OPEN SCIENCE AND RESEARCH

This handbook aims to help researchers, research organisations, decision-makers, financiers, and the general public promote the adoption and use of open science and research (OSR).

OSR opens new opportunities for participating in scientific research and applying research results, increasing the global contribution and social impact of scientific activities.

Finland seeks to become a leader in OSR, applying its principles to accelerate Finnish scientific research and boost its impact.

Achieving this goal will require the extensive participation of the research community and the internalisation of new working methods, but with the aid of OSR, we aim to boost the competitiveness and quality of Finland's research system, promoting reliability and transparency in scientific research.

This handbook aims to facilitate this process, and will be edited and enhanced by key stakeholders as we progress. Handbook versions approved by the strategy team will be published on the openscience.fi website.

Currently, the handbook comprises the following sections:

The key premises for OSR	Give to the strategy team, 2 June 2014
Promoting OSR	Give to the strategy team, 2 June 2014
General principles	
Promoting openness in the research process	
Measures for science policymakers	
Measures for research financiers	
Measures for research administration	
Measures for research organisations and research teams	
Measures for researchers	
Putting OSR into practice	Additions from working groups and open comments during 2014; to be published in the forum on 25 November
Open research publications	
Open research data	
Open research methodologies	
Open research infrastructures	
Open research support services	
International situation	Additions from working groups during 2014
Glossary	Additions from working groups and cooperation with the Ministry of Finance during 2014

The first version of this handbook includes Chapter 1, short versions of Chapters 2 and 4, and Chapter 5. Over the course of 2014, additions will be made by working groups from the OSR Initiative (ATT), from open comments, and from the road map.

Detailed guidelines and model processes will be inserted into Chapters 2 and 3 in particular.

Openness is a key principle of science and research, creating new opportunities for participation by researchers, decision makers and the general public.

OSR is now a globally accepted way of promoting science and its social impact. In adopting OSR, we generate increased opportunity for transparency, repeatability and confirmation of research results.

For OSR to thrive, the research community needs wide-ranging access to the publications, data, methods, expertise, and support services generated by, and required for, scientific research.

Scientific knowledge is by nature open and responsible, and this openness should be reflected not only in data collection but also in research and evaluation methods. Others' desire to access and use research results indicates a study's significance and, because its results are widely used, openness also increases the impact of that research.

Science can be democratised through the use of new operating models for OSR. OSR is not just a collection of methods and recommendations — it's a way of thinking, of promoting open-mindedness and networking. Digitalisation has opened up the research process, creating new opportunities for cooperation and communication.

Openness provides potential for change. A key aspect of this is ensuring that emerging researchers working outside of established research infrastructures have equal opportunities for data access, something especially relevant in emerging countries.

Openness gives everyone the principled opportunity to research, criticise or affirm research results in accordance with their abilities. This increases trust in science, and boosts corporate activity. Intangible commodities such as data, publications, methods, and services also benefit from increased openness in science. Making materials more widely — or freely — available, can also increase the potential for innovation.

The aim of science has always been to promote high-quality research and best practice, and to prevent poor research and falsification. OSR by its nature supports this, requiring efficient, open methods for managing research data. OSR can be successfully adopted only if those responsible for research systems[1] are motivated and trained to apply OSR principles. Every research system should routinely employ open methods for managing research data. The first practical requirement is that each actor must have clearly structured, up-to-date descriptions of how to promote open science**.** With the aid of OSR, we can promote sustainability, usability, access, and trust in research.

OSR depends on openness in the research process and working culture. Models for openness can be used to create opportunities for rich dialogue, and to preserve and increase diversity.

Research data, along with its associated expertise and understanding, are distributed across a variety of research actors, networks and communities. In these circumstances, openness must be increased:
- inwardly: to bring new ideas to the research process;
- outwardly: to enable others to harness ideas in new ways.

The recipe to achieving OSR is simple: we make our research offerings openly available, and use this openness to increase our impact:

1) We will choose to make our research offerings — including publications, data and methods — openly available in accordance with the principles of research ethics and the judicial environment, thus benefiting from the opportunities afforded by open access, open peer reviews, and parallel archiving. We will publish research results with an open licence (recommendation CC4.0 BY) and use support services that facilitate openness.

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[1] A more detailed description of the research system can be read here:
http://www.research.fi/fi/tutkimusymp%C3%A4rist%C3%B6t

2) We will make full use of research offerings made openly available by others, ensuring we have the required expertise, open-source software, and information about open standards and interfaces, as well as the solutions to implement them.

BENEFITS OF OSR

OSR brings with it benefits including:

- **Increased efficacy:** We can use existing materials and methods to update our processes, resulting in faster development thanks to shared resources.
- **Increased awareness of the scientific model:** We can promote awareness of scientific methods and ways of working.
- **Improved focus and better quality research results:** We can confirm and validate data more quickly, improving quality and repeatability of results through greater transparency in research practices**.**
- **Faster generation of new research ideas:** We can more easily apply research results in real time.
- **Increased commitment to science and improved scientific literacy:** The general public can more easily access scientific results and methods.
- **Increased economic and social impact:** Businesses and decision-makers can more easily access and harness research results and methods.

OSR creates **opportunities for a variety of stakeholders to participate** in brainstorming research topics, conducting research, evaluating results, and developing software.

The basic logic of science and research dictates that science, along with its methods and results, should be as open as possible. Using OSR, **research results and new information can be confirmed and validated independently** and without bias, and support structures are required for this validation.

In making data and research results open, we **enable and further new businesses and innovations**, such as the creation of new services and software.

Openness is also **economical and effective[2]:** previously collected data and information generated from it become globally, efficiently and equally accessible to all.

Openness also improves the quality of research**:** results and data enable scientific observations to be verified or challenged, so **the global body of scientific knowledge can develop and correct itself faster** and without redundancy.

Openness also **promotes the faster transfer of information** for use by all. It guarantees **equal access to research data**, regardless of geography.

Providing open access to research results and data in an information network **increases the visibility** of researchers, research results, and research institutions, and **improves impact**.

Different stakeholders benefit from OSR in different ways (Figure 1), including increased visibility (citations, mentions in social and other media), increased credits (references to publications, data and methods; awards for openness), increased funding (rewards for openness, awards for clear definitions of copyright/proprietary rights), and improved networking (new opportunities, better workload distribution, better results analyses). To harness these benefits, we must implement the measures that are covered in more detail in the Chapter *Promoting OSR.*

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[2]According to a study conducted by the European Commission, open data projects are expected to generate 140 billion per annum (European Commission Information Society 2012, Public Sector Information – Raw data for new services and products). The economic impact of open research data is not so straightforward. A recent study estimated that investments in availability services would generate income in a ratio of 2–10 to investments (Beagrie, N. and Houghton J.W. (2014) The Value and Impact of Data Sharing and Curation: A synthesis of three recent studies of UK research data centres, Jisc.)

Researchers	Research teams	Organisations	Decision-makers and financiers	The general public	National level
• Visibility • Credits • Funding • Networking	• Visibility • Funding • Cost-effectiveness • Networking	• Funding • Quality • Cost-effectiveness	• Decisions based on better information • Increased impact of funding • Quality	• Increased understanding and expertise • Increased opportunities to have an influence	• The promotion of human rights and democracy • Decisions based on research data

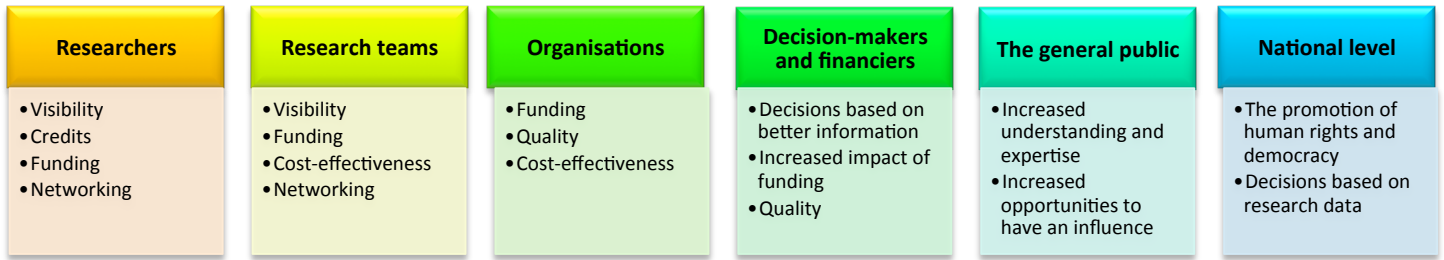*Figure 1: Benefits to different parties.*

Barriers to OSR include:

1) The narrow reward culture in current academia: there is no real incentive to promote and reward openness
2) Lack of infrastructure to support openness: there is widespread uncertainty about how the costs of openness will be covered. For example, business models may prevent increased openness in some research institutions
3) Fear that raw data will be misinterpreted, methods misused, or data published too early
4) Uncertainty over the ownership of data and methods
5) Lack of expertise in promoting openness

These barriers are not insurmountable, and change can be supported by, for example:
1) Developing incentives to promote cultural change: we need to clearly define the rewards and requirements for openness using indicators, metrics, and career impact, for example
2) Promoting cooperation and interoperability: we need to build platforms for enabling and rewarding cooperation
3) Planning for the sustainable development of research services and infrastructures: we need to develop with interoperability in mind, using open-source software, and open interfaces and standards whenever possible
4) Identifying OSR expertise and supporting its growth
5) Developing clear OSR policies and guidelines for every party involved

Openness is not black and white. In practice, we operate between the extremes of the open-closed scale (Figure 2), seeking a functional combination of availability, machine readability, costs, and legality. For example, research that reuses materials subject to the Personal Data Act requires a data-protection guarantee. In such instances, researchers are urged to be open with regard to their publications and methods.
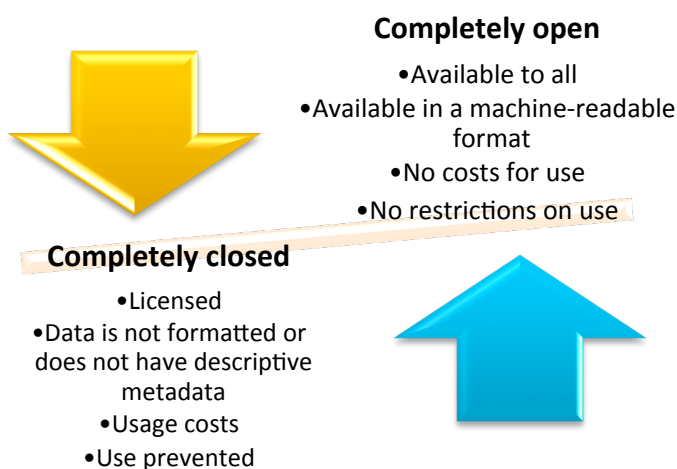
Completely open
• Available to all
• Available in a machine-readable format
• No costs for use
• No restrictions on use

Completely closed
• Licensed
• Data is not formatted or does not have descriptive metadata
• Usage costs
• Use prevented

Figure 2: Levels of openness.

a. Basic principles and best practices
b. Promoting openness in the research process
    i. Measures for science policymakers
    ii. Measures for research financiers
    iii. Measures for research administration
    iv. Measures for research organisations and research teams
    v. Measures for researchers

BASIC PRINCIPLES AND GOOD PRACTICE IN OSR

Best practice in promoting OSR includes the development of
- common, binding ethical guidelines for research;
- good methods for managing research data;
- basic principles for openness, including recommendations for their expansion.

In 2012, the Finnish Advisory Board on Research Integrity (TENK) — appointed by the Ministry of Education and Culture — worked with the Finnish research community to update its ethical guidelines on good scientific practice and how to handle suspected violations (see the HTK guidelines: http://www.tenk.fi/fi/htk-ohje).

Openness and well-managed research results lead to high-quality operations and results[3]: honesty, diligence, and accuracy. The characteristics of high quality include usability and availability, integrity and accuracy, openness and confidentiality.

High-quality data is a central requirement for good data management. When research data is well managed[4], data is not altered without reason, is not corrupted or lost during processing, and can be relied on for its accuracy and quality.

Quality assurance and accuracy in research data management are absolutes that cannot be compromised without justification. However, measures to ensure data quality and accuracy should always be scaled to the data's significance and importance. The greater the data's importance, the more effort should go into ensuring its quality and accuracy.

Availability and usability are essential and closely related concepts. Usability is generally used when referring to information systems, while availability is used in connection with data, publications and methods. Availability has two dimensions: the concrete availability of data and methods, such as the physical location of files, and the technical and other requirements for making data available.

Data confidentiality and protection is a key aspect of data management. **Data security** covers the usability, integrity and confidentiality of other parties' data. Research system providers, the general public, decision-makers and companies must be safe in the knowledge that sensitive or confidential material surrendered for research purposes does not end up in the possession of third parties.

Figure 3 shows the process of promoting OSR as a whole.

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[3] Guidelines for high-quality and good evaluation can be found at, for example,
http://www.helsinki.fi/laatu_ja_arviointi/tutkimus.html
[4] Guidelines for good data management:
http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/01_julkaisut/04_hallinnon_kehittaminen/4127/4128_fi.pdf
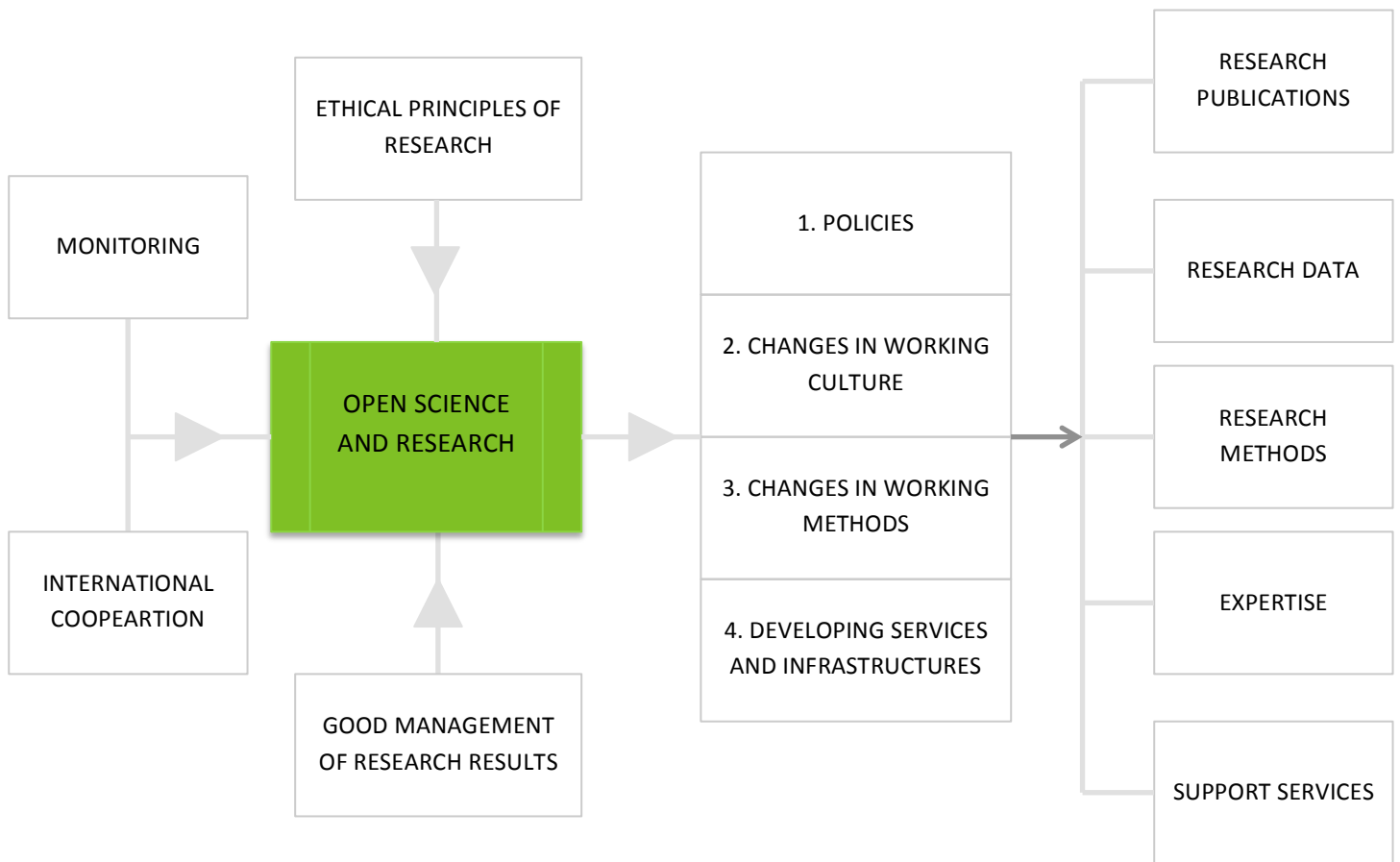
Figure 3: The entire process of the OSR promotion.

In practice, OSR is promoted at four levels:

1) general policy
2) working culture
3) working methods
4) services and infrastructure

The following shows how OSR is promoted at each level.

The Finnish research system operates under a few basic policies:

1) Research results — including publications, data, methods and the tools required to publish — should be openly available in data networks via an open interface in accordance with ethical principles and respecting legal operating environments.
2) Openness within research infrastructures should always be pursued when it is legally and contractually possible.
3) The further use of research results should not be unnecessarily restricted[5], and the terms and conditions of their use should be clearly defined.
4) The scientific and research community should work with financiers to define quality criteria and indicators for OSR that can be used alongside other indicators used in research.

PROMOTING OPENNESS IN THE RESEARCH PROCESS

Achieving openness requires an open approach at all stages of the research process, with different challenges at each stage (Figure 4).

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[5] See, for example, the application directive on unnecessary restrictions *The Act on the Openness of Government Activities*:
http://oikeusministerio.fi/fi/index/toimintajatavoitteet/lakiensaataminen/julkisuuslaki/uudistuksesta.html
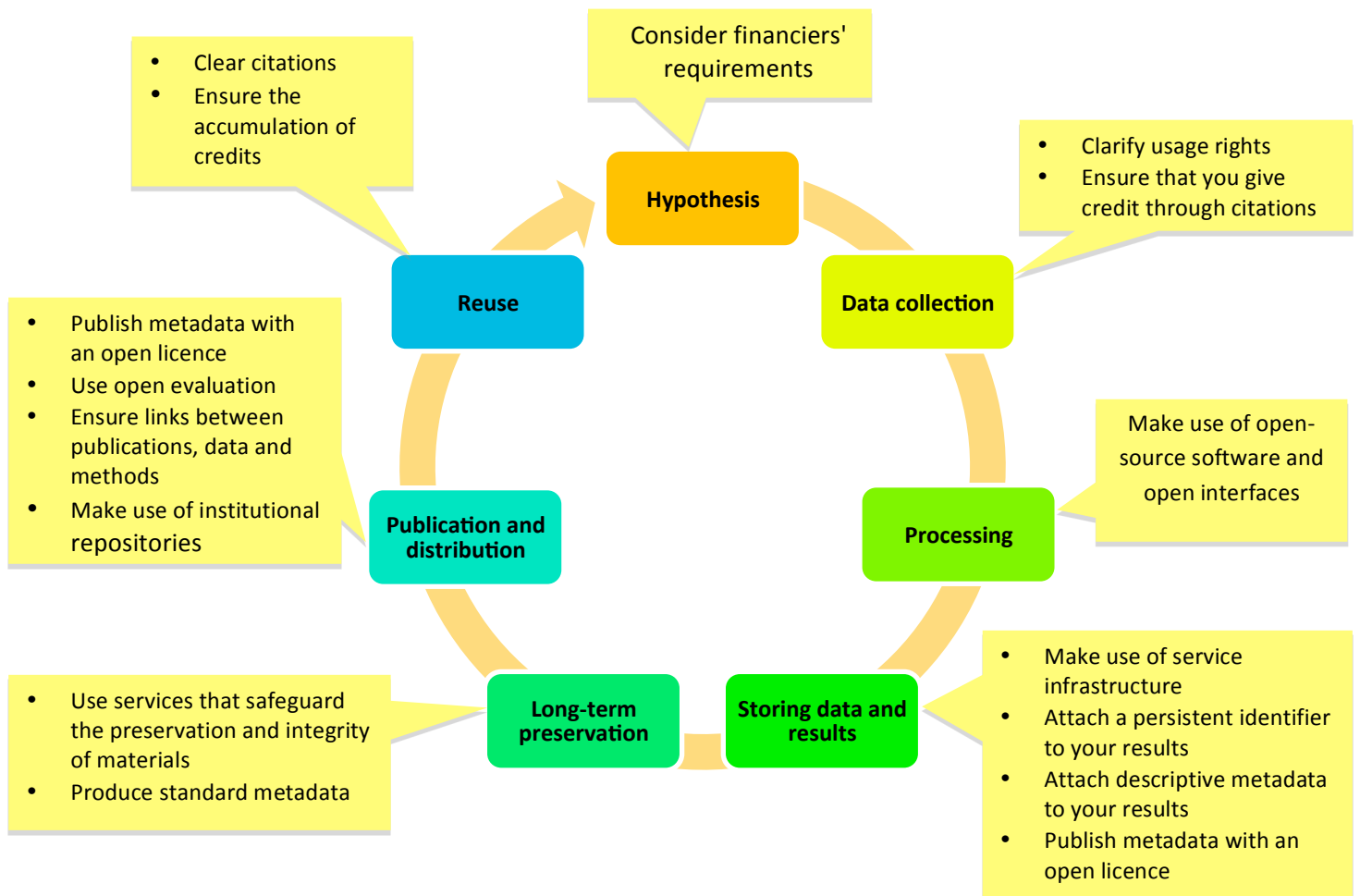
Figure 4: Promoting openness at different stages of the research process.

To develop a working culture that supports OSR, Finland requires best practice and clear policies from financiers and organisations within the research system. This means supporting and considering openness in, for example, contracts, funding and credits.

The research process alternates between planning, action and evaluation. We need to adapt our working methods not only with regard to research structures and processes, but also values, attitudes and behaviour.

Finland's data infrastructure service offering should be built on a sustainable base, and should provide services for the storage, retrieval and preservation of data, methods and publications. Infrastructure interoperability must be ensured when materials or methods cannot be made freely available. Services should by designed comprehensively and cooperatively.

Promoting openness requires the cooperation of all parties, each with their own measures and responsibilities (Figure 5).
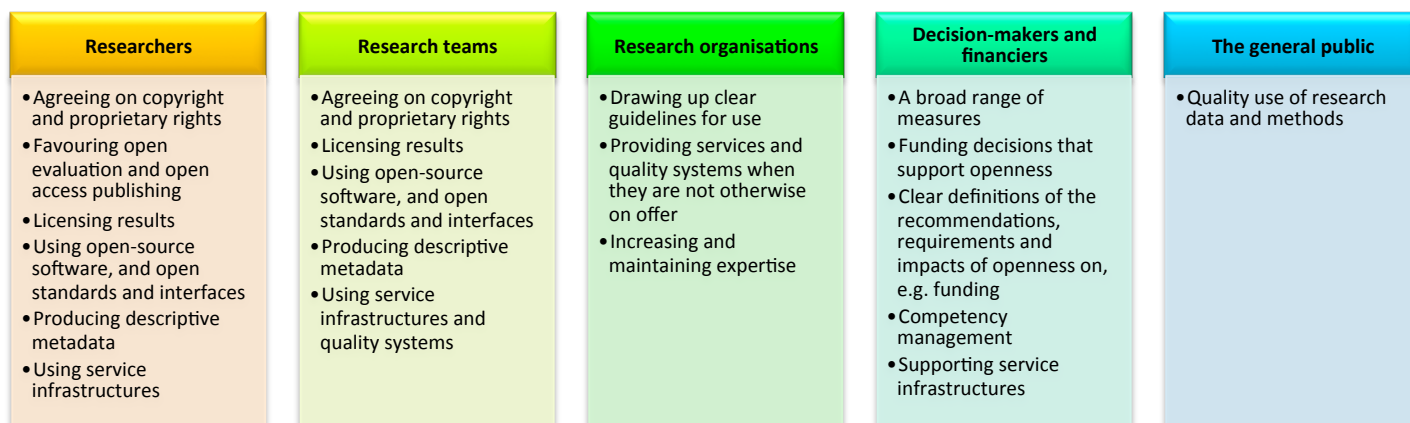
Researchers	Research teams	Research organisations	Decision-makers and financiers	The general public
• Agreeing on copyright and proprietary rights • Favouring open evaluation and open access publishing • Licensing results • Using open-source software, and open standards and interfaces • Producing descriptive metadata • Using service infrastructures	• Agreeing on copyright and proprietary rights • Licensing results • Using open-source software, and open standards and interfaces • Producing descriptive metadata • Using service infrastructures and quality systems	• Drawing up clear guidelines for use • Providing services and quality systems when they are not otherwise on offer • Increasing and maintaining expertise	• A broad range of measures • Funding decisions that support openness • Clear definitions of the recommendations, requirements and impacts of openness on, e.g. funding • Competency management • Supporting service infrastructures	• Quality use of research data and methods

Figure 5: Measures to promote OSR by stakeholder.

MEASURES FOR SCIENCE POLICYMAKERS

OSR often requires amendments to existing structures. When drawing up scientific policies to promote openness, policymakers need to consider:

- mixed policies
- measures for both providers and users
- methods for obtaining the required expertise and making use of networked expertise
- ways to promote an open approach throughout the innovation system
- both pre-emptive measures and those dictated by change
- ecosystem architecture and services

MEASURES FOR RESEARCH FINANCIERS

When making the decision to fund research, financiers should require:

- swift publication of research results
- clear contracts on copyrights and proprietary rights concerning research results
- the open licensing of results (the OSR Initiative ATT recommends a CC4.0 BY licence)
- data management planning
- an open use policy for funded research infrastructures

Research financiers should support:

- open access publishing (financially)
- open cooperation
- an operating model for the long-term preservation of research results
- the building of service infrastructures

Research financiers should state:

- what their recommendations are concerning alternatives for open access publication
- how openness will be rewarded in career development
- how the financier would like copyrights and proprietary rights to be managed
- what quality criteria they stipulate for research
- the metrics and indicators to be used in evaluations

MEASURES FOR RESEARCH ORGANISATIONS

As part of their operation, research organisations should:

- develop clear data policies
- develop clear publication policies
- develop clear licensing policies
- clearly describe researchers' rights regarding openness
- increase and maintain expertise
- encourage the use of a common service infrastructure, providing any required local infrastructure services
- collect the required indicator data
- provide quality systems

MEASURES FOR RESEARCH TEAMS

When collaborating as part of a research team, individual teams should:

- agree on copyrights, proprietary rights and licensing of results
- recommend and use open-source software, and open standards and interfaces
- produce descriptive metadata
- use of quality systems
- ensure the repeatability of research results
- promote interoperability

MEASURES FOR RESEARCHERS

As part of their research process, researchers should:

- agree on copyrights, proprietary rights and licensing of results in accordance with guidelines
- use citations
- choose a publishing channel
- use open evaluation whenever possible
- embrace open access publishing (articles, data, methods)
- ensure the repeatability of research results
- produce descriptive metadata

Figure 6 summarises the measures different parties should take when supporting OSR.

AGREEING ON COPYRIGHT AND OTHER PROPRIETARY RIGHTS	• According to the HTK guidelines: 'Before starting research or hiring researchers, all members of research projects and teams—the employer, principal investigator and team members—should agree on members' rights, principles regarding copyright, responsibilities and obligations, and the issues pertaining to the material storage and rights of use in a manner that is approved by all parties. Agreements can be updated as research progresses.'
FUNDING DECISIONS	• **To promote OSR**, funding decisions should support open operating models and require the publication of research results. Finnish financiers should consider the costs of open access publishing when deciding on funding.
GIVING AND RECEIVING CREDIT	• At the moment, researchers and research teams are primarily evaluated using indicators based on the volume and quality of their research. This system gives insufficient recognition to OSR and other more extensive social, economic and innovative impacts. • **To promote OSR**, credit should be given for the open access publishing of research results (see TENK's researcher CV template).
LICENSING	• **To clarify copyright and proprietary rights, research results should be published under open licences or as open source files (see Glossary). The further use of research data and publications should not be unnecessarily restricted, and their terms and conditions of use should be clearly stated. Common, standard, machine-readable licences should be used (such as CC BY 4.0, which is to be the new JHS recommendation).**
USING OPEN-SOURCE SOFTWARE AND OPEN STANDARDS AND INTERFACES	• Research data management should favour — but not force — open-source solutions, and open standards and interfaces. However, when making purchasing decisions, openness and free use should be calculated as a clear benefit. Solutions purchased from external system providers in particular should be based on open-source solutions.
USING SERVICE INFRASTRUCTURES	• The storage and distribution of research data and publications should use infrastructures that enable open access to, and the long-term preservation of, materials. These services should not result in any unjustified changes in the data, data should not be corrupted or lost during processing, and the accuracy and integrity of data should not be in question. In research data management, quality and accuracy are absolutes that should not be compromised without justification. Such services include the popular PubMed central, ArXiV, Openaire+ and Zenodo services on a European level, and in Finland, IDA, Etsin, repositories at institutions of higher education and research institutes, and the forthcoming long-term preservation solutions.
OPEN EVALUATION	• **To promote OSR**, peer review can be carried out through open evaluation (see, for example, Peerage of Science, http://www.peerageofscience.org/).
OPEN ACCESS PUBLISHING	• Research organisations and researchers must ensure that their publications are available. The most important criteria when selecting a primary publication channel is to ensure the greatest possible impact for the research. As open access (OA) is known to increase impact, when a non-OA channel is used, parallel availability should be assured via an OA channel. Researchers should be supported so that processes to promote openness are straightforward and the associated support services are easy to use. Publishing covers everything from articles to data and methods.
PRODUCE RICH METADATA	• When describing research publications, the Dublin Core standard should be applied, as well as the MARC format commonly used by libraries. The minimum metadata model was developed during the National Research Data Project (TTA) to describe metadata. It is supported by the Etsin metadata catalogue. Insisting on a minimum amount of metadata will help people locate and identify research data. To retain usability, more descriptive metadata is required, such as detailed information about data collection, the means of collection, the selection of units of observation and other variables. Metadata should be stored throughout the data lifecycle. Each field of science and type of data has its own standards and practices for storing metadata. • In addition to descriptive metadata, largely programmatic administrative metadata are also produced for research publications and data. These support preservation and rights control. Metadata can be enriched with links to other metadata for publications based on the same research data, for example.
PROMOTING INTEROPERABILITY (SEMANTIC, TECHNICAL)	• When describing and storing publications and data, the aforementioned international and national open standards should be used to enable the linking and further use of metadata produced by different organisations.
QUALITY SYSTEMS	• Compliance with a quality system at either institution or even process level is recommended.

Figure 6: A summary of measures to promote openness.

PUTTING OSR INTO PRACTICE

(Additions from working groups during 2014)

     a. Open research publications
     b. Open research data
     c. Open research methods
     d. Open research infrastructures
     e. Open research support services

INTERNATIONAL TRENDS

(Additions from working groups during 2014)

A large number of Finnish and international research organisations and financiers have set targets for increasing the openness of research results. For example, the European Commission *'Recommendation on Access to and Preservation of Scientific Information'* sets out policies and targets for openness in European research.

The openness of research data has improved thanks to a report published by the OECD in 2007, entitled *'Principles and Guidelines for Access to Research Data from Public Funding'*.

The OECD Council's 2008 recommendation for Enhanced Access and More Effective Use of Public Sector Information had a major impact on the PSI Directive. Open science stakeholders — such as financiers, institutions of higher education and their libraries, datacentres, scientific societies and backers — are looking at the major challenges and opportunities raised by the reuse of data items.

An increasing proportion of scientific publications are appearing in open access journals. One such journal, *PLoS One* has unquestionably become the world's biggest scientific journal. Other significant scientific periodicals, such as *Nature* and *Science*, are publishing articles on open science with increasing frequency. Publishers are developing strategies to distribute research data in tandem with publications.

The variety of public and private sector stakeholders taking part in these activities, and the range of projects involved indicates that OSR is becoming more widespread and increasingly important across the globe. Example projects include *DataCite;* the pre-print service *arXiV; OpenAIRE*, which collates publications on EU projects; *Zenodo*, which collates data; and field-specific repositories such as *PANGAEA* and *Dryad*. Many major research infrastructures (such as the ESFRI projects) are also sharing their results via open services.

However, sharing of research data has not yet become the norm. Although the publication of research data is of global interest, the key to successfully embracing OSR lies in understanding the associated challenges facing a variety of different stakeholders.

GLOSSARY

(Additions from working groups and cooperation with the Ministry of Finance during 2014)

AUTHORITY SERVICES

An authority file supports the identification of individuals or associations by differentiating similarly named individuals with the aid of dates, professions, etc. However, the authority file also collates the individual/association's name variants to ensure 'access' to the same person/organisation's work regardless of the form in which their name appears. The authority file also organises the database by linking a person's various 'public identities', such as real name and pen name. In the same way, new and old names resulting

from personal or organisational name changes are also linked. National libraries create name authority files for works published in their country. Search terms in accordance with national regulations are stored in a target's authority file along with any relevant IDs (ISNI, ORCID) and name variants. The information is collated in international databases (such as the ISNI and ORCID databases and the Virtual International Authority File VIAF), which are freely available online. The current public administration recommendation is to also publish this information as open linked data.

AVAILABILITY

Availability determines whether information is available in accordance with its purpose, in principle both technically and in accordance with other operational requirements.

CITATION

A citation is used to refer to a source. It can be placed as an in-line citation within the text, in the footer as a footnote, as an endnote at the end of a publication or section thereof, or as a reference in a bibliography, for example. Sources have typically been research publications, but research data stored in a repository can also be a source. Repositories usually contain both the actual item (for example, a data file(s), code-book or questionnaire) as well as the metadata associated with the item. All these can be cited. When citing research data, the important differentiating elements are the author, the item's title, the version number, the repository ID (usually the item number), the collection date, the collector, producer and distributor, and (if available) a PID. The Finnish national standard SFS 5989 (Lähde- ja tekstiviitteitä koskevat ohjeet) provides guidelines on using citations and references. Many institutions of higher education use citation software based on the aforementioned standard. The Finnish Social Science Data Archive also provides guidance on citing research data (see http://www.fsd.uta.fi/fi/aineistot/jatkokaytto/viittaaminen.html).

EXAMPLE 1   SOSIAALIBAROMETRI 1994 [digital item]. FSD1129, version 1.0 (2002-03-11). Helsinki: Sosiaaliturvan keskusliitto [producer], 1994. Tampere: Yhteiskuntatieteellinen tietoarkisto [distributor], 2002.

EXAMPLE 2   INTERNATIONAL SOCIAL SURVEY PROGRAMME 2007: Leisure Time and Sports [digital item]. ZA4850, version 2.0.0 (2009-10-29). Cologne: GESIS [producer, distributor], 2009. doi:10.4232/1.10079. Available at: http://dx.doi.org/10.4232/1.10079

EXAMPLE 3   EKHOLM, Peter, Karina JUTILA and Pentti KILJUNEN: Käsitykset ilmastonmuutoksesta 2006 [digital item]. FSD2262, version 1.0 (2007-05-10). Lempäälä: Yhdyskuntatutkimus [data collection], 2006. Helsinki: Ajatuspaja e2 [producer], 2006. Tampere: Yhteiskuntatieteellinen tietoarkisto [distributor], 2007.

According to the HTK guidelines: *'Researchers should acknowledge the work and achievements of other researchers in an appropriate manner, showing respect for others' work by citing other researchers' publications in an appropriate manner and giving others' achievements due value and significance both in their research and the publication of their results.'*

DATA INTEGRITY

Data integrity means '*1. (Data or a data system that is) genuine, authentic, free from internal conflicts, comprehensive, up-to-date, legal, and usable. 2. A characteristic by which information or a message has not been altered without authority, and any potential changes can be traced with an audit trail.*' (Glossary of Government Information Security, 1/2000).

OPEN ACCESS PUBLISHING

In its simplest form, open access publishing (articles, reports, monographs) means uploading a research publication to a data network and granting rights to read, copy, print and link to entire scientific publications. Open access publishing means free dissemination of scientific information. A scientific publication is openly available when both the scientific community and the general public have unrestricted access via the Internet without charge.

In simple terms, Golden OA (the Gold Road) means open journals, while Green OA (the Green Road) means self-archiving. More detailed information about the alternatives for open access publishing is available from, for example, Ilva & Lilja: Kotimaiset tieteelliset lehdet ja avoin julkaiseminen (Finnish scientific journals and open access publishing). 2014. URN:NBN:fi-fe2014050725729.

OPEN DATA

Open data refers to unprocessed information accumulated by research organisations, researchers, public administration, companies or private persons that is made freely accessible to third parties for use without charge.

OPEN INTERFACES

An open interface refers to well-documented, free-to-use means of transferring data between software.[6] For example, a database will provide software developers with an interface for queries.

OPEN KNOWLEDGE

Open knowledge refers to unrestricted access to digital content and data that users may use, amend and distribute without charge. To meet the criteria for open knowledge, items must available in full, in a usable and amendable format, via the Internet. Items must also be licensed for unrestricted use, amendment and distribution.

OPEN LICENCES

Research data and publications are usually protected by copyright. However, agreements can be signed to enable open use of these materials. Creative Commons licences can be used to grant selected rights and freedoms to users, readers or experiencers. By combining different terms and conditions, you handle your rights in a way that suits both you and the situation. You can try combining different terms and conditions with your choice of licence. The OSR Initiative (ATT) recommends CC0, CC 4.0 BY or, if necessary, other generally recognised licences. [7]

OPENNESS AND CONFIDENTIALITY OF RESEARCH RESULTS

Confidentiality is '*1. Maintaining the confidentiality of data, and protecting the rights associated with data, data processing and communications from violation. 2. The extent to which confidentiality is considered important.*' (Glossary of Government Information Security, 1/2000).

OPEN RESEARCH ENVIRONMENTS OR INFRASTRUCTURES

A research environment or infrastructure comprises the tools, equipment, materials and services that enable research to be carried out. Research infrastructures can be used to strengthen research communities and

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[6] Cf. PERA definitions:
http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/03_muut_asiakirjat/20101208Julkis/01_PERA_tietovarantojen_rajapinnat_20101208.pdf
[7] http://creativecommons.fi/lisenssit/

increase capacity. Research infrastructures can be located in one place, be decentralised, or be virtual. An open research infrastructure provides access to a comprehensive package — the research process via which the results will be produced. For a research infrastructure to be considered open, results, publications and background materials must be freely available to the research community.

OPEN SCIENCE

Open science means the promotion of an open operating model in scientific research. The key objective is to publish research results, along with the data and methods used, so they can be examined and used by any interested party.

Open science includes practices such as promoting open access publishing, open access publishing itself, harnessing open-source software and open standards, and the public documentation of research processes with 'memoing'.

OPEN SOURCE

Open source is a way to develop and share software. The software's source code is freely available to be used, copied, altered, and shared. In the open source development world, both ideas and finished products are available for all to see and use. Any single company does not manage development — it is a global community consisting of private persons and companies. Everyone can participate in development work, and bugs can be quickly found and fixed. This often leads to high software quality, good data security, and software interoperability.

OPEN STANDARDS

Open standard means adherence to established, commonly agreed standards, so developers can create replica or compatible software. Open standards are available to all, so anyone can find out about and adhere to them.

PEER REVIEW

Peer review, or 'refereeing', comes from the custom in which scientific articles sent to journals or other publications are evaluated by the editorial team and selected external experts. Peer reviewers examine the content and scientific significance of the submitted article, along with its linguistic form and textual structures, ensuring that each article adheres to principles of scientific writing (such as succinctness, clarity in diagrams and tables, source citations).

PERSISTENT IDENTIFIERS

Identifiers for publications and research data are used to, for example, search for, identify and link materials. Identifiers are also mandatory for long-term preservation. Depending on the type of publication involved, the identifier may be an ISBN (monographs) or a variety of persistent identifiers (PIDs). A Handle ID is used in repositories, a DOI in commercial publishers' systems, and a URN in national libraries' digital collections. A PID is almost exclusively used for research data in national and international projects, while the National Research Data Project (TTA) and OSR Initiative (ATT) use a URN. IDs are also required for researchers and other juridical bodies participating in the research process (universities and other institutions of higher education, research institutes, scientific communities and their institutions, research teams). These identifiers are always separately allocated in Finland.

QUALITY SYSTEM

A quality system consists of procedures and processes for assuring the quality of training, research, social dialogue and impact, human resources, services, and management.

USABILITY

Usability is defined as follows: *According to the Glossary of Government Information Security (1/2000), usability means '1) a characteristic of data, an information system or service, by which it is available to those with the right to use it, and can be used at the desired time and in the required manner, and 2) ease of use'.*