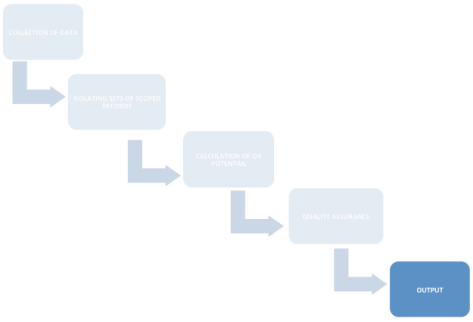
- **Data Foundation**. The collected data and the registered links to fulltexts and their resolvability back to the universities research databases, has been tested. The tests have been based on sampling across the universities.

- **Downloaded fulltext files.** The collected data and the registered links and their resolvability back to the universities research databases, has been tested. A selection of the downloaded fulltext files have been inspected to ensure that they can indeed be considered files representing the scientific article – in a complete and readable fashion. The test have focused on files that, based on simple computerbased analysis, could seem to deviate suspiciously from the metadata registered for the publication (page number, file sizes, etc.)

- **Links to external OA repositories.** All files, realized through links to recognized external OA repositories, have been inspected in order to ensure that the links lead to a fulltext file representing the scientific article.

- **Random sample.** A random sample of 5% from the total set of realized Open Access potential, from each university, has been inspected with the aim of validating the overall data quality

6 Process 5: Output



As output, the Open Access Indicator produce a number of data reports as well as web-friendly visualisations of the summations of these.

The Danish Research Database (http://forskningsdatabasen.dk/) is used as dissemination platform for the visualisations and the reports.

6.1 Data Reports for download

Five data reports are produced:

1) Summations:: The sets of scoped records, aggregated and distributed on **Realized**, **Unused** and **Unclear** Open Access potential
    a. ***Nationaly*** (set of scoped records *excluding* duplicates)
    b. Distributed on ***Main Research Area*** (set of scoped records *excluding* duplicates)
    c. Distributed on ***the universities*** (set of scoped records *including* duplicates)

2) Detailed foundation for (a) and (b): Total list of publication records in the ***set of scoped records excluding duplicates***

3) Detailed foundation for (c): Total list of publication records in the ***set of scoped records including duplicates***

4) The list of ***accepted external repositories*** (The Whitelist) used for the calculation

5) The list of ***accepted journals with extended embargoes*** (The Blacklist) used for the calculation

6.2 Web Dissemination via The Danish Research Database

The summations of the Open Access Indicator are visualised on http://forskningsdatabasen.dk/en/open_access/overview, from where data reports can be downloaded as well.

7 Appendix A: The Fulltext Download Sub Process

All the fulltexts registered (by its URL) in the scoped set of publication metadata records are attempted downloaded in a single sub process.

This sub process is implemented in the following way:

- Fulltexts are downloaded one by one (serial; not in parallel)

- Fulltexts are downloaded in a ”University Round Robin” fashion:
    - one fulltext from university 1
    - one fulltext from university 2,
    - one fulltext from university 3,
    - …,
    - one fulltext from university N,
    - one fulltext from university 1,
    - one fulltext from university 2,
    - …,
    - one fulltext from university N,
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