Open science recommendation and checklist for research, development and innovation activities in collaboration between research organisations and companies

Contents

1. Introduction

This is a recommendation for the implementation of an open science[1] approach in research, development and innovation activities (RDI activities)[2] [3]between Finnish research organisations[4] and companies. RDI activities are often carried out through RDI projects. The recommendation describes how research results[5] and data[6] generated in company collaboration[7] can be utilised and/or disseminated safely, efficiently and as openly as possible. The recommendation was written in cooperation by open science coordination, the openness in company collaboration working group and the Finnish scientific community and business community. It is consistent with the Declaration for Open Science and Research 2020-2025, the open operating culture policy currently under preparation and other national recommendations arising from the coordination of open science.

The recommendations are intended for researchers working in research organisations and research support service personnel who prepare and implement RDI projects in collaboration with companies. The recommendation can be modified to meet the needs of each organisation. Figure 1 summarises the content of the recommendation. Cooperation between researchers and companies is regulated by many laws, the terms and conditions of research funders and good scientific practice[8]. In RDI

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[1] **Open science:** Open science is an umbrella term that aims to promote open operating models in science and research. Open science has become an internationally significant way of promoting science and research as well as the impact of research and science on society. Reference: https://avointiede.fi/en/what-open-science

[2] https://www.stat.fi/meta/kas/t_ktoiminta.html

[3] https://www.stat.fi/meta/kas/innovaatio_toim.html

[4] **Research organisation:** Research organisation refers to higher education institutions and public research institutes registered in Finland. Reference: Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–-2025 (1): Policy component for open access to journal and conference articles.

[5] **Research result:** Research result refers to an identifiable expression that provides information about a study that has been conducted and its results. Reference: Research management vocabulary

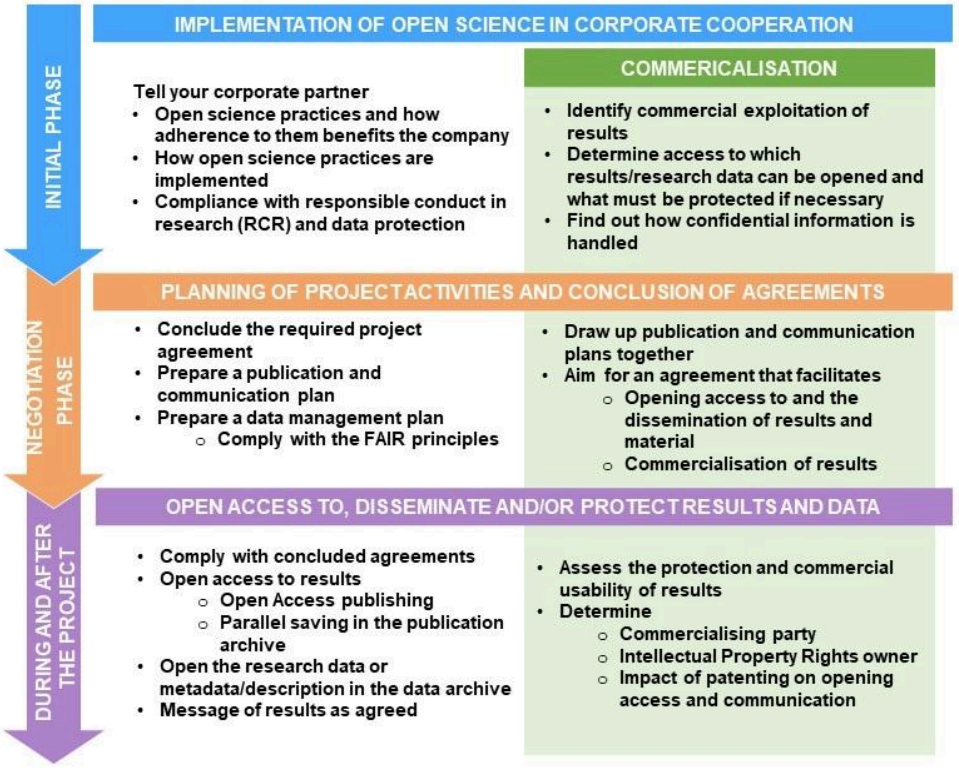
[6] **Research material:** Research material is a resource used by a researcher or research group during the research process, i.e. basic scientific and artistic research material in digital, analogue or physical form. Research material is a broader concept than research data, including source literature (e.g. document materials) and samples (e.g. blood samples, mosses). Reference: Openness of research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data.

[7] **Company collaboration:** Collaboration between companies and research organisations refers to organised, active cooperation and other transfer of expertise, working together and goal-oriented interaction and communication. The collaboration can be funded by a public or private organisation. Reference: https://www.stat.fi/til/inn/2018/inn_2018_2020-04-23_kat_016_en.html

[8] **Responsible conduct of research (RCR)** Responsible conduct of research is a code of conduct for scientists to ensure that research is ethically acceptable and reliable and that its results are credible. Reference: https://edition.fi/tsv/catalog/book/64

activities carried out in collaboration in accordance with the requirements of open science, there must be a balance between open and confidential information. The openness of the research material, communication and publication of the results must be agreed upon by agreement between the research organisation participating in the RDI activities and the company. The recommendation also includes a checklist.

Figure 1. Implementation of open science practices in corporate cooperation during the project's life cycle.



2. In the beginning of company collaboration

RDI projects conducted in company collaboration should take into account the European and national objectives of open science. The business world is influenced by an open innovation approach [9] which is parallel to open science, so many companies are interested in more open operating methods. However, those working in the business world are usually not always familiar with open science practices originating from the world of science. For this reason, the promotion of open science is often the responsibility of the researcher and the research organisation in RDI projects conducted in corporate cooperation. Research organisations provide support for the implementation of open science practices, so please contact your organisation's support services in good time.

In RDI projects conducted in company collaboration, the starting points for promoting openness are trust and understanding of the objectives and needs of the other party. When agreeing on the operating methods of open science, research organisations, business partners and funding organisations participate in the discussion. All the above-mentioned organisations may have their own terms, regulations or operating methods for open science. During the planning phase of the RDI

[9] http://www.openinnovation.fi/

project, discuss with your business partner to determine what open science means and how and what level of openness the project will aim for. For example, consider what is the aim of the collaboration, what matters you are willing to negotiate and what matters you cannot compromise on. To get help in planning and implementing open science practices, contact support services for corporate cooperation and/or open science in your organisation at an early stage.

During the planning phase of the RDI project, negotiate with your company partner about opening and/or disseminating access to background information and research results as well as research material. During this discussion, agree on how the results of the RDI project should be disseminated from both the perspective of the company and the researcher. Justify why it is worthwhile to publish openly, communicate results and provide open access to research data in the project. Also, help your corporate partner understand how openness benefits you as a researcher from the point of view of merit and dissemination of publications.

Restricting open access may be justified if the commercial exploitation of the results and the protection of related rights are endangered. Explain to your corporate partner that open access to research results does not always mean making research results available to everyone free of charge, but instead aims to benefit all parties. For example, open science practices can increase the visibility of the company and thus attract suitable people to be recruited by the company, help in finding new partners and promote development that is beneficial for the whole industry

Responsible conduct in research. A RDI project implemented in corporate cooperation must comply with legislation, cooperation agreements and responsible conduct in research.[10] Therefore, it is important for those participating in the RDI project to be familiar with both the agreements needed in the project and their special characteristics, as well as the principles of responsible conduct in research. Research organisations and companies may have different starting points, objectives and guidelines related to the implementation of research, which may cause ethical conflicts between the parties. To avoid potential conflicts, it is necessary to agree with the corporate partner already at the planning stage on how to ensure responsible conduct in research in the project.

Discuss with your corporate partner what kind of requirements compliance with responsible conduct in research sets for the implementation of the RDI project. As a researcher, you must adhere to the principle of independence and ensure that there are no attempts to influence the research results or prevent the publication of results, even when they do not meet expectations. The corporate partner must be aware that the RDI project cannot guarantee the end result desired by the company. To promote science, it is important that researchers also retain the opportunity to publish.

Contact the representative of the ethics committee operating in your area or the responsible persons for the organisation's research ethics, if the RDI project is subject to an ethical ex-ante evaluation. When the research object of an RDI project is the personnel of an organisation, the research author usually has to apply for a research permit. The practices for granting a research permit vary by organisation.

Data protection. Ensuring data protection is important when promoting cooperation between the research organisation and the business world. If personal data is processed in the RDI project, plan the processing of personal data by familiarising yourself with the instructions provided by your organisation and company. Legal and responsible processing of both personal data and confidential information on the company's operations is a prerequisite for cooperation between the research

[10] https://tenk.fi/en/advice-and-materials/RCR-Guidelines-2012

organisation and the company. When concluding cooperation agreements, discuss how confidential information will be handled in the project. Agree with your corporate partner what tools, information systems and platforms you can use for processing confidential information. In addition, discuss with your business partner whether a non-disclosure agreement should be drawn up for the project.

If you have questions related to responsible conduct in research, contact your research organisation's research ethics support person and in any matter related to data protection the data protection officer of your research organisation.

3. Negotiation phase

3.1 Conclusion of a project agreement or contract

One or more agreements or contracts will usually be concluded before the start of an RDI project. Sufficient time must be reserved for the preparation of the agreements. Find out who in your organisation has the right to sign agreements. Think carefully about your own minimum goals for the content of the agreement and also think about the matter from the company's perspective. Be willing to compromise so that other parties in the project, such as those that are important to the company, will also be taken into account. The agreement is often made together with the support services of the research organisation. The agreement must at least include the agreement's period of validity, clauses on the ownership of data, publications and research results, as well as administration and intellectual property rights of the project. Support services may have agreement templates that are ready for corporate cooperation and can be used as a starting point for contract negotiations. However, the agreement templates must always be customised to suit each project.

Typical agreements related to corporate cooperation include:

- A memorandum of understanding, MoU or letter of intent is a non-binding agreement between two or more parties. It expresses the desire of the parties to collaborate. The participants of the project conclude the MoU with the intention of defining the cooperation within a certain time. The memorandum of understanding creates a framework for negotiations between the parties of the RDI project, and is usually done before the project agreement negotiations.
- Contract or Consortium agreement, CA or Partnership agreement PA is concluded in the beginning of the project between the project parties. It defines the rights, obligations and responsibilities of the parties to the project concerning its administrative structure and the allocation of funding, as well as confidentiality, liability and intellectual property rights. There are many different funder-specific models for these agreements.
- A **transfer of rights agreement** is concluded between the researcher and the research organisation in order to enable the research organisation to fulfil its external funding obligations. These obligations are based on the terms and conditions of the donors. Typically, the scope of transfer of rights agreements is tied to the terms of funding. In other respects, the rights remain with the researcher. These agreements are concluded either on a project-specific basis or on an indefinite basis.

- The **framework agreement** is a general agreement negotiated between the parties, which is typically valid until further notice. Framework agreements are a good tool for well-established cooperation, as they reduce the amount of administrative work and speed up the launching of projects. In addition, a separate agreement will be concluded, which will specify the details of the project and, if necessary, make deviations to the terms of the framework agreement.
- A **grant agreement** (GA) is an agreement between the project leader or the research organisation and the funder, in which the terms and conditions of funding for public funded projects are agreed. These terms and conditions are defined in the main part of the agreement, in addition to which the agreement contains various appendices. The other parties to the project commit to the agreement using the accession form. Grant agreements are defined by the funder and their content cannot usually be negotiated.
- A **non-disclosure agreement,** NDA or confidentiality agreement defines confidential material and/or information that the parties only wish to share with one another. The agreement allows the parties to at least confirm that they will not disclose the information subject to the agreement to third parties and / or use the information subject to the agreement for purposes other than the implementation of the agreed project. It is essential to state in the agreement how confidential information or material is labelled or declared confidential. The agreement should be made fixed-term so that the agreement does not unduly restrict the researcher's other freedom to act.
- A **data processing agreement** (DPA) lays down the requirements of the General Data Protection Regulation concerning the processing of personal data.

3.2 Publication and communication plan

RDI projects carried out with corporate partners typically include trade secrets or intellectual property rights that must be protected, so in the beginning of the project it is important to plan what will be published about the project and how to carry out the external communication[11]. The publication and communication practices of the project must be adapted to the transparency requirements set out by an external funder. Speak with your corporate partner about the limits of openness from the perspective of publishing and communications.

The publication plan includes an initial agreement on who will have the right to publish results, when publication will be possible and which publication channels will be used. If the results contain trade secrets, speak with your business partner about whether access can be opened to the results considered to be trade secrets, or parts of them, in part or with a delay after a certain period of time. Also agree on the basics of authorship, i.e. on what basis you will include the names of authors of the articles in publications. The TENK recommendation on authorship [12] outlines the practices that you can apply in authorship matters. Where necessary, the publication plan and/or the project

[11] Koskinen, I., Ruuska, M., Suni, T., Aivelo, T., Leppänen, J., Lähteenmäki-Smith, K., . . . Salonen, H. (2018). *Tutkimuksesta toimintaan*: Tieteentekijän opas viestintään ja vaikuttamiseen. Art House.

[12] TENK recommendation on authorship agreements https://tenk.fi/fi/ajankohtaista/tenkin-suositus-tekijyydesta-sopimiseksi.

agreement must contain an operating model for reviewing the publications, i.e. comment on how long the parties to the project reserve time for reviewing the publications. The plan may also state how long the parties to the project may, if they so wish, delay publication due to patenting or the deletion of confidential information.

Ensure that the project agreement enables communication and defines the terms and conditions and framework for communication. Tell your corporate partner about the benefits of communication and emphasise that the dissemination of researched information for wider use promotes the impact of the research and the operations of the company. A corporate partner or party that funds a cooperation project may have its own communication guidelines, compliance with which is mandatory, unless otherwise agreed. Prepare an appropriate communication plan for the project with the corporate partner at the project planning stage or at latest when starting the project. Consider at least the following in the plan:

1. In your communication plan, define the areas of responsibility in communication between the different project parties. Agree on the type of operating model and timetable used for communication in the project. In addition, check the project funder's communication and publication requirements.
2. Together with your corporate partner, specify the project's target groups and consider who the publications and communications are directed at. You can also separately identify messages addressed to your research organisation and project target groups.
3. Explain the core messages of the project in 3-5 sentences. For example, highlight the main objectives of the project, which general phenomenon the project is related to, or the main measures of the project. Explain the core messages and make sure that the core messages are understandable for those who are not familiar with the field of science in question.
4. Use different communication and publication channels diversely, taking the target groups and project communication objectives into account. Carefully consider the use and establishment of new communication channels from the perspective of objectives and target groups.

3.3 Data management plan

Researchers are usually responsible for the preparation of a data management plan and the management of research data in RDI projects implemented in cooperation with companies. In the beginning of the RDI project, tell your corporate partner what the data management plan and the management of research data mean and why they are important. In RDI activities carried out in cooperation with companies, the data management plan and the management of research data are based on the same practices, instructions and objectives as in other RDI activities. The data management plan is regularly updated as the RDI project progresses.

Data management aims to comply with the so-called FAIR principles,[13] [14]i.e. the material must be Findable, Accessible, Interoperable and Re-usable. The data can be opened with licences, of which Creative Commons (CC) licences are typical in research. CC licences enable the open dissemination and further use of research publications and data[15]. Further information on the practices for opening access to the data can be found in the policy component on the availability of open access to research data.[16] Good planning ensures that materials can be utilised and/or disseminated as openly as possible. In addition, confidential background materials will only be used for the agreed purpose and stored appropriately. To get started, follow these steps:

- Familiarise yourself with the instructions and policies of your organisation and your corporate partner as well as those for the data management of potential funders. For example, many funders require the open licensing of data. Take the requirements into account in your plan. If necessary, also use other instructions, such as those of the Social Science Data Archive[17].
- Ask your organisation's support services for help in planning data management in a timely manner. At the same time, ask if any practices have been previously agreed on with your corporate partner.
- Involve your corporate partner in preparing the plan. Joint planning helps partners understand the requirements that need to be taken into account in the management of research data.
- Agree with your corporate partner on the practices for opening access to research material. In the plan, describe such points as how the use of data is made possible by opening access to it.
- Consider together whether access to at least part of the research data can be made available.

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[13] **FAIR principles:** The FAIR principles refer to the quality of research data from the perspective of its further use. The aim of the principles is to make the research data Findable, Accessible, Interoperable and Reusable.

Research data and metadata in accordance with the FAIR principles are semantically functional, meaning they are so well structured, described, tagged, licensed and safely stored that they can be found and read by machine. Reference: Openness of research data and methods. National policy and executive plan by the higher education and research community for 2021–-2025. Policy component 1: Open access to research data.

[14] Openness of research data and methods. National policy and executive plan by the higher education and research community for 2021–-2025. Policy component 1: Open access to research data.

[15] https://creativecommons.fi

[16] Openness of research data and methods. National policy and executive plan by the higher education and research community for 2021–-2025. Policy component 1: Open access to research data.

[17] Data management planning. Data management manual. Social sciences data archive. https://www.fsd.tuni.fi/en/services/data-management-guidelines/data-management-planning/

- In the plan, specify exactly what has been agreed to in the project agreement regarding the ownership and intellectual property rights (IPR) of the data generated during the project.
- In the plan, describe how you will collect, share and store confidential, classified and/or personal data. Comply with the EU General Data Protection Regulation if you intend to process personal data.
- Describe how to enable reuse of the data.

4. During and after the project

4.1 Opening access to publications

By making RDI project publications and research data available to others, you can increase their usability and visibility. Opening them may also help in finding new research partners. As described in previous chapters, opening access to publications and data is agreed upon in the project agreements, and the practices for opening access are described in the publication, communication and data management plans.

Publication in an RDI project may be scientific, professional and/or directed at the general public. The interests of both researchers and companies will determine what types of publication channels data will be published in. The selection of publication channels is also influenced by the company's sector. Discuss with your corporate partner which publication channels would be useful for the company and industry. Here is a list of options for open publishing:

- Publishing the articles in a magazine based on the Open Access principle (Gold OA)
- Parallel publication of the publication's or author's own most recent version of an article in the organisation's open publication archive in accordance with the terms and conditions of the publisher (Green OA)
- Paying to open the publication in a subscription magazine (hybrid OA)
- Publishing in open publication archives specific to each field of science.

In addition to the above-mentioned scientific journals, suitable publication channels may include open books and reports or, for example, professional journals, professional and stakeholder blogs and podcasts. General magazines can be a suitable way to reach a wider readership. If necessary, request parallel permission to save the publication in your own organisation's publication archive and confirm the terms and conditions for the further use of the publication with the publisher.

4.2 Opening research data

The good management and openness of research data will improve the further use of the data and support the creation of new inventions. When opening access to research data, remember at least the following principles:

- "As open as possible and as closed as necessary".

- Comply with the terms and conditions of financial instruments.
- Select a data archive[18] where you can determine the degree of openness appropriate for the research data: The data can be openly available to everyone, only available with permission or fully closed. Follow your organisation's instructions for selecting an archive.
- Store research data in a data archive in a format that is available with open license software or software commonly used in the field.
- In addition to the research data, save the metadata[19] in the data archive, i.e. a description that helps others understand the data and use it.
- If the research data cannot be opened, you may be able to open the relevant metadata in, for example, your organisation's research information system, where this information can be found by everyone. Write the metadata in a manner that keeps the information specified for confidentiality undisclosed.

There are certain reasons for restricting access to research data, for example:

- The research data contains personal data or other identifiable data that cannot be deleted.
- A trade secret or IPR protection prevents the opening of access to research data, or at least postpones the opening date.
- The RDI project partner is a company that does not want its name published.

4.3 Commercialisation

In the case of the results of the RDI project, their protection and commercial usability must be assessed. Consider the following:

- Are the results inventions that should be protected, for example, by patenting, or by registering design protection and trademark[20]?
- Is the result a more efficient production process that companies could benefit from?
- Could an existing company commercialise the results, or does commercialisation require the creation of a new company?
- Would it be reasonable to consider commercialising and/or publishing and disseminating the software code under a free open source license?

Commercialisation of RDI projects is usually depicted as a straightforward chain of events starting with an idea or an invention and proceeding through testing and product development to the establishment of a new company. In practice, the process is rarely this straightforward, instead the

[18] **Data archive:** A system suitable for storing, transmitting and managing research data and the services built around it. Reference: Research management vocabulary

[19] **Metadata:** Information describing the context, content and structure, management, processing and compilation of research data. Metadata enables the implementation of the FAIR principles and can be used to automate data management. Metadata can be linked to the entire research data or part of it (e.g. measurement method). Reference: Research management vocabulary

[20] Finnish Patent and Registration Office https://prh.fi/en/index.html

parties may also go back and forth along this path. Commercialisation can be described using either a three-stage invention path[21] or a nine-level Technological Readiness Level scale (TRL)[22] as follows:

1. **Brainstorming (TRL 1-3):** Commercialisation is strongly linked to research at the brainstorming stage, as inventions are usually the result of lengthy research. Research will continue by testing the functionality of the invention (proof of concept) and by carrying out product development. At the brainstorming stage, a market study can be conducted and the possibilities of protecting an invention can be investigated.
2. **Work (TRL 4-6):** The product or service prototype is built during the work phase. If the aim is to establish a new company (spin-off), a business plan is usually drawn up at this stage. During the preparation phase, cooperation with an existing company may also be possible.
3. **Commercialisation (TRL 7-9):** Once a functional prototype and business plan are ready, the intellectual property rights of the product can be transferred to the company to be established. Intellectual property rights can also be sold or licensed to the existing company.

When planning commercialisation, find out who will act as the commercialising party and who will own the intellectual property rights of your results. The results of RDI projects can often be disseminated by opening access to them and utilised by commercialising them. For example, patenting often does not prevent the opening of access to results. The results can be concealed until the patent application is submitted to the authorities, after which the results can be published openly. Even so, request approval for publication from the patenting party to ensure that the patenting process will not be compromised by the publication of the results.

Contact your organisation's support services well in advance. Explain the objectives related to the commercialisation and opening of access to results in your RDI project. Support services will help you commercialise your results. The support may include the investigation of intellectual property rights, drawing up a project agreement, submitting an invention notification or protecting an invention. Separate funding can be applied for in the commercialisation process.

5. Checklist for corporate projects

This checklist is intended as an aid for the planning phase of corporate projects. The checklist complements the Recommendation for Open Science for research carried out in collaboration between research organisations and companies. Make sure that you and your corporate partner discuss the points below from the perspective of the RDI project.

[21] Invention path, https://www.keksinnot.fi/keksinto-polku/

[22] The technological readiness scale, which was originally defined by NASA in the 1990s as a means of measuring the maturity of a particular technology, https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html . The EU has its own scale, which differs slightly from the NASA readiness scale, European Commission. 2014. “Technology readiness levels (TRL)”, http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2016_2017/annexes/h2020-wp1617-annex-g-trl_en.pdf

Implementation of open science in company collaboration

- € We have discussed what open science means to different parties in the RDI project and have jointly familiarised ourselves with practices in accordance with open science.
- € In the scope of the project, we have ensured the implementation of responsible conduct of research, such as ethical advance assessment and / or research permits.
- € We have taken care of the data protection and security of the project.
    - € We have agreed on how we will process personal data and confidential information.
    - € We will process personal data in accordance with the EU's General Data Protection Regulation.

Planning of project activities and concluding agreements

Conclusion of a project agreement

- € We have concluded the necessary agreements to implement the project:
    - € Memorandum of understanding
    - € Project agreement
    - € Agreement on the transfer of rights
    - € Framework agreement
    - € Grant agreement
    - € Non-disclosure agreement
    - € Data processing agreement

Publication and communication plan

- € We have negotiated and agreed on
    - what will be published and communicated about the project to external parties.
    - who will have the right to publish results, when publication is possible and which publication channels will be used.
    - how authorship will be determined.
- € We have adapted the publication and communication practices of the project to the requirements set out by all parties involved.

Data management plan

- € We have familiarised ourselves with the guidelines and policies pertaining to management of all parties.
- € We have prepared a data management plan in cooperation with our corporate partner.
- € In the plan, we have described
    - how we will collect, share and store confidential, classified and/or personal data.
    - how we will facilitate the reuse of the data, for example by opening access to research data.

Open, disseminate and/or protect research results and data

Opening publications

- € We have reviewed what has been agreed to with the corporate partner as regards publishing or communicating the project results.
- € We have selected suitable publication channels that are as open as possible.
- € We have verified the terms and conditions for further use and parallel storage of publications with the publisher.

Opening research data

- € We have reviewed what has been agreed on with our corporate partner as regards opening access to the data.
- € We have selected a suitable data archive for the research data [23].

[23] **Data archive:** A system suitable for storing, transmitting and managing research data and the services built around it. Reference: Research management vocabulary

- € In addition to the research data, we have saved the metadata or description of the data in the data archive. If we cannot open the actual research data, we have published the metadata of the data.

Commercialisation

- € We have held discussions with all parties on how the research material and results generated in the project can be commercialised.
- € We have assessed the protection and commercial usability of the project results.
- € We have determined
    - the party that will commercialise the results.
    - the owner of the IPR for the results.
    - that the publication of the results does not jeopardise patenting.
- € We have been in contact with my organisation's support services to get help in the commercialisation of the results.

6. Glossary

7. Recommendation author list

Anna Mikkonen Häme University of Applied Sciences

Anne Kärki Satakunta University of Applied Sciences

Annina Lattu Tampere University

Helena Puhakka-Tarvainen Karelia University of Applied Sciences

Heli Lehtivuori Tampere University

Inka Stormi Häme University of Applied Sciences

Leo Lahti University of Turku

Maria Söderholm Finnish Environment Institute

Seliina Päällysaho Seinäjoki University of Applied Sciences