Open Science and Research in Finland

Evaluation of Openness in the Activities of Higher Education Institutions, Research Institutes, Research-funding organisations, the Academic and Cultural Institutes abroad and Learned Societies and Academies in 2019

Preliminary report

Summary

This preliminary evaluation of the openness of Finnish research organisations and research-funding organisations was completed as part of the Open Science and Research activities by the Ministry of Education and Culture.

The Open Science and Research Roadmap (OSR Roadmap) was published in 2014 to support research organisations in making progress towards openness. In the OSR Roadmap, certain objectives and actions were defined, as well as the responsibilities of different stakeholders in policy implementation. The openness of activities were first evaluated in 2015, when universities, universities of applied sciences and research institutes were assessed with respect to their policies on and open science practices. In 2016, the evaluation was repeated and extended to cover university hospitals and research-funding organisations. The evaluation of research-funding organisations included a comparison with selected European research-funding organisations. The evaluation of year 2017 covered the activities of Finnish research organisations and research-funding organisations. All the previous evaluations are available at https://avointiede.fi/fi/kypsyystasoselvitys. This evaluation covers the activities of Finnish higher education institutions, research institutes, research-funding organisations, the Academic and Cultural Institutes abroad and Learned Societies and Academies in 2019.

The purpose of these evaluations is to highlight best practices and areas of development. The evaluation is by no means directed at the quality of work of the research organisations and research-funding organisations. In addition, the ranking has no direct impact on the activities of organisations as such, but merely visualises their scores. As such, it should be interpreted carefully and by no means treated as a ranking table.

This evaluation examines the key indicators chosen to gauge performance on openness. Key indicators are used to provide some insights on the competences and capacity of the research system in supporting progress towards openness.

Contents

Introduction

The Ministry of Education and Culture's now historical Open Science and Research Initiative (ATT), defined the Open Science and Research Roadmap 2014–2017[1] .The roadmap identified a set of actions and measures to ensure the openness and reproducibility of research, and to enable the opportunities afforded by open science to be developed and used extensively in Finnish society. The ATT initiative is now in the past, and the Federation of Finnish Learned Societies (TSV) coordinates Open Science in Finland. However, to be comparable with the previous reports, the framework of the evaluation is based on the earlier roadmap. 1.

The roadmap's four sub-objectives are still relevant: reinforcing the intrinsic nature of science and research, strengthening openness-related expertise, ensuring a stable foundation for the research process, and increasing the social impact of research.

Open science and research requires a good, open method for managing research processes and results. This can be achieved if those responsible for research systems are motivated and trained to put the related principles into practice. Various stakeholders have responsibility for implementing such principles, based on the objectives listed on the OSR Roadmap. Development objectives are paired with measures defined as responsibilities on the OSR Roadmap. Success in achieving the related targets will be evaluated by measuring the key factors underlying individual measures, in order to form a set of indicators.

Being responsible for the activities and culture of research environments, research organisations play a vital role in steering development towards the objectives in hand. The following responsibilities listed in the Roadmap can be considered key actions for promoting openness within the activities of research organisations:

- Including openness within the organisation's strategy
- Supporting and facilitating a collaborative culture
- Well-defined policies for publication, licensing, copyright and proprietary rights
- A clear description of researchers' rights and obligations with regard to openness
- Developing and maintaining competences
- Promoting the use of shared services
- Systematic use of quality systems
- Promotion of interoperability
- Exemplary management of research results and methods
- Promoting openness, availability, visibility and usability, and introducing support services for the measurement of such factors

An organisation's operational culture should be apparent in its strategies, values, and quality systems. It is therefore important for organisations to provide clear guidelines for researchers, and to communicate their research results openly online. Openness also requires organisations to adhere to and support national and international shared and general guidelines, policies, and principles, when existing.

1.1 Framework for Evaluation

The OECD Science, Technology and Industry Outlook document says the following: *"As Open Science progresses, new policy approaches will be needed to determine how public research is funded, research is undertaken, research outputs are exploited, research results are accessed and protected, and to shape how science and society interact."*

In order to develop policies that support open science and research in the appropriate manner, we need a better understanding of several critical aspects of the openness of research activities, such as the policies and guidelines that apply to research funding. For this purpose, we need to provide indicators for benchmarking national performance in open science. We believe that the selected indicators reflect openness-related management and support activities.

The purpose of this evaluation is to highlight best practices and areas of development at national level in order to encourage national collaboration and to initiate discussions on open

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[1] The Open Science and Research Roadmap 2014–2017, http://openscience.fi/open-science-and-research-roadmap-2014-2017

science and research at international level. This evaluation is by no means directed at the quality of work of the organisations and has no direct impact on the activities of organisations as such. It merely visualises maturity scores in facilitating and advancing open science and should be interpreted with caution: it should by no means be treated as a ranking table.

This evaluation examines the key indicators selected to gauge performance in terms of steering, management and support of openness. Such indicators are used to provide insights on the competences and capacity of the research system to progress towards openness. However, since Open Science and openness are interpreted differently depending on the country and organisation, the overall comparison has limitations. This report is one in a series of studies on the open science and metrics[23], a fact that highlights the importance of debates on the topic. For example, an earlier survey on Open Access Publishing Policies from Science Europe also examined research-funding organisations, but based on a different approach.[4]

1.2 Purpose of Evaluation

The evaluation covers 39 higher education institutions and 12 Finnish research institutes, three major Finnish research-funding organisations, four Finnish academic and cultural institutes abroad and seven organisations of learned societies and academies

The target of evaluating organisations is:
- To assess the openness of operational cultures and establish a clear picture of the current level of openness
- To identify strengths and weaknesses in promoting openness
- To identify areas in which support and cooperation are needed
- To evaluate progress, when previous evaluation data is available

2. The Approach

The key objectives, against which the assessments are made, are defined in the Open Science and Research Roadmap. Using the objectives listed in this roadmap, various stakeholders have responsibility for putting openness policies into practice. The development objectives are implemented through actions, which are defined as responsibilities in the OSR Roadmap. Key indicators reflect the objectives to be targeted. Success in achieving the targets is evaluated by scoring against the key measures that form the indicators. Figure 1 shows the relation of the OSR Roadmap to the indicators, measures and scores of this analysis.
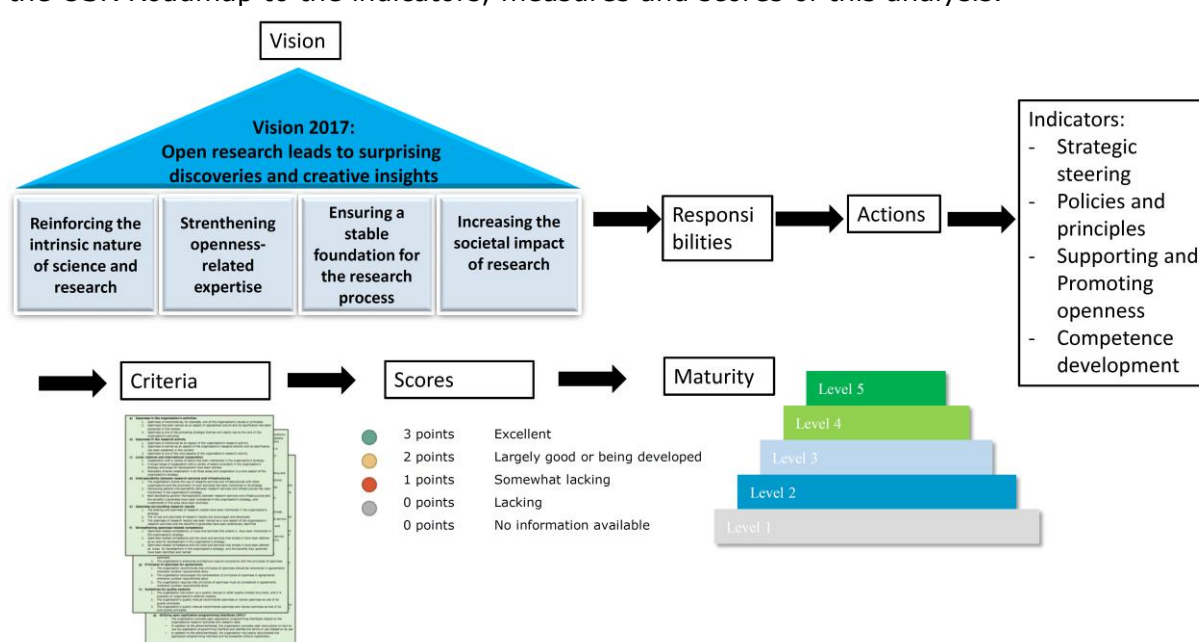

Figure 1: Relation of this evaluation and its indicators and measures to the Open Science and Research Roadmap 2014–2017

[2] https://ec.europa.eu/research/openscience/index.cfm?pg=altmetrics_eg
[3] https://ec.europa.eu/research/openscience/pdf/report.pdf
[4] http://scieur.org/oa-survey

The measures have been fine-tuned and modernized for the 2019 analysis by collaborative efforts. The fine-tuned measures were tested, and further re-defined to make it possible to see differences in the data. The key indicators are used, as earlier, to define the maturity of openness activities. Maturity in turn is described in levels, the so-called maturity hierarchy. Each organisation is ranked at the final phase within this maturity hierarchy, based on the scores given for each measure.

The evaluation consisted of the following steps:

4) **Preliminary data collection**: Data used in preliminary analysis consists of information available on each organisation's external website: its publicly accessible strategies, policies and principles, and its guidelines for supporting openness. Preliminary data collection covers only parts of the final data.
5) **Preliminary analysis**: Based on this information, the preliminary level of openness for the organisations was scored with in a number of areas. Scoring was based on indicators derived from the responsibilities for promoting openness assigned to each organisation within the Open Science and Research Roadmap.
6) **Preliminary report**: Preliminary evaluation based on the preliminary analysis.
7) **Complementary Data Collection:** Data collected via a request for information was sent to organisations of interest by the Ministry of Education and Culture, together with the preliminary analysis. In the request for information, the organisations can make additions and correct mistakes or misinformation in the preliminary data and analysis, and provide further insights on the activities undertaken within the organisation.
8) **Final Analysis**: Based on preliminary and complementary data collection.
9) **Final Report**: This report. The final evaluation based on the combined data.

2.1 Preliminary Data Collection

As the preliminary data, information was collected from the organisations' external websites. During data collection, a specific set of data was used in the analysis performed for each key indicator. For all indicators, data was limited to each organisation's external (public) website. No information available on internal (e.g. intranet) pages was included. If the organisation's website linked to external guidelines, the website had to mention that the organisation either adhered to those guidelines or recommended their use. A simple link to external guidelines did not suffice.

All of the organisations' strategies were collected from public websites for analysis. If no bespoke strategy document was available for downloading, strategy-related web pages, or comparable documents (such as values and visions), were used instead.

Other information was acquired from external websites, both by browsing and via searches using terms derived from the indicator's measures. All of the available relevant information was included in the analysis.

The preliminary data was collected in May-June 2019.
The data gathered for this analysis is available in Appendices 6-11.

2.2 Complementary Data Collection

During complementary data collection, the preliminary data, preliminary report and a request for information are sent to all organisations for a review and additions. The organisations are able to provide further insights into the activities conducted within each organisation.

Complementary data should arrive latest on September 16th 2019 to Ministry of Education and Culture.

The reviewed data and the responses to the requests for information will be combined to form the final data for the final evaluation.

2.3 Indicators and Scoring Principles

In the analysis, selected indicators are used to evaluate organisations' openness.

The indicators for higher education institutions and research institutes were:
1) Strategic Steering
2) Policies and Principles
3) Supporting Openness
4) Competence Development

The indicators for research-funding organisations were:
1) Strategic Steering and Principles of Openness
2) Openness in Research Funding
3) Supporting and Promoting Openness

The indicators for academic and cultural institutes working abroad were:
1) Strategic Steering and Principles of Openness
2) Openness in Research Funding
3) Supporting and Promoting Openness

The indicators for learned societies and academies were:
1) Strategic Steering and Principles of Openness
2) Openness in Research Funding
3) Supporting and Promoting Openness

Each indicator has a number of individual measures that were scored using the data, based on the score category (see below). All indicators and measures are found in Appendices 1,2, 3 and 4.

Openness was evaluated separately for each measure, using a four-tiered scoring system:

For each measure, each organisation was given a score between zero and three on the basis of the available information. Valuation of the scores for each measure was performed by at least two individuals. If no information was available or information was lacking, zero points were awarded. The scores for each measure used in an indicator were presented as follows:

	3 points	Excellent
🟢	3 points	Excellent
🟡	2 points	Largely good or being developed
🔴	1 points	Somewhat lacking
⚪	0 points	Lacking
No legend	0 points	No information available

To achieve the overall score for openness, a sum score was calculated covering all measures and across all indicators for each organisation. This was calculated as the sum of points received for all measures across all indicators.

2.4 Maturity Levels

Based on the analysis scores, the higher education institutes, the research institutes, research-funding organisations, the Academic and Cultural Institutes abroad and Learned Societies and Academies were placed within a hierarchy of maturity levels. A five-level maturity model was employed. A figure depicting the overall maturity level is shown below. The scores required for each maturity level are given alongside the maturity levels in question. Table 1 provides an interpretation of these maturity levels from the perspective of open science and research.

Level 5 Strategic

An open operational culture is publicly encouraged throughout the organisational level and openness has been defined as a core value in the organisation's strategy and policies. Activities are open and developed in accordance with the principles of openness and in cooperation with other actors. Openness has also been linked to the long-term planning and management of activities. The organisation is always able to ensure that it is moving towards its goals, and is learning and adapting. Key benchmarks are in comprehensive use and are continually reviewed. Personnel are aware of their targets and the organisation's progress towards openness.

Level 4 Managed

The organisation is actively working towards an open operational culture, and principles of openness have been publicly set as one of its objectives. Activities are largely open and adhere to the principles of openness. Openness is managed and regularly measured. Measurements are analysed and corrective measures are proactively taken. The organisation is mature in terms of its utilisation of open information, which is also taking on increased significance.

Level 3 Defined

At this level, decisions are increasingly made with the aid of data based on openness measurements. Management supports the planning and implementation of an already more effective openness strategy. The organisation has done a great deal of work towards breaking down information silos, in order to establish an extensive organisation-wide technology management and architecture. Although progress has been made towards an open operational culture, this has yet to be completely achieved due to deficiencies in policies and principles. Openness is not to be found as a core steering value in the organisation's strategy. Activities are in many respects open and based on documented descriptions.

Level 2 Partly managed

The organisational culture will begin to change at the next level. Understanding the benefits of openness and its impact on activities is key. However, support for openness is limited and the organisation still has unlinked data warehouses. The first steps have been taken towards an open operational culture, but this is not publicly encouraged. Openness does not appear as a core value in the organisation's strategy. Activities are open to some extent. The organisation has begun efforts to develop competencies and create a systematic approach to openness. Performance measurement is largely the measurement of financial performance.

Level 1 Unmanaged

No steps have yet been publicly taken towards an open operational culture and the organisation lacks guiding principles and policies. Processes have not been clearly defined. Openness is not included in the organisation's strategy. Openness-related activities are not encouraged at organisational level. Indicates a situation in which openness is not consciously managed. At worst, the organisation may be an information silo. The term 'information silo' denotes informal point solutions. Although systems are in use, data for reports and benchmarks is often manually collated from a variety of information systems and other sources.

Table 1: An interpretation of these maturity levels from the perspective of open science and research.

Promoting Openness in Higher Education Institutions

The preliminary data from the Higher Education Institutions' web pages form the preliminary evaluation results. The Ministry of Education and Culture sent a request for information, in which the research organisations were able to add information to and correct mistakes or misinformation in the preliminary data and analysis.

3. The collected data supports the identification of best practices and areas of development. Against this background, the results show that organisations with resolute strategic steering and clear policies and principles are able to manage change towards openness.

Higher Education institutions are compared only in relation to the results of their earlier evaluation performed in 2016.

4.1 Strategic Steering

An organisation's strategy reveals both its long-term and short-term visions, and the organisation's strategic choices and commitment to the implementation of various measures needed to advance open science. An organisation uses its strategy to communicate its objectives not only to its own personnel but also to others. The openness of an organisation's operating culture should therefore be evident in its strategy. Transparency is at least as important as concrete actions. Table 2 shows the measures considered for the evaluation of activities in this indicator. Table 3 shows the scoring of each organisation for each measure in this indicator.

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Strategic Steering

    a) **Openness in the organisation's strategy**
    b) **Openness in the research activity**
    c) **Local, national and international cooperation**
    d) **Managing interoperability**
    e) **Openness of research results**
    f) **Strengthening of openness-related competencies**

See Appendix 1 for more details on scoring in relation to these measures.

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Table 2: Measures for Strategic Steering indicator

Based on the score results, higher education institutions have actively included openness to their strategies. At the same time, a bit less commitment to openness in research activity is indicated by the strategic documents and shown as scores 1b.

Local, national, and international cooperation is strongly noted in the higher education institutions' strategies, but only one of them has the cooperation named as the core aspect of their strategies. More than half of the universities have mentioned the promotion of interoperability in their strategic steering, but only one third of the universities of applied sciences. Less than half of the universities and a little more than one third of universities of applied sciences mention openness of research results in the strategy-level. Strengthening openness-related competencies has clearly intensified in the strategic documents since previous evaluation.

Organisation	a	b	c	d	e	f	points
AALTO	red	grey	red	red	grey	grey	3
HANKEN	grey	grey	grey	grey	grey	grey	0
HY	red	green	yellow	red	red	yellow	10
ISY	yellow	red	yellow	red	red	red	8
JY	red	grey	red	grey	grey	grey	2
LaPY	yellow	red	red	red	grey	yellow	6
LUT	red	red	red	red	red	red	7
MPKK	grey	grey	grey	grey	grey	grey	0
OY	yellow	red	red	yellow	red	red	9
TAIDE	grey	grey	yellow	grey	grey	grey	2
TUNI	green	green	yellow	green	yellow	green	16
TY	green	green	yellow	green	yellow	green	16
VY	grey	grey	yellow	grey	grey	grey	2
ÅA	green	green	green	red	yellow	red	13
ARCADA	red	red	grey	red	red	red	5
CENTRIA	grey	grey	yellow	grey	grey	grey	2
DIAK	grey	grey	red	grey	grey	grey	1
HAAGA-HELIA	grey	grey	red	grey	grey	grey	1
HAMK	red	grey	red	grey	grey	grey	2
HUMAK	red	grey	yellow	grey	grey	grey	3
HÅ	grey	grey	grey	grey	grey	grey	0
JAMK	red	red	yellow	red	red	red	7
KAMK	red	red	yellow	grey	red	red	6
KARELIA	red	red	yellow	red	red	red	7
XAMK	red	red	yellow	red	red	red	7
LAMK	grey	grey	red	grey	grey	grey	1
LAPIN AMK	red	red	red	red	red	red	6
LAUREA	grey	grey	yellow	grey	grey	grey	2
METROPOLIA	red	red	grey	red	red	red	5
NOVIA	red	red	yellow	red	red	red	9
OAMK	grey	grey	red	grey	grey	grey	1
PAMK	grey	grey	yellow	grey	grey	grey	2
SAIMAA	red	grey	red	grey	grey	grey	2
SAMK	grey	grey	red	grey	grey	grey	1
Savonia	grey	grey	yellow	grey	grey	red	3
SEAMK	red	red	yellow	red	red	red	9
TAMK	grey	grey	yellow	grey	grey	grey	2
TURUN AMK	grey	grey	yellow	grey	grey	grey	2
VAMK	grey	grey	yellow	grey	grey	grey	2

Table 3: Scoring for Higher education Institutions for Strategic Steering - indicator

4.2 Policies and Principles

The organisations implement their strategies in practice by defining and executing policies and principles that encourage openness. These include defining policies on the openness of data, methods, publications and collaboration, writing clear instructions for supporting services and aiming at establishing open research enterprise architecture, and including openness within an organisation's quality systems. Their various policies and principles describe openness as part of the organisation's activities and help actors to embrace openness. Table 4 shows the measures considered for the evaluation of activities in this indicator. Table 5 shows the scoring of each organisation for each measure in this indicator.

Table 4: Measures for Policies and Principles Indicator

Organisation	Principles (a b c d e f g h i)	Points
AALTO		16
HANKEN		11
HY		24
ISY		20
JY		17
LaPY		9
LUT		17
MPKK		2
OY		20
TAIDE		9
TUNI		22
TY		23
VY		10
ÅA		10
ARCADA		7
CENTRIA		0
DIAK		19
HAAGA-HELIA		19
HAMK		23
HUMAK		12
HÅ		2
JAMK		21
KAMK		13
KARELIA		24
XAMK		16
LAMK		19
LAPIN AMK		19
LAUREA		18
METROPOLIA		3
NOVIA		3
OAMK		9
PAMK		4
SAIMAA		13
SAMK		15
Savonia		2
SEAMK		20
TAMK		20
TURUN AMK		24
VAMK		4

Table 5: Scoring for Policies and Principles indicator for Higher Education Institutions

Based on the data, higher education institutions have actively set policies and principles to promote and clarify their stand in openness. About 80% of the higher education institutions have principles, which recommend or encourage the use of open-access channels for publishing. Nearly all (93%) of the universities and 72% of the universities of applied sciences have recommendations on self-archiving the publications in institutional or other repositories. Openness of research methods (including algorithms and code) is not as well managed in policies as the availability, use and licensing of research data, but still about 64% of the universities of applied sciences and 64% of the universities and have policies and principles for this. Most of the universities of applied sciences require openness of research methods. The data shows that the principles of Open Science framework have been considered and all encourage compliance with these. Principles of openness for cooperation have also been widely set.

4.3 Supporting Openness

The indicators refer to concrete actions in organisations, with which openness can be promoted and encouraged. By well-defined guidelines for the research community, it is possible for the entire organisation to harness the benefits of openness. A common understanding of the benefits of openness coupled with competences facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 6 shows the measures considered for the evaluation of activities in this indicator. Table 7 shows the scoring of each organisation for each measure in this indicator.

> **Supporting Openness**
>
> a) **Monitoring the openness of publishing (Open Access, self-archiving)**
> b) **Monitoring the openness of research data (making data available, utilisation)**
> c) **Monitoring the visibility of research (impact; scientific and social media)**
> d) **Services for cataloguing and creating metadata for research materials**
> e) **Services for documenting research publications and materials**
>
> **See Appendix 1 for more details about scoring in these measures.**

Table 6: Measures for Supporting Openness indicator

Table 7: Scoring for Higher Education Institutions for Supporting Openness -indicator

Organisation	Supp. Open. a	b	c	d	Total Points
AALTO	green	yellow	yellow	yellow	9
HANKEN	yellow	yellow	green	yellow	9
HY	green	grey	green	yellow	8
ISY	red	red	red	yellow	5
JY	green	grey	yellow	yellow	7
LaPY	yellow	grey	yellow	yellow	4
LUT	grey	grey	yellow	yellow	4
MPKK	grey	grey	grey	grey	0
OY	yellow	yellow	yellow	yellow	8
TAIDE	grey	grey	grey	yellow	2
TUNI	green	green	yellow	yellow	10
TY	green	green	green	yellow	11
VY	grey	grey	grey	yellow	2
ÅA	grey	grey	grey	green	3
ARCADA	grey	grey	yellow	yellow	4
CENTRIA	grey	grey	grey	grey	0
DIAK	green	green	green	red	10
HAAGA-HELIA	grey	grey	grey	yellow	2
HAMK	green	yellow	green	yellow	10
HUMAK	grey	grey	grey	yellow	2
HÅ	grey	grey	grey	grey	0
JAMK	grey	grey	grey	yellow	2
KAMK	grey	grey	red	yellow	3
KARELIA	yellow	yellow	green	yellow	9
XAMK	yellow	yellow	yellow	yellow	8
LAMK	red	grey	grey	yellow	3
LAPIN AMK	yellow	yellow	grey	yellow	6
LAUREA	yellow	grey	grey	yellow	4
METROPOLIA	grey	grey	grey	grey	0
NOVIA	grey	grey	grey	grey	0
OAMK	grey	grey	grey	grey	1
PAMK	grey	grey	grey	grey	0
SAIMAA	yellow	yellow	grey	yellow	6
SAMK	grey	grey	grey	yellow	2
Savonia	grey	grey	yellow	grey	2
SEAMK	yellow	grey	grey	yellow	4
TAMK	green	green	yellow	yellow	8
TURUN AMK	yellow	yellow	grey	yellow	6
VAMK	grey	grey	grey	yellow	2

Based on the data nearly all of the higher education institutions provide guidelines and some support for documenting research results e.g. self-archiving research publications. Less organisations monitor the openness of publications and half of the organisations monitor openness of research data or have plans to do so.

Most of the universities but minority of the universities of applied sciences monitor the visibility of their research in both scientific and social media and the related data is actively collected to support openness.

4.4 Competence Development

By steering the research community, it is possible for an entire organisation to harness the benefits generated by openness. Well-defined guidelines support the development of this. . Coupled with competencies, a common understanding of such benefits facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 8 shows the measures considered for the evaluation of activities in this indicator. Table 9 shows the scoring of each organisation for each measure in this indicator.

4.5 Maturity Rankings of Higher Education Institutions

Each organisation's ranking is based on the total sum of scores for each of the measures, for all indicators. Figures 2 and 3 present the score results for each indicator, based on the findings of the evaluation. Table 10 presents the total sum of scores, across all indicators, for each research organisation included in this analysis.

Organisation	Preliminary sum score in 2019	Difference to 2016 total sum score	Total sum score 2016
AALTO	28	-11	39
HANKEN	20	-17	37
HY	42	-12	54
ISY	33	-2	35
JY	26	-22	48
LaPY	19	-12	31
LUT	28	-16	44
MPKK	2	-	-
OY	37	-7	44
TAIDE	13	+4	9
TUNI	48	-	-
TY	50	+11	39
VY	14	-1	15
ÅA	26	+1	25
ARCADA	14	-2	16
CENTRIA	2	-15	17
DIAK	30	+7	23
HAAGA-HELIA	22	+7	15
HAMK	35	+22	13
HUMAK	17	+12	5
HÅ	2	-	-
JAMK	30	+21	9
KAMK	22	+9	13
KARELIA	40	+26	14
XAMK	31	-	-
LAMK	23	-3	26
LAPIN AMK	31	+22	9
LAUREA	24	-1	25
METROPOLIA	8	-9	17
NOVIA	15	+4	11
OAMK	11	+3	8
PAMK	4		
SAIMAA	21	+6	15
SAMK	18	+10	8
SAVONIA	7	-6	13
SEAMK	33	+3	30
TAMK	30	+20	10
TURUN AMK	32	+15	17
VAMK	8	+3	5

Table 10: Preliminary sum scores in 2019 across all indicators for each research institution and the difference in total sum score compared to the total score in 2016.
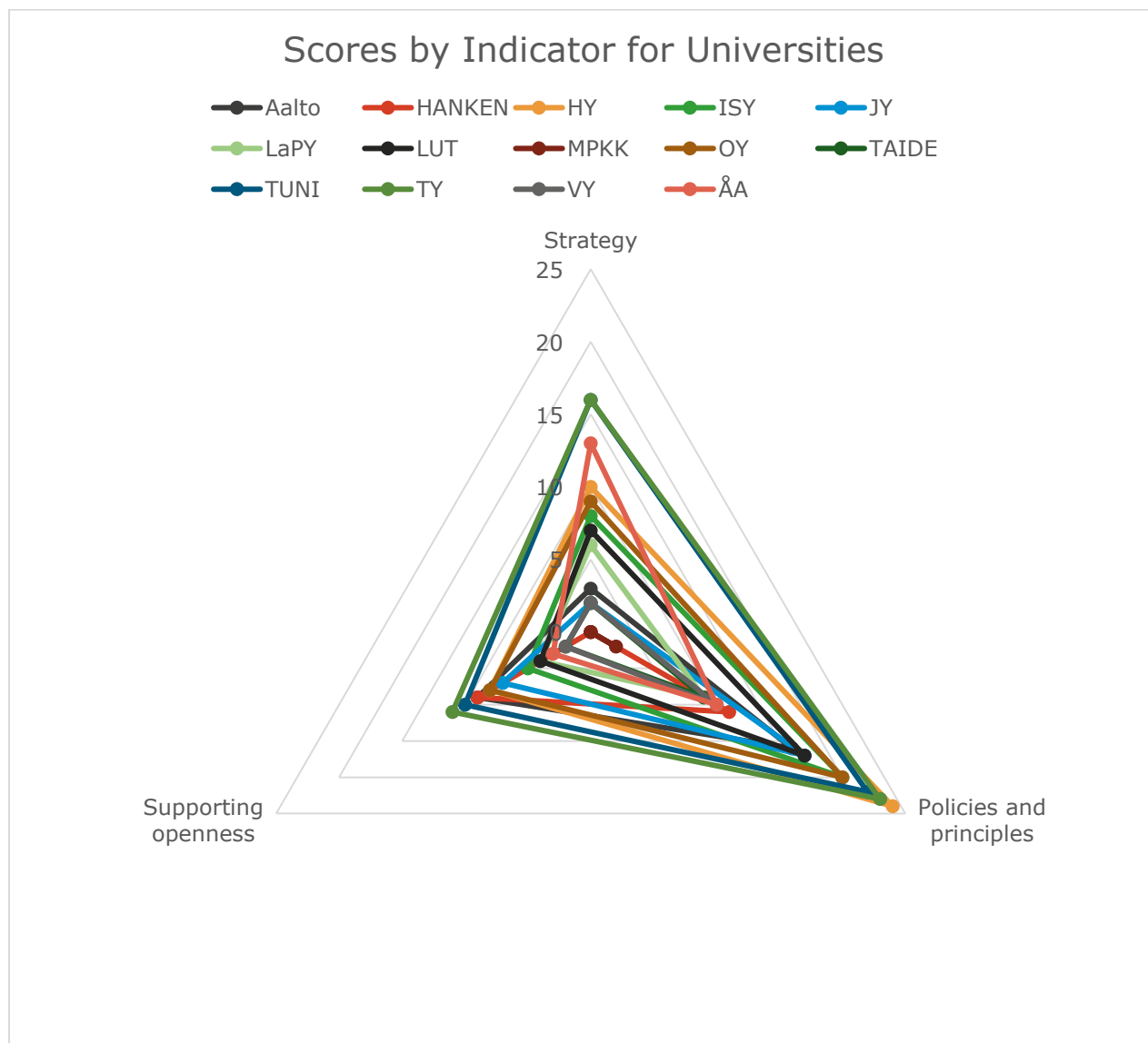
Figure 2. Scores by indicator for the Universities.

Looking at the scores by indicator, it is obvious that Policies and Principles is the most mature area of openness at all universities. The results also show, even before the complementary data, that some organisations have been able to make relevant improvements in the openness of the operating culture.

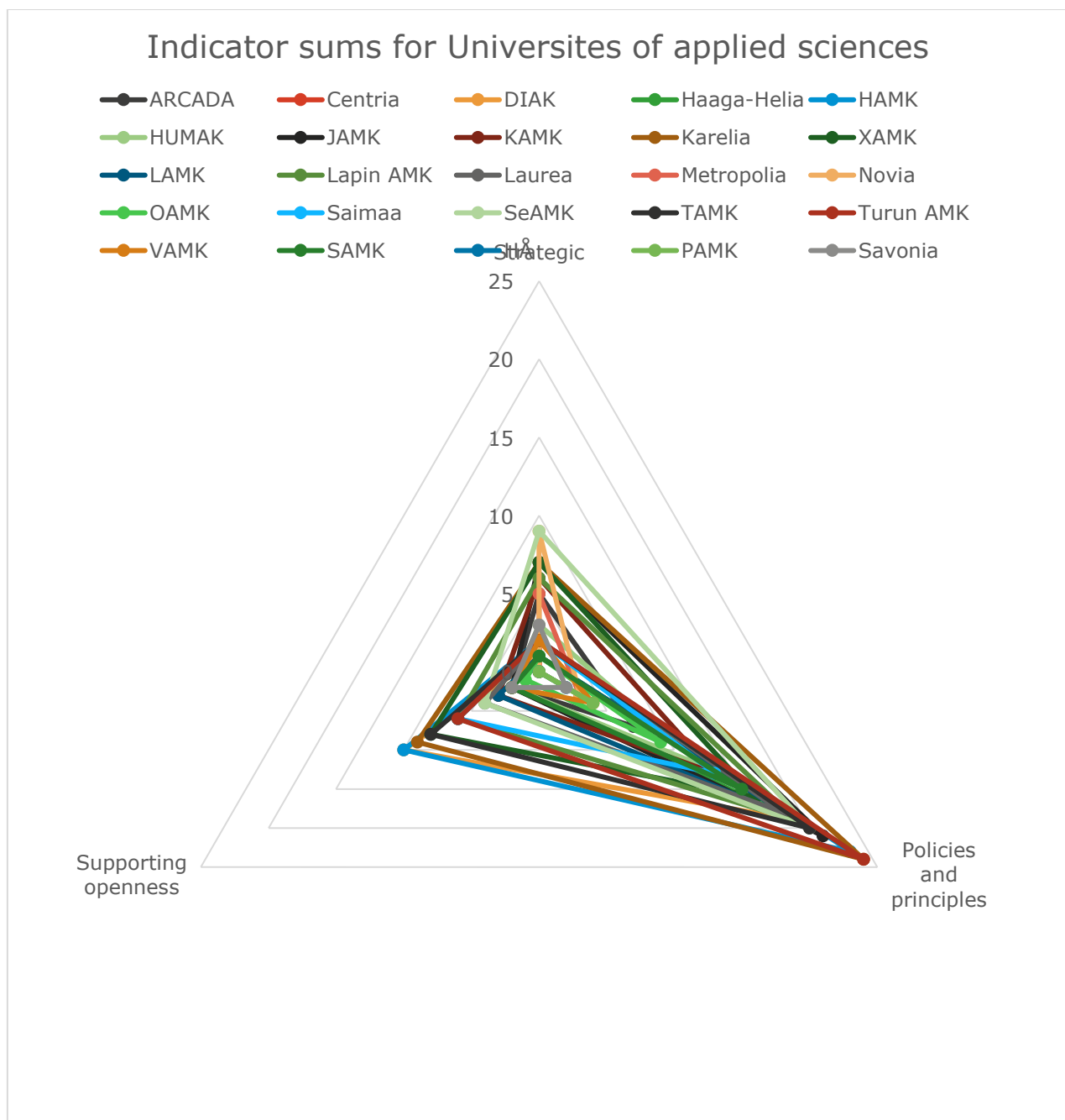*Figure 3. Scores by indicator for the universities of applied sciences*.

It is very clear , that Policies and Principles is the most mature area of openness similarly at all universities of applied sciences The results also show, even before the complementary data, that universities of applied science as a whole have been able to make relevant improvements in the openness of the operating culture.

Promoting Openness in Research Institutes

The Finnish state research institutes are evaluated to support the identification of best practices and areas of development in 2019.

Data was collected from information openly available in organisations' web pages. The correction round is based on requests for information, sent by the Ministry of Education and Culture. In the requests for information, the research institutes are able to add information to 4. and correct mistakes or misinformation in the preliminary data and analysis.

Finnish research institutes are compared with their results of the evaluation performed in 2017.

4.1 Strategic Steering

An organisation's strategy reveals both its long-term and short-term visions, and the organisation's strategic choices. An organisation uses its strategy to communicate its objectives not only to its own personnel but also to others. The openness of an organisation's operating culture should therefore be evident in its strategy. Transparency is at least as important as concrete actions. Table 11 shows the measures considered for the evaluation of activities in this indicator. Table 12 shows the scoring of each organisation for each measure in this indicator.

> **Strategic Steering**
>
>   a)   **Openness in the organisation's strategy**
>   b)   **Openness in the research activity**
>   c)   **Local, national and international cooperation**
>   d)   **Managing interoperability**
>   e)   **Openness of research results**
>   f)   **Strengthening of openness-related competencies**
>
> **See Appendix 1 for more details on scoring in relation to these measures.**

Table 11: Measures for Strategic Steering indicator

Organisation	Strategic Steering a b c d e f	Total points
Ruokavirasto	● ● 🟡 ● ● ●	2
GTK	● ● 🟡 🔴 ● ●	3
IL	🔴 🔴 🟢 🟢 🟡 🔴	10
FIIA	● ● ● ● ● ●	0
LUKE	● 🔴 🟡 ● ● 🟡	5
MML	🟢 🟢 🟢 🟢 🟢 🟡	17
STUK	● ● 🟡 ● ● ●	2
SYKE	🔴 🔴 🔴 ● 🔴 ●	4
THL	● 🔴 🟡 ● ● ●	3
TTL	● 🔴 ● ● ● ●	1
VATT	● 🟡 🟡 ● ● ●	4
VTT	● 🔴 🔴 ● ● ●	2

Table 12: Scoring for research institutes for Strategic Steering indicator

Research institutes are strong in collaboration at all levels. Two of the institutes excel in the strategical openness (IL and MML). Research institutes should utilise their cooperative culture and collaboration skills in the development of the strategic steering of open science and research. As a whole, they could benefit from a consultation of the Finnish universities.

4.2 Policies and Principles

The organisations implement their strategies in practice by defining and executing policies and principles that encourage openness. These include defining policies on the openness of data, methods, publications, and collaboration, writing clear instructions for supporting services and aiming at establishing open research enterprise architecture, and including openness within an organisation's quality systems. Their various policies and principles describe openness as part of the organisation's activities and help actors to embrace openness. Table 13 shows the measures considered for the evaluation of activities in this indicator. Table 14 shows the scoring of each organisation for each measure in this indicator.

Policies and Principles

a. **Principles of openness for scientific publications**
b. **Principles of self-archiving of scientific publications**
c. **Principles of openness relating to research methods**
d. **Principles of openness relating to the availability, use and licensing of research data**
e. **Service principles supporting openness**
f. **Guiding principles from Open Science framework**
g. **Principles of openness for cooperation**
h. **Principles of openness in agreements**
i. **Guidelines for quality systems**

See Appendix 1 for more details on scoring in relation to these measures.

Organisation	Policies and Principles a b c d e f g h i	Total Points
Ruokavirasto		6
GTK		9
IL		10
FIIA		0
LUKE		9
MML		11
STUK		4
SYKE		9
THL		6
TTL		6
VATT		9
VTT		5

Table 14: Scoring for research institutes in accordance with the Policies and Principles indicator

Collaboration is traditionally a strong area for research institutes, and they are very mature in openness of collaboration. Other areas of strength are principles of openness for research data, service principles supporting openness and adopting principles form Open Science Framework. Surprisingly, principles of openness of research methods (code and algorithms) only appear in three institutes. Almost all of the research institutes seem to lack appropriate implementation plans of the policies. In this, the Finnish universities could prove to be worth of benchmarking.

4.3 Supporting Openness

The measures are concrete actions in organisations with which openness can be promoted and encouraged. By well-defined guidelines for the research community, it is possible for the entire organisation to harness the benefits of openness. A common understanding of the benefits of openness coupled with competences facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 15 shows the measures considered for the evaluation of activities in this indicator. Table 16 shows the scoring of each organisation for each measure in this indicator.

Supporting Openness

a. Monitoring the openness of publishing (Open Access, self-archiving)
b. Monitoring the openness of research data (making data available, utilisation)
c. Monitoring the visibility of research (impact; scientific and social media)
d. Services for cataloguing and creating metadata for research materials
e. Services for documenting research publications and materials

See Appendix 1 for more details on scoring in relation to these measures.

Table 15: Measures for Supporting Openness indicator

Organisation	Supp. Open. a	b	c	d	Total Points
Ruokavirasto	●	●	○	●	3
GTK	○	●	○	●	4
IL	○	●	○	●	4
FIIA	○	○	○	○	0
LUKE	○	●	○	●	4
MML	●	●	○	●	5
STUK	○	○	○	○	0
SYKE	○	●	○	●	4
THL	○	●	○	●	4
TTL	○	●	○	●	4
VATT	●	●	●	●	7
VTT	○	○	○	○	0

Table 16: Scoring for research institutes for Supporting Openness –indicator

Monitoring the openness of research data and services for documenting research publications are the most mature at research institutes. Some organisations (minority, 25%) monitor the openness of publishing.

4.4 Competence Development

By steering the research community, it is possible for an entire organisation to harness the benefits generated by openness. Well-defined guidelines support the development of this. . Coupled with competencies, a common understanding of such benefits facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness.

Section on Competence Development is evaluated after the complementary data collection.

4.5 Maturity Rankings of Research Institutes

Each organisation's ranking is based on the total sum of scores for each of the measures, for all indicators. Table 17 presents the total sum of scores, across all indicators, for each research institute included in this analysis. Figures 4 presents the score results for each indicator, based on the findings of the evaluation of the institutes.

Organisation	Preliminary sum score in 2019	Total sum score in 2017	Difference to 2017
Ruokavirasto	11	7	+4
GTK	16	10	+5
IL	24	27	-3
FIIA	0		
LUKE	18	32	-14
MML	33	31	+2
STUK	6	12	-6
SYKE	17	32	-15
THL	13	35	-22
TTL	11	34	-23
VATT	20	12	+8
VTT	7	19	-12

Table 17: Partial sum scores in 2019 across all indicators for each research institute and the difference in total sum score compared to the total score in 2017. The partial sum score is due to missing complementary data (added by the organisation in complementary data collection)

The results show that some organisations have been able to make improvements in the openness of the operating culture.
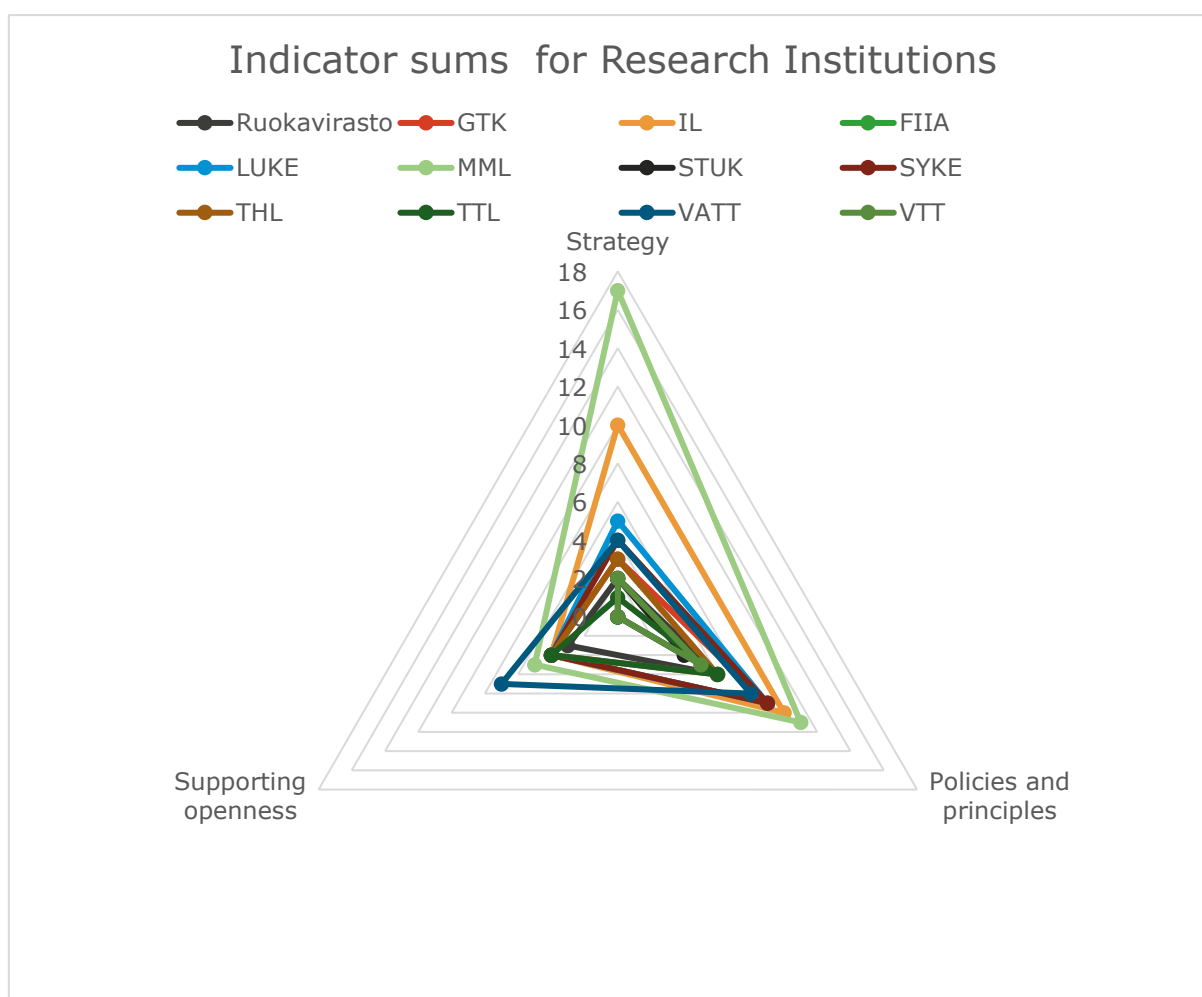

Figure 4: Indicator sums for research institutes.

The most mature indicator is strategic steering of openness.

Promoting Openness in Research-funding organisations

In 2019, data was collected from information openly available in organisations' web pages. The correction round is based on requests for information, sent by the Ministry of Education and Culture. In the requests for information, the research-funding organisations are able to add information to and correct mistakes or misinformation in the preliminary data and analysis.

5.

3.1 Strategic Steering and Principles for Openness

An organisation's strategy reveals both its long-term and short-term visions, as well as its strategic choices. An organisation uses its strategy to communicate its objectives not only to its own personnel, but also to others. Openness within the organisation's operating culture should therefore be evident in its strategy. Transparency is at least as important as concrete actions. Table 18 shows the measures considered for the evaluation of activities in this indicator. Table 19 shows the scoring of each organisation for each measure in this indicator.

Strategic Steering and Principles for Openness
a) **Strategic steering of openness**
b) **Promoting the openness and re-use of research outputs**
c) **National and international cooperation**
d) **Interoperability of research infrastructures**
e) **Strengthening openness-related competence**
See Appendix 2 for more details about scoring in these measures.

Table 18: Measures for Strategic Steering and Principles for Openness indicator

Organisation	Strategic Steering a b c d e	Total Points
Academy of Finland	🟢 🟡 🟢 🟢 ⚪	11
Business Finland	🟡 🟡 🟢 ⚪ ⚪	7
Kone	⚪ ⚪ 🟡 ⚪ ⚪	2

Table 19: Scoring for research-funding organisations in Strategic Steering and Principles for Openness indicator

Strategic steering of openness has evolved since 2017. Data shows that one funder has openness as one of the prevailing strategic themes clearly at the core of all activities. One funder names openness as an aspect of operational culture and its significance has been explained. Two funders promote openness and re-use of the research they fund as a principle.

National and international cooperation is well established for all of the research funders and it can be seen as core part of their strategic steering.

Based on the data, just one research funder has policies or principles on developing interoperability in the research infrastructures they fund. It should be noted though that not all of the research funders in this analysis fund research infrastructures. No funder has mentioned the strengthening of openness-related competencies or services in their strategies.

3.2 Openness in Research Funding

The research funding organisation implements strategy in practice by defining and executing policies and principles that encourage openness. These include defining policies on the openness of data, methods, research infrastructures, and publications. The principles describe openness as part of the research-funding organisations' activities and help actors to embrace it. Table 20 shows the measures considered for the evaluation of activities in this indicator. Table 21 shows the scoring of each organisation for each measure in this indicator.

> **Openness in Research Funding**
>
>   a) **Principles of open-access publishing**
>   b) **Principles of research data openness**
>   c) **Principles of research method openness**
>   d) **Principles of openness for research infrastructures**
>
> **See Appendix 2 for more details on scoring according to these measures.**

Table 20: Measures for Openness in Research Funding indicator

Organisation	Openness in Research Funding a b c d	Total Points
Academy of Finland	🟢 🟢 🔴 🟡	9
Business Finland	🟢 🔴 ⚪ ⚪	4
Kone	🔴 🔴 ⚪ ⚪	2

T*able 21*: Scoring for research-funding organisations in Openness in Research Funding indicator

All research funders have established openness to some extent in their research funding. Two funders require open access publishing and one recommends it, as the case has been in previous years. For research data, one funder requires, and two recommend openness.

Based on the findings, one research funder recommends openness for research methods, including algorithms and code. Only one funder has principles of openness for the research infrastructures it funds. As noted in section 3.1., some of them do not fund research infrastructures at all.

Although only three research-funding organisations were included in the evaluation, it should be noted that in developing principles for openness, especially smaller research funders could benefit from a more intensive cooperation in the area between both research-funding organisations and universities.

3.3 Supporting and Promoting Openness

The measures included in this indicator are concrete actions taken within the research funding organisation, using which openness can be promoted and encouraged. Using well-defined guidelines for the research community, it is possible for the entire organisation to harness the benefits of openness. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 22 shows the measures considered for the evaluation of activities in this indicator. Table 23 shows the scoring of each organisation for each measure in this indicator.

> **Supporting and Promoting Openness**
>
>   a) **Instructions for open science and research**
>   b) **Recommendations of openness for research outputs**
>   c) **Developing openness in research funding evaluation**
>   d) **Monitoring openness**
>   e) **Openness of funding decisions**
>
> **See Appendix 1 for more details on scoring according to these measures.**

Table 22: Measures for Supporting and Promoting Openness indicator

Organisation	Supporting Openness a b c d e	Total Points
Academy of Finland	🟢🟡🟡🔴🟡	10
Business Finland	🔴🔴🔴⚪🟡	5
Kone	🔴🔴🔴⚪🔴	4

Table 23: Scoring for research funders in Supporting and Promoting Openness indicator

All research funders have instructions for open science and research practices for funding applicants in some form. All research funders also have information available on the possibilities of research outputs openness. All research funders explain broadly the process of their funding calls and the review criteria used, but only one of them have openness or re-use of research as a review criterion in their funding calls. One research funder monitors the openness of the research they fund as a permanent part of their common reporting required from the funded research and promotes re-use of research results. All research funders publish their funding decisions on their website, two in a machine-readable format.

3.4 Maturity Rankings of Research-Funding Organisations

Each research-funding organisations' ranking is based on the total sum of scores derived from each of the measures used for each of the indicators. Figure 5 presents the indicator results of research-funding organisations, based on the findings of the evaluation. Table 24 presents the total sum of scores across all indicators for each research-funding organisation included in this analysis.

Organisation	Total sum score in 2019	Total sum score in 2017	Difference to 2017
Academy of Finland	30	31	-1
TEKES	16	18	-2
Kone Foundation	8	8	0

Table 24: Total sum scores across all indicators for each research-funding organisation and the difference in total sum score compared to the total score in 2017.

Academy of Finland has reached level 4 with definite actions and improvements especially in communicating the recommendations, policies, and instructions to applicants.
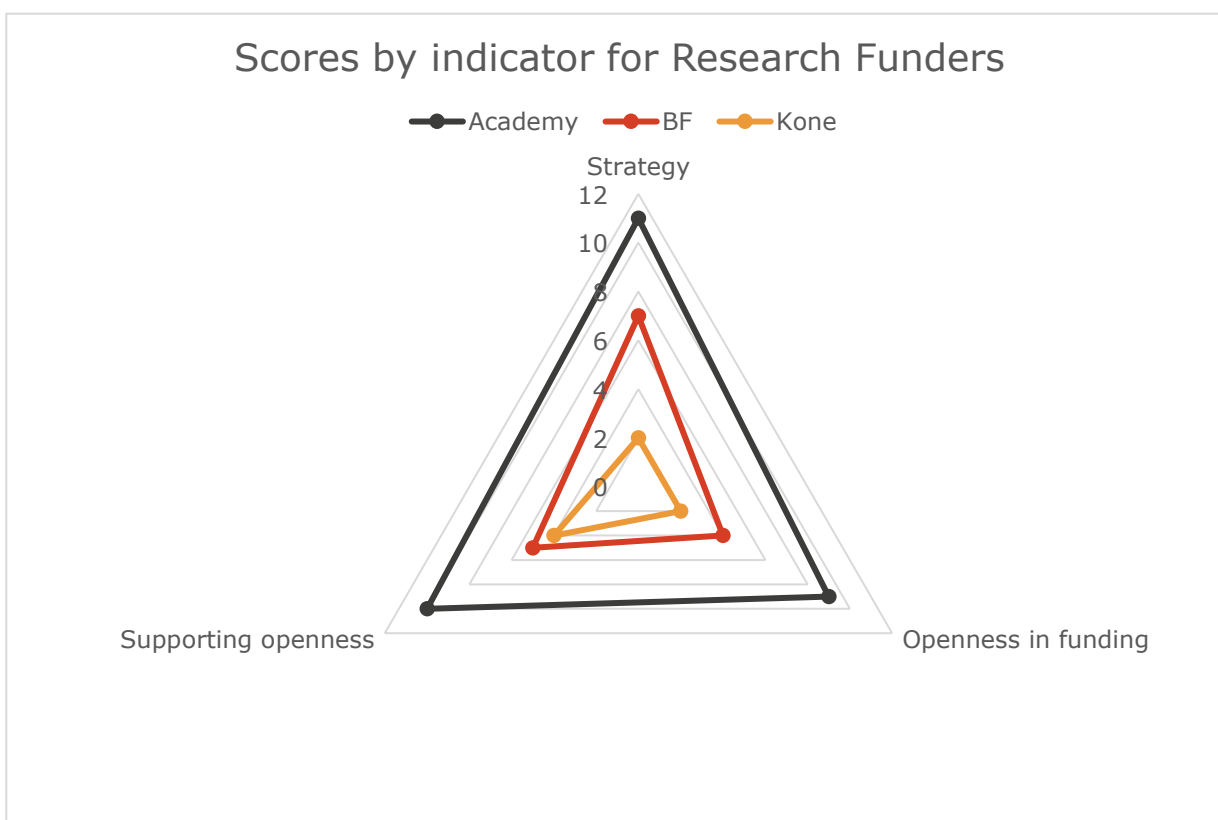

Figure 5: Scores by indicator for research funding organisations.
Scores by section reveal that research funders are most mature in strategic openness.

22

Promoting Openness in Academic and Cultural Institutes abroad

Data collected from the web pages form the preliminary evaluation results. The Ministry of Education and Culture sends a request for information, in which the institutes are able to add information to and correct mistakes or misinformation in the preliminary data and analysis. The academic and cultural institutes have not been studied earlier, so comparison data is not available.

6.

4.1 Strategic Steering

An organisation's strategy reveals both its long-term and short-term visions, and the organisation's strategic choices. An organisation uses its strategy to communicate its objectives not only to its own personnel but also to others. The openness of an organisation's operating culture should therefore be evident in its strategy. Transparency is at least as important as concrete actions. Table 25 shows the measures considered for the evaluation of activities in this indicator. Table 26 shows the scoring of each organisation for each measure in this indicator.

Strategic Steering

  a) **Strategic steering of openness**
  b) **Promoting the openness and re-use of research outputs**
  c) **National and international cooperation**
  d) **Interoperability of research infrastructures**
  e) **Strengthening of openness-related competencies**

  See Appendix 3 for more details on scoring in relation to these measures.

Table 25: Measures for Strategic Steering indicator

Organisation	Strategic Steering a b c d e	Total Points
Lähi-Idän Instituutti	⚪⚪🟢⚪⚪	3
Rooman Instituutti	⚪⚪🟢⚪⚪	3
Ateenan Instituutti	⚪⚪🔴⚪⚪	1
Japanin Instituutti	⚪⚪🟢⚪⚪	3

Table 26: Scoring for the Academic and Cultural institutes for Strategic Steering indicator

Based on the data of this evaluation, these institutes have not included openness in their strategies. At the same time, all institutes have local, national, and international cooperation strongly noted in the strategies.

4.2 Policies and Principles

The organisations implement their strategies in practice by defining and executing policies and principles that encourage openness. These include defining policies on the openness of data, methods, publications, and collaboration, writing clear instructions for supporting services and aiming at establishing open research enterprise architecture, and including openness within an organisation's quality systems. Their various policies and principles describe openness as part of the organisation's activities and help actors to embrace openness.

Policies and Principles

  a) **Principles of open access publishing**
  b) **Principles of research data openness**
  c) **Principles of openness relating to research methods (including algorithms and code)**
  d) **Principles of openness for research infrastructures**

  See Appendix 3 for more details on scoring in relation to these measures.

Table 19: Measures for Policies and Principles indicator

Table 27 shows the measures considered for the evaluation of activities in this indicator. Table 28 shows the scoring of each organisation for each measure in this indicator.

Table 27: On previous page, the Policies and Principles indicator

Organisation	Funding Openn. a b c d	
Lähi-Idän Instituutti	⚪⚪⚪⚪	0
Rooman Instituutti	⚪⚪⚪⚪	0
Ateenan Instituutti	⚪⚪⚪⚪	0
Japanin Instittuuti	⚪⚪⚪⚪	0

Table 28: Scoring for Institutes in the Policies and Principles indicator

4.3 Supporting Openness

The measures are concrete actions in organisations with which openness can be promoted and encouraged. By well-defined guidelines for the research community, it is possible for the entire organisation to harness the benefits of openness. A common understanding of the benefits of openness coupled with competences facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 29 shows the measures considered for the evaluation of activities in this indicator. Table 30 shows the scoring of each organisation for each measure in this indicator.

Supporting Openness

   a) **Instructions for open science and research**
   b) **Recommendation of openness for research outputs**
   c) **Developing openness in collaboration**
   d) **Monitoring openness**
   e) **Monitoring impact and visibility of research (scientific and social media)**

See Appendix 3 for more details about scoring in these measures.

Table 29: Measures for Supporting Openness indicator

Organisation	Supporting Openness a b c d e	Total Points
Lähi-Idän Instituutti	⚪⚪⚪⚪⚪	0
Rooman Instituuutti	⚪⚪⚪⚪⚪	0
Ateenan Instituutti	⚪⚪⚪⚪⚪	0
Japanin Instituutti	⚪⚪🔴⚪⚪	2

Table 30: Scoring for institutes for Supporting Openness indicator

4.5 Maturity Rankings of Academic and Cultural Institutes

The institutes included in the evaluation were ranked based on a five-level maturity model. Each institutes' ranking is based on the total sum of scores for each of the measures, for all indicators. Figure 6 presents the maturity results for academic and cultural institute, based on the findings of the evaluation. Table 31 presents the total sum of scores, across all indicators, for each research organisation included in this analysis.

Organisation	Total sum score in 2019
Lähi-Idän instituutti	3
Rooman Instituutti	3
Japanin Instituutti	5
Ateenan Instituutti	1

Table 31: Total sum scores across all indicators for each academic and cultural institute 2019.

Promoting Openness in Learned Societies and Academies

Data collected from the web pages form the preliminary evaluation results. The Ministry of Education and Culture sends a request for information, in which the organisations are able to add information to and correct mistakes or misinformation in the preliminary data and analysis. These organisations have not been studied earlier, so no comparison data is available.

7.

4.1 Strategic Steering

An organisation's strategy reveals both its long-term and short-term visions, and the organisation's strategic choices. An organisation uses its strategy to communicate its objectives not only to its own personnel but also to others. The openness of an organisation's operating culture should therefore be evident in its strategy. Transparency is at least as important as concrete actions. Table 31 shows the measures considered for the evaluation of activities in this indicator. Table 32 shows the scoring of each organisation for each measure in this indicator.

Strategic Steering

  f) **Strategic steering of openness**
  g) **Promoting the openness and re-use of research outputs**
  h) **National and international cooperation**
  i) **Interoperability of research infrastructures**
  j) **Strengthening of openness-related competencies**

See Appendix 4 for more details on scoring in relation to these measures.

Table 31: Measures for Strategic Steering indicator.

Organisation	Strategic Steering a b c d e	Total points
TSV	🟢🟡🟢⚪🟡	10
TENK	🟡⚪🟢⚪🟡	7
TJNK	⚪⚪🟡⚪⚪	2
Tiedeaka	⚪⚪🟢⚪⚪	3
Tiedeseura	🔴🟡🟢🔴⚪	7
TTA	⚪⚪🟢⚪⚪	3
STV	⚪⚪🟢⚪⚪	3

Table 32: Scoring for Learned Societies and Academies for Strategic Steering indicator

Based on the data of this evaluation, less than half of these organisations have included openness in their strategies. Only two promote openness and re-use of results.

Local, national, and international cooperation is present in the strategies, as nearly all have cooperation named as the core aspect of their strategies. Less than half have mentioned the promotion of interoperability in their strategic steering. Only two mention openness-related competencies.

4.2 Policies and Principles

The organisations implement their strategies in practice by defining and executing policies and principles that encourage openness. These include defining policies on the openness of data and publications, writing clear instructions for supporting services, and including openness within an organisation's quality systems. Their various policies and principles describe openness as part of the organisation's activities and help actors to embrace openness. Table 33 shows the measures considered for the evaluation of activities in this indicator. Table 34 shows the scoring of each organisation for each measure in this indicator.

Table 33: Measures for Policies and Principles indicator

Organisation	Policies and Principles a b c d	Total Point
TSV		2
TENK		0
TJNK		0
Tiedeaka		0
Tiedeseura		2
TTA		0
STV		0

Table 34: Scoring for the Policies and Principles indicator

Only two of the learned societies and academies have principles of openness for scientific publications.

4.3 Supporting Openness

The measures are concrete actions in organisations with which openness can be promoted and encouraged. By well-defined guidelines for the research community, it is possible for the entire organisation to harness the benefits of openness. A common understanding of the benefits of openness coupled with competences facilitates cooperation and researcher exchange. Guidelines play a key role in providing information and motivation, and thereby the more extensive promotion of openness. Table 35 shows the measures considered for the evaluation of activities in this indicator. Table 36 shows the scoring of each organisation for each measure in this indicator.

Table 35: Measures for Supporting Openness indicator

Organisation	Supp. Open. a b c d e	Total Points
TSV		1
TENK		1
TJNK		0
Tiedeaka		0
Tiedeseura		0
TTA		0
STV		0

Table 36: Scoring for Learned Societies and Academies for Supporting Openness -indicator

Only two of the learned societies and academies have instructions for open science and research.

4.5 Maturity Rankings of Learned Societies and Academies

Each organisation's ranking is based on the total sum of scores for each of the measures, for all indicators. Figure 6 presents the results for learned societies and academies, based on the findings of the evaluation. Table 37 presents the total sum of scores, across all indicators, for each research organisation included in this analysis.

Organisation	Total sum score in 2019
TSV	13
TENK	8
TJNK	2
Tiedeakatemia	3
Tiedeseura	9
TTA	3
STVA	3

Table 37: Total sum scores across all indicators for each learned society and Academies in 2019.
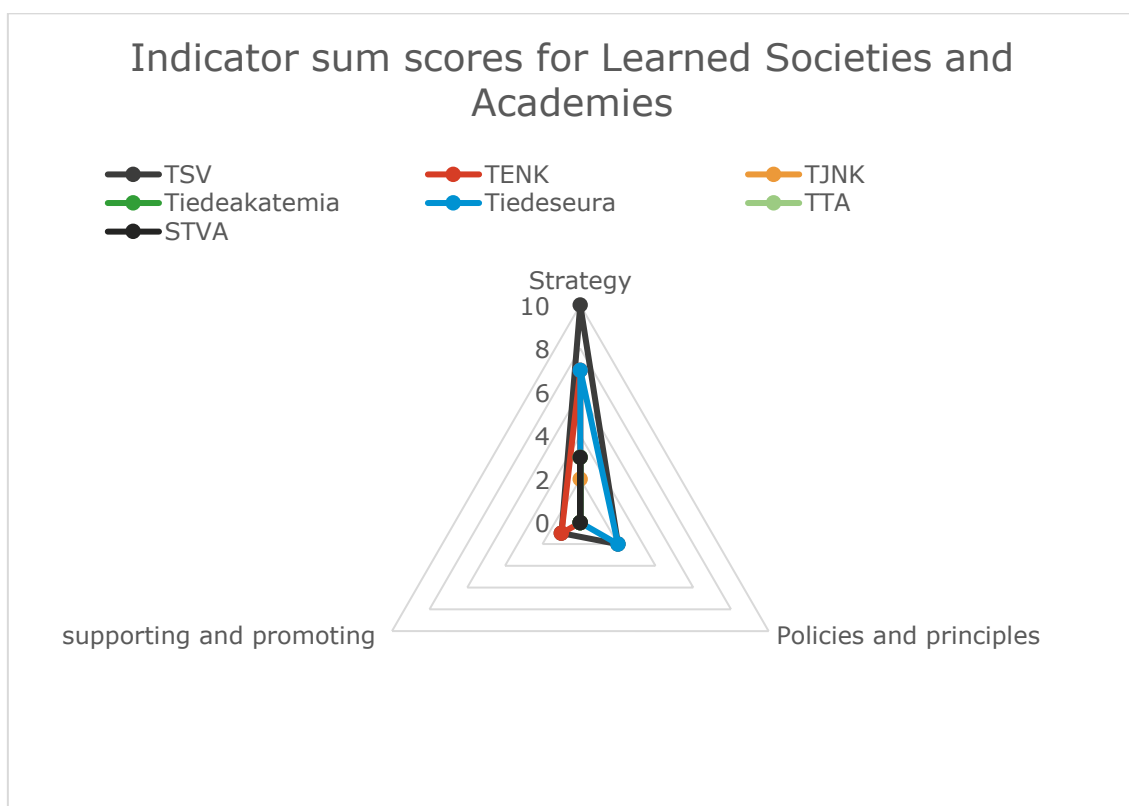
Figure 6: Indicator sum scores for Learned Societies and Academies.

Appendices

Appendix 1 – Indicators and Measures for Research Organisations

Appendix 2 – Indicators and Measures for Research-funding organisations
8.

Appendix 3 – Indicators and Measures for Academic and Cultural Institutes

Appendix 4 – Indicators and Measures for Learned Societies and Academies

Appendix 5 – Abbreviations Used in the Analysis

Appendices 6 – 11 – Data Collected for the Analysis

Appendix 1: Indicators and Measures for Research Organisations

1) Strategic Steering and Principles for Openness

a) Openness in the organisation's strategy documents (as a value and a commitment)
1. Openness is mentioned as, for example, one of the organisation's values or principles
2. Openness has been named as an aspect of operational culture and its significance has been explained in this context
3. Openness is one of the prevailing strategic themes and clearly visible in organisation's activities

b) Openness in the research activity
1. Openness is mentioned as an aspect of the organisation's research activity
2. Openness is declared as an aspect of the organisation's research activity and its significance and practices have been explained in this context
3. Openness is one of the core aspects of the organisation's research activity, and it is actively supported, developed, encouraged and required.

c) Local, national and international cooperation
1. Cooperation with a variety of actors has been mentioned in the organisation's strategy
2. Cooperation with a variety of actors is evident in the organisation's strategy and areas for development have been defined
3. Noticeably diverse cooperation in all level and cooperation is a core aspect of the organisation's strategy. Organisation is responsible of collaborative activity, and actively monitors the results.

d) Managing interoperability
1. The organisation shares the use of research services and infrastructures with other organisations and the promotion of such activities have been mentioned in its strategy
2. Developing general interoperability of services, infrastructures and data have been mentioned in the organisation's strategy
3. Both developing general interoperability of services, infrastructures and data and the benefits it generates have been considered in the organisation's strategy, and investments and support actions and resources in this area are present.

e) Openness of research results
1. The sharing and openness of research results have been mentioned in the organisation's strategy
2. The re-use and openness of research results are encouraged and developed
3. The openness of research results has been named as a core aspect of the organisation's research activities and the benefits it generates have been extensively identified

f) Strengthening openness-related competence
1. Openness-related competence, or tools and services that enable it, have been mentioned in the organisation's strategy
2. Openness-related competence and the tools and services that enable it have been defined as an area for development in the organisation's strategy
3. Openness-related competence and the tools and services that enable it have been defined as a focus area for resourcing in the organisation's strategy, and the benefits they generate have been identified.

2) Policies and Principles

a) Principles of openness for scientific publications

1. The organisation recommends the use of open access channels for its research publications

2. The organisation encourages the use of open access channels for its research publications with incentives

3. The organisation requires the use of open access channels for its research publications

b) Principles of self-archiving for scientific publications

1. The organisation recommends self-archiving (green open-access) research publications in an institutional repository or other open archives.

2. The organisation encourages self-archiving (green open-access) research publications in an institutional repository or other open archives, and has a support process in place for it.

3. The organisation requires self-archiving (green open-access) research publications in an institutional repository or other open archives, and has a support process in place for it.

c) Principles of openness relating to research methods (including algorithms and code, both developed and utilized)

1. The organisation recommends openness in the publication and development of research methods and algorithms and code, and has an incentive in place for it.

2. The organisation encourages openness in the publication and development of research methods and algorithms and code, and has an incentive in place for it.

3. The organisation requires openness in the publication and development of research methods and algorithms and code.

d) Principles of openness relating to the availability, use and licensing of research data

1. The organisation has a data policy and policy implementation plan recommending openness of research data, open licensing and open data repositories.

2. The organisation has a data policy and policy implementation plan encouraging the open licensing of research data in accordance with the national recommendations and using open data repositories.

3. The organisation has a data policy and policy implementation plan requiring open licensing of research data in accordance with the national recommendations [5] and use of agreed open data repositories

e) Service principles supporting openness[6] (commitment to and scope of open collaboration)

1. The organisation has recommendations for service principles for the resources it administers, and can give access to users from other organisations.

2. The organisation has written service principles for most of the resources it administers, and others can get access for research purposes. Descriptions can be found on the organisation's website.

3. The organisation has written service principles for most of the resources it administers, and it is easy to gain access and get open information on resource usage. Descriptions can be found on the organisation's website.

f) Guiding principles from Open Science framework [7](for example in managing research data life cycle, availability and reliability)

1. The organisation has considered the principles of openness, and implemented these in relevant policies**.**

2. The organisation's enterprise architecture encourages compliance with the principles of openness.

3. The organisation's enterprise architecture requires compliance with the principles of openness.

g) Principles of openness in cooperation (commitment to and scope of open collaboration, for example in publication platforms for national journals)

1. The organisation is in the starting phase in open collaboration, but does not describe this in detail.

2. The organisation is committed to some collaboration and openly describes its collaboration activities, but not the expected results and principles.

3. The organisation invests in dialogue with other actors and invests in communicating about principles and expected results of open collaboration.

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[5] https://avointiede.fi/fi/koordinaatio/hankearkistot/att-hankkeen-arkisto/keskeiset-linjaukset/tiedon-saatavuus: Tutkimusdatan ja -julkaisujen jatkokäyttöä ei rajoiteta tarpeettomasti ja niiden käyttöehdot tuodaan selkeästi esille. Noudatetaan yleisiä, standardimuotoisia lisenssejä (suositus CC BY 4.0.), jotka ovat koneluettavia. Metatiedot julkaistaan CC0 –lisenssillä.

[6] https://avointiede.fi/fi/koordinaatio/hankearkistot/att-hankkeen-arkisto/keskeiset-linjaukset/palveluperiaatteet

[7] https://avointiede.fi/fi/koordinaatio/hankearkistot/att-hankkeen-arkisto/keskeiset-linjaukset/arkkitehtuuriperiaatteet

h) Principles of openness in agreements (licensing and re-use)

1. The organisation recommends that principles of openness should be considered in agreements, whenever juridical requirements allow it

2. The organisation encourages the consideration of principles of openness in agreements whenever juridical requirements allow it, and has a contract framework for it.

3. The organisation requires that principles of openness must be considered in agreements whenever juridical requirements allow it, and has a contract framework and model contracts available for it.

i) Guidelines for quality systems

1. The organisation has drawn up a quality manual or other quality-related document, and it is available on organisation's external website

2. The organisation's quality manual recommends openness or names openness as one of its quality principles, and has guidelines on how to use openness to increase quality.

3. The organisation's quality manual recommends openness and names openness as one of its core quality principles. It includes a process for developing openness.

3) Supporting and Promoting Openness

a) Monitoring the openness of publishing (open access, self-archiving, APC, BPC)
1. The organisation does not yet monitor the openness of its publishing activities, but has plans to do so.
2. The organisation monitors the openness of its publishing activities to some extent and is developing the monitoring process.
3. The organisation monitors the openness of its publishing activities and processes by type, and data is actively collected
b) Monitoring the openness of research data (making materials available, utilisation)
1. The organisation does not yet monitor the openness of its research data, but has plans to do so.
2. The organisation monitors the openness of its research data to some extent and developments for the monitoring process are ongoing.
3. The organisation monitors the openness of its research data, and related information and metadata is being actively collected and used to improve the process.
c) Monitoring the visibility of research (for impact; scientific and social media)
1. The organisation does not yet monitor the visibility of its research activities, but has plans to do so.
2. The organisation monitors the visibility of its research activities to some extent but does not distinguish scientific and other media hits.
3. The organisation monitors the visibility of its research activities and data is being actively collected. The organisation does distinguish scientific and other media hits.
d) Services for catalogueing and creating metadata for research materials
1. The organisation does not yet use such services, but has plans to do so.
2. The organisation uses such services to some extent and is developing its metadata management.
3. The organisation actively uses such services, and uses the metadata for insight and steering.
e) Services for documenting research publications and materials
1. The organisation provides self-help guidelines for storing research publications in its own archives and information about parallel publishing.
2. In addition to the aforementioned, the organisation provides guidelines and some support personnel helping on storage and metadata for research materials, and information about open access publication.
3. In addition to the aforementioned, the organisation has a sufficient amount of support personnel guiding documentation, suitable storage sites for research materials and metadata, and explaining what must be considered when storing them. The topic is extensively covered and its benefits for researchers have been explained.

4) Competence Development

a) Lifecycle management of research data8
-The organisation provides self-help guidelines for creating a data management plan and its significance and benefits for research are explained
-The organisation provides some support and guidelines for the life-cycle management and digital preservation of research data and its significance and benefits for research are explained.
-The organisation provides strong support and guidelines for the life-cycle management and digital preservation of research data and its significance and benefits for research are acknowledged via supporting incentives.
b) The re-use and findability of research results9
-The organisation provides self-help guidelines for creating external links and persistent identifiers for research and research materials (including DOI, URN, ORCID), research publications and data (including CC, ODC) and gives grounds for their use.
-The organisation provides guidelines and some support for creating external links and persistent identifiers for research and research materials (including DOI, URN, ORCID), research publications and data (including CC, ODC) and gives grounds for their use.
- The organisation provides guidelines and sufficient support for creating external links and persistent identifiers for research and research materials (including DOI, URN, ORCID), research publications and data (including CC, ODC). These topics are extensively covered and their benefits for researchers have been explained.
d) Use of common open science services*
-The organisation has local services aligned with the Academy of Finland's or other major scientific funders guidelines on availability and publishing of research
-The organisation recommends the use of the Fairdata services (IDA, Etsin, AVAA) or other national services (such as AILA, DMP-Tuuli, Journal.fi) for managing research data
-The organisation recommends the use of international or European services (such as PubMed Central, arXiv, OpenAIRE, Zenodo, EUDAT, EOSC) for managing research data
* For the measures marked with bullet points the organisations were able to receive points for each criterion they fulfilled. For example, an organisation could fulfill only the last criteria for it to receive one point for the measure.

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8 Information on PSI-renewal: http://data.consilium.europa.eu/doc/document/ST-13418-2018-INIT/en/pdf
9 Example on FAIR guidelines:
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf

Appendix 2: Indicators and Measures for Research-funding organisations

1)   Strategic Steering and Principles for Openness

a) Strategic steering of openness
1. Openness is mentioned as one of the organisation's values or principles
2. Openness has been named as an aspect of operational culture and its significance has been explained in this context
3. Openness is one of the prevailing strategic themes and clearly lies at the core of the organisation's activities

b) Promoting the openness and re-use of research outputs
1. Openness of funded research's outputs is mentioned in the organisation's strategy
2. Openness of funded research's outputs is encouraged and research funding is developed this in mind
3. Openness and re-use of funded research's outputs is named as one of the core aspects of the organisation's research funding

c) National and international cooperation
1. Cooperation in research funding on the national and international level is mentioned in the organisation's strategy
2. Cooperation in research funding on national and international level is mentioned in the organisation's strategy and there are funding calls and instruments in use based on this cooperation
3. Cooperation in research funding on national and international level is names as one of the core aspects of research-funding organisation's activities and there are funding calls and instruments in use based on this cooperation

d) Interoperability of research infrastructures
1. Interoperability and shared use of funded research services and infrastructures is mentioned in the organisation's strategy
2. Interoperability and shared use of funded research services and infrastructures is mentioned in the organisation's strategy and those are being developed
3. Interoperability and shared use of funded research services and infrastructures is mentioned in the organisation's strategy and those are developed even further acknowledging the benefits

e) Strengthening openness-related competence
1. Openness-related competences, are mentioned in the organisation's strategy
2. Openness-related competences are defined as an area for development in the organisation's strategy
3. Openness-related competences are defined as an area for development in the organisation's strategy, and the opportunities created by these are identified extensively

2) Openness in Research Funding[10]

a) Principles of open access publishing
1. Funded research's publications are recommended to be published in open access publishing channels
2. Funded research's publications are urged to be published in open access publishing channels
3. Funded research's publications are required to be published in open access publishing channels

b) Principles of research data openness
1. Funded research's data is recommended to be published open
2. Funded research's data is urged to be published open in accordance with national recommendations on open data publishing services and open licensing
3. Funded research's data is required to be published open in accordance with national recommendations on open data publishing services and open licensing

c) Principles of research methods openness ((including algorithms and code, both developed and utilized)
1. Openness of funded research's methods is recommended and developed further
2. Openness of funded research's methods is urged and developed further
3. Openness of funded research's methods is required and developed further

d) Principles of openness for research infrastructures
1. Funded research infrastructures are recommended to enable shared use in their policies and terms of use
2. Funded research infrastructures are urged to enable shared and open use in their policies and terms of use
3. Funded research infrastructures are required to clearly enable shared and open use in their policies and terms of use in accordance with national recommendations

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[10] [10] Politiikkatyökalu: https://www.openaire.eu/d3-1-toolkit-for-policy-makers-on-open-access-and-open-science

3)   Supporting and Promoting Openness

a) Instructions for open science and research
   1. Instructions on open research practices are available and benefits of open science are presented to research funding applicants
   2. Comprehensive instructions on open research practices are available and benefits of open science are presented to research funding applicants
   3. Comprehensive instructions on open research practices are available, benefits of open science and how these are taken into account by research funder, for example in funding instruments, are presented to research funding applicants

b) Recommendations of openness for research outputs
   1. The possibilities of research outputs openness are presented to research funding applicants
   2. The possibilities of research outputs openness are presented and openness is recommended to research funding applicants
   3. The possibilities and benefits of research outputs openness are broadly presented and openness is recommended to research funding applicants

c) Developing openness in research funding evaluation
   1. The research funder explains broadly the process of funding calls and the evaluation criteria used
   2. The research funder explains broadly the process of funding calls and the evaluation criteria used. One review criterion in funding calls is openness and re-use of research outputs
   3. The research funder explains broadly the process of funding calls and the evaluation criteria used. One review criterion in funding calls is openness and re-use of research outputs and the indicators to measure these are explained

d) Monitoring openness
   1. The research funder monitors the openness of funded research alongside the common reporting required
   2. The research funder monitors the openness of funded research alongside the common reporting required and the re-use of research results is promoted during the research
   3. Monitoring the openness of funded research is a permanent part of the common reporting required and the re-use of research results is promoted during the research

e) Openness of funding decisions
   1. The research funder opens its own information for example by publishing the funding decisions on its website
   2. The research funder opens its own information for example by publishing the funding decisions on its website in a machine-readable format
   3. The research funder opens its own information for example by publishing the funding decisions on its website in a machine-readable format and through an open API

Appendix 3: Indicators and Measures for Academic and Cultural Institutes

1) Strategic Steering and Principles for Openness

a) Strategic steering of openness
1) Openness is mentioned as one of the organisation's values or principles
2) Openness has been named as an aspect of operational culture and its significance has been explained in this context
3) Openness is one of the prevailing strategic themes and clearly lies at the core of the organisation's activities

b) Promoting the openness and re-use of research outputs
1) Openness of research outputs is mentioned in the organisation's strategy
2) Openness of research outputs is encouraged and research funding is developed this in mind
3) Openness and re-use of research outputs is named as one of the core aspects of the organisation's research funding

c) National and international cooperation
1) Cooperation on the national and international level is mentioned in the organisation's strategy
2) Cooperation on the national and international level is mentioned in the organisation's strategy and there are instruments in use based on this cooperation
3) Cooperation on the national and international level is named as one of the core aspects of organisation's activities and there are instruments in use based on this cooperation

d) Interoperability of research infrastructures
1) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy
2) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy and those are being developed
3) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy and those are developed even further by implementing principles of openness

e) Strengthening openness-related competence
1) Openness-related competence, or services that enable it, are mentioned in the organisation's strategy
2) Openness-related competence, or services that enable it, are defined as an area for development in the organisation's strategy
3) Openness-related competence, or services that enable it, are defined as a focus area for resourcing and area for development in the organisation's strategy, and the opportunities created by these are identified extensively

2) Openness in Policies and Principles

a) Principles of open access publishing
1) Research publications are recommended to be published in open access publishing channels
2) Research publications are urged to be published in open access publishing channels
3) Research publications are required to be published in open access publishing channels

b) Principles of research data openness
1) Research data is recommended to be published open
2) Research data is urged to be published open in accordance with the national recommendations on open data publishing services and open licensing
3) Research data is required to be published open in accordance with the national recommendations on open data publishing services and open licensing

c) Principles of research methods openness methods (including algorithms and code, both developed and utilized)
1) Openness of research methods is recommended and developed further
2) Openness of research methods is urged and developed further
3) Openness of research methods is required and developed further

d) Principles of openness for research infrastructures
1) Research infrastuctures policies and terms of use recommends to enable shared use their
2) Research infrastructures policies and terms of use urges to enable shared and open use
3) Research infrastructures policies and terms of use requires to enable shared and open use, and the terms of use are in accordance with the national recommendations

3) Supporting and Promoting Openness

a)   Instructions for open science and research
1)   Instructions on open research practices are available and benefits of open science are presented to researchers
2)   Comprehensive instructions on open research practices are available and benefits of open science are presented to researchers
3)   Comprehensive instructions on open research practices are available, benefits of open science and how these are taken into account are presented to researchers

b)   Recommendations of openness for research outputs
1)   The possibilities of research outputs openness are presented to researchers
2)   The possibilities of research outputs openness are presented and openness is recommended to researchers
3)   The possibilities and benefits of research outputs openness are broadly presented and openness is required from researchers

c)   Developing openness in collaboration
1)   The organisation explains broadly the process of collaboration and the possible review criteria used
2)   The organisation explains broadly the process of collaboration and the possible review criteria used. One review criterion in collaboration is openness and re-use of research results
3)   The organisation explains broadly the process of collaboration and the possible review criteria used. One review criterion in collaboration is openness and re-use of research and the indicators to measure these are explained

d)   Monitoring openness
1)   The organisation monitors the openness of research alongside the common reporting
2)   The organisation monitors the openness of research alongside the common reporting and the re-use of research is promoted during the research
3)   Monitoring the openness of research is an elementary part of the common reporting and monitoring the results steer actions.

e)   Monitoring impact and visibility of research (scientific and social media)
1)   The organisation does not yet monitor the visibility or impact of its research activities, but plans to do so.
2)   The organisation monitors the visibility or impact of its research activities to some extent.
3)   The organisation monitors the visibility or impact of its research activities, and data is being actively collected.

Appendix 4: Indicators and Measures for Learned Societies and Academies

1) Strategic Steering and Principles for Openness

a) Strategic steering of openness
1) Openness is mentioned as one of the organisation's values or principles
2) Openness has been named as an aspect of operational culture and its significance has been explained in this context
3) Openness is one of the prevailing strategic themes and clearly lies at the core of the organisation's activities

b) Promoting the openness and re-use of research outputs
1) Openness of research outputs is mentioned in the organisation's strategy
2) Openness of research outputs is encouraged in organisations' strategy
3) Openness and re-use of research outputs is named as one of the core aspects of the organisation's strategy

c) National and international cooperation
1) Cooperation on the national and international level is mentioned in the organisation's strategy
2) Cooperation on the national and international level is mentioned in the organisation's strategy and there are instruments in use based on this cooperation
3) Cooperation on the national and international level is named as one of the core aspects of organisation's activities and there are instruments in use based on this cooperation

d) Interoperability of research infrastructures
1) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy
2) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy and those are being developed
3) Interoperability and shared use of services and infrastructures is mentioned in the organisation's strategy and those are developed even further by implementing principles of openness

e) Strengthening openness-related competence
1) Openness-related competence, or services that enable it, are mentioned in the organisation's strategy
2) Openness-related competence, or services that enable it, are defined as an area for development in the organisation's strategy
3) Openness-related competence, or services that enable it, are defined as a focus area for resourcing and area for development in the organisation's strategy, and the opportunities created by these are identified extensively

2) Openness in Policies and Principles

a) Principles of open access publishing
1) Research publications are recommended to be published in open access publishing channels
2) Research publications are urged to be published in open access publishing channels
3) Research publications are required to be published in open access publishing channels

b) Principles of research data openness
1) Research data is recommended to be published openly
2) Research data is urged to be published openly in accordance with the national recommendations on open data publishing services and open licensing
3) Research data is required to be published openly in accordance with the national recommendations on open data publishing services and open licensing

c) Principles of research methods openness methods (including algorithms and code, both developed and utilized)
1) Openness of research methods is recommended and developed further
2) Openness of research methods is urged and developed further
3) Openness of research methods is required and developed further

d) Principles of openness for research infrastructures
1) Research infrastructures policies and terms of use recommend shared use
2) Research infrastructures policies and terms of use urges to enable shared and open use
3) Research infrastructures policies and terms of use requires to enable shared and open use, and the terms of use are in accordance with the national recommendations

3) Supporting and Promoting Openness

a) Instructions for open science and research
1)   Instructions on open research practices are available and benefits of open science are presented to researchers
2)   Comprehensive instructions on open research practices are available and benefits of open science are presented to researchers
3)   Comprehensive instructions on open research practices are available, benefits of open science and how these are taken into account, are presented to researchers

b) Recommendations of openness for research outputs
1)   The possibilities of research outputs openness are presented to researchers
2)   Openness of research outputs is recommended to researchers
3)   Openness of research outputs openness is required from researchers

c) Developing openness in collaboration
1)   The organisation explains broadly the process of collaboration and the possible review criteria used
2)   The organisation explains broadly the process of collaboration and the possible review criteria used. One review criterion in collaboration is openness and re-use of research
3)   The organisation explains broadly the process of collaboration and the possible review criteria used. One review criterion in collaboration is openness and re-use of research and the indicators to measure these are explained

d) Monitoring openness
1)   The organisation monitors the openness of research alongside the common reporting required
2)   The organisation monitors the openness of research alongside the common reporting required and the re-use of research is promoted
3)   Monitoring the openness of research is a permanent part of the common reporting required and the re-use of research is promoted

e) Monitoring impact and visibility of research (scientific and social media)
1)   The organisation does not yet monitor the visibility or impact of its research activities, but plans to do so.
2)   The organisation monitors the visibility or impact of its research activities to some extent.
3)   The organisation monitors the visibility or impact of its research activities, and data is being actively collected.

Appendix 5: Abbreviations Used in the Analysis

Organisation	Abbreviation
Aalto yliopisto	AALTO
Åbo Akademi	ÅA
Academy of Finland	AKA
Arcada - Nylands svenska yrkeshögskola	ARCADA
Ateenan Instituutti	Ateenan Instituutti
Centria ammattikorkeakoulu	CENTRIA
Diakonia-ammattikorkeakoulu	DIAK
Finnish Environment Institute	SYKE
Finnish Food Safety Authority	Ruokavirasto
Finnish Institute of International Affairs	FIIA
Finnish Institute of Occupational Health	TTL
Finnish Meteorological Institute	IL
Geological Survey of Finland	GTK
Haaga-Helia ammattikorkeakoulu	HAAGA-HELIA
Hämeen ammattikorkeakoulu	HAMK
Helsingin yliopisto	HY
Högskolan på Åland	HÅ
Humanistinen ammattikorkeakoulu	HUMAK
Institute for the Languages of Finland	KOTUS
Itä-Suomen yliopisto	ISY
Japanin Instituutti	Japanin Instituutti
Jyväskylän ammattikorkeakoulu	JAMK
Jyväskylän yliopisto	JY
Kaakkois-Suomen ammattikorkeakoulu	XAMK
Kajaanin ammattikorkeakoulu	KAMK
Karelia-ammattikorkeakoulu	Karelia
Kone Foundation	KONE
Lahden ammattikorkeakoulu	LAMK
Lähi-Idän Instituutti	Lähi-Idän Instituutti
Lapin ammattikorkeakoulu	LAPIN AMK
Lapin yliopisto	LY
Lappeenrannan- Lahden teknillinen yliopisto	LUT
Laurea-ammattikorkeakoulu	LAUREA
Maanpuolustuskorkeakoulu	MPKK
Metropolia ammattikorkeakoulu	METROPOLIA
National Institute for Health and Welfare	THL
National Land Survey of Finland	MML
Natural Resources Institute Finland	LUKE
Oulun seudun ammattikorkeakoulu	OAMK
Oulun yliopisto	OY
Poliisiammattikorkeakoulu	PAMK
Radiation and Nuclear Safety Authority	STUK
Rooman Instituutti	Rooman Instituutti
Saimaan ammattikorkeakoulu	SAIMAA
Satakunnan ammattikorkeakoulu	SAMK
Savonia-ammattikorkeakoulu	SAVONIA
Seinäjoen ammattikorkeakoulu	SEAMK
Suomalainen Tiedeakatemia	Tiedeaka
Suomen Tiedeseura	Tiedeseura
Svenska handelshögskolan	HANKEN

Svenska Tekniska Vetenskapsakademien i Finland r.f.	STV
Taideyliopisto	TAIDE
Tampereen ammattikorkeakoulu	TAMK
Tampereen yliopisto	TUNI
Tekes	TEKES
Teknillisten Tieteiden Akatemia	TTA
Tiedonjulkistamisen neuvottelukunta	TJNK
Tieteellisten seurain valtuuskunta	TSV
Turun ammattikorkeakoulu	TURUN AMK
Turun yliopisto	TY
Tutkimuseettinen neuvottelukunta	TENK
Vaasan ammattikorkeakoulu	VAMK
Vaasan yliopisto	VY
VATT Institute for Economic Research	VATT
VTT Technical Research Centre of Finland	VTT
Yrkeshögskolan Novia	NOVIA

Appendices 6 - 11: Data Collected for the Analysis

Data for organisations are available for download at respective pages at:
https://avointiede.fi/kypsyystasoselvitys/2019/lisatietopyynto