

D5.1. TRAINING AND EDUCATION IN OPEN SCIENCE SKILLS

GAP analysis

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NHL Stenden University of Applied Sciences

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Executive Summary

The Regional University Network (RUN) is a European University made up of seven Higher Education Institutions (HEIs) from 6 countries and has 75,000 students and 8,000 staff. All RUN-EU partners have a regional focus and are engaged in the three RUN-EU thematic areas: Future sustainable industry and regional development, bioeconomy and social innovation. The focus of the RUN-EU PLUS project (Professional Research Programmes for Business and Society) is on promoting the development of research and innovation collaborations with industry, business and societal partners for regional development.

A central workpackage in the RUN-EU PLUS project is 'Mainstreaming Open Science Practices'. Open science is defined by the European Commission (n.d.) as "An approach to the scientific process that focuses on spreading knowledge as soon as it is available using digital and collaborative technology. Expert groups, publications, news and events." The individual partners of the RUN-EU alliance are all at different points on the pathway to develop their open science practices.

The RUN European University is committed to mainstreaming open science practices and skills within its research and innovation platforms through the delivery of new programmes and initiatives aimed at further strengthening our commitment to open science principles. A comprehensive Data Management Plan - Deliverable 2.2- (Technological University of the Shannon: Midlands Midwest, 2022) has been developed based on the principle that good data governance is essential to good research practice, ensuring that RUN-EU PLUS data is 'FAIR' (Findable, Accessible, Interoperable, and Re-usable).

This report highlights the current situation on the capacities of the member university research support teams to comply with open science principles and practices and identifying the main gaps to be addressed through training and education.

All the RUN-EU universities provide support in publishing open articles, but there are some key challenges and goals concerning FAIR data and sourceware as well as the factors to enhance contribution to open science activities. They are listed as the following:

- Most university respondents to the survey think more than 50% of the organisation is not well informed on open access and FAIR data. Similar responses were provided to questions relating to citizen science and cooperation outside university scholarly communities. This may be a reflection of the number of university academics actively involved in research activities that would result in these types of dissemination outputs and activities.
- The absence of detailed training programmes in most universities about FAIR data, research data management and sourceware.

- Most workshops are taught at beginner level.
- Universities mention the General Data Protection Regulation (GDPR) and intellectual property in their workshops, but there are no specialized workshops on that subject at all universities.
- Provision of greater clarity of what is expected of researchers within the university guidelines, policies and roadmaps related to open science can be developed and promulgated at an institutional level.
- The number of published open articles can be improved, by publishing all peer-reviewed articles openly, whether through the green route or not.
- Storing and sharing research data is done in various ways, often using environments that are not specifically created for storing and sharing research data which may increase the risk of data loss. In addition, an infrastructure for archiving research data needs to be implemented at most universities.
- Attention to rewarding open science activities (research output, research process, service and leadership, research impact, teaching and supervision and professional experience) should be enhanced through dedicated monitoring of these activities.
- Organisation of wide knowledge about altmetrics must be improved.
- Experience with early scholarly communication can be expanded.
- Citizen science is a field to explore further.

This report will form the basis for the content of the training workshops that will be developed. Also, it will serve as a discussion paper for respondents and Open Science ambassadors in the RUN-EU PLUS project. By empowering the Open Science Ambassadors Network and implementing workshop provision to directly address the GAPS detailed in this report, an increased awareness and knowledge of open science themes will be created within the RUN-EU network and other institutions, both in scientific and professional fields.

The Open Science Ambassadors (OSAs) will champion open science within each RUN-EU organisation and collaborate with the OSAs of the other partners. Open Science Ambassadors serve as the linking pin between the outputs of RUN-EU PLUS work package 5 ‘Mainstreaming of Open Science Practices’ and their own organisation, by increasing conversations around open science, cultivating greater awareness for open science, fostering openness to embed open science in daily work and establishing the necessary tools in support of the open science agenda.

By jointly developing workshops on the various themes the level of expertise of ambassadors and research support staff within RUN-EU will increase. By attending the RUN-EU PLUS Open Science workshops, participants will have a better understanding of the opportunities for open

publishing. The same applies for others outside the RUN-EU project because workshops will be shared as Open Educational Resources. Because of the annual evaluation of these workshops, with results and feedback from participants, these workshops will be improved, and knowledge on themes will be further developed through active learning.

1. RUN-EU PLUS Consortium and Open Science

The Regional University Network (RUN) is a European University which brings together 7 regionally focused Institutions across the European Union. All RUN-EU partners have a regional focus and are engaged in the three RUN-EU thematic areas: Future sustainable industry and regional development, Bioeconomy, and Social innovation.

The focus of RUN-EU PLUS is on promoting the development of research and innovation collaborations with industry, business and societal partners for regional development. This is accomplished through developing and implementing RUN-EU professional practice-based research degree programmes at masters and doctoral level and by supporting researchers with a research career development programme offering multiple training options including in the field of open science.

The participating institutions in RUN-EU consist of different types of higher education institutions including technological universities, polytechnic institutes and universities of applied sciences. The RUN- European University is made up of the following seven partners:

- Technological University of the Shannon: Midlands Midwest (TUS, Ireland)
- Vorarlberg University of Applied Sciences (FHV, Austria)
- Széchenyi István University (SZE, Hungary)
- Häme University of Applied Sciences (HAMK, Finland)
- NHL Stenden University of Applied Sciences (NHL Stenden, Netherlands)
- Polytechnic of Cavado and Ave (IPCA, Portugal)
- Polytechnic of Leiria (IPL, Portugal)

The RUN European University is committed to mainstreaming open science practices and skills within its research and innovation platforms through the delivery of new programmes and initiatives aimed at further strengthening our commitment to open sciences principles. A comprehensive Data Management Plan – Deliverable 2.2 - (Technological University of the Shannon: Midlands Midwest, 2022) has been developed based on the principle that good data governance is essential to good research practice. It describes the approach to data management to be followed by the consortium based on the “Guidelines on Data management in Horizon 2020” (European Commission, 2016), ensuring that RUN-EU PLUS data is 'FAIR' (Findable, Accessible, Interoperable, and Re-usable). The DMP details the purpose of the data collection and generation within the RUN-EU PLUS project according to its objectives, as well as the types, formats, origin and sizes of the data. Aspects such as data security and ethical aspects are also covered.

The objective of this gap analysis was to identify and map the gaps in training and education on open science skills and to support the development of new practices for students, researchers and managers at all career stages. The RUN-EU PLUS open science training programmes along with our Open Science Ambassadors (OSAs) will support our open science agenda across our consortium to exchange best practice and mutual learning within the RUN-EU alliance.

In the RUN-EU PLUS project we use the definition of Open Science as formulated by the European Commission (n.d.):

“An approach to the scientific process that focuses on spreading knowledge as soon as it is available using digital and collaborative technology. Expert groups, publications, news and events.”

Open science is not only a policy priority for the European Commission but also the Organisation for Economic Co-operation and Development (OECD) which identifies that that broadening access to scientific publications and data is at the heart of open science. Both identify several potential benefits for open science including:

- Open science promotes a more accurate verification of scientific results. By combining the tools of science and information technologies, scientific enquiry and discovery can be sped up for the benefit of society.
- Open science reduces duplication in collecting, creating, transferring and re-using scientific material.
- Open science increases productivity in an era of tight budgets.
- Open science results in great innovation potential and increased consumer choice from public research.
- Open science promotes citizen trust in science. Greater citizen engagement leads to active participation in scientific experiments and data collection. One of the goals of the RUN-EU PLUS network is mainstreaming new and innovative programmes and initiatives across the alliance to strengthen the RUN-EU commitment to open science practices, principles and skills. The vision is that is that through developing Open Science practices in the consortium the strengths of each institution will be visible and benefit in developing activities on this topic.

The following objectives are defined in the RUN-EU PLUS project proposal:

1. To mainstream open science practices and skills within our R&I platforms and delivery of new programs and initiatives and to develop resources across the RUN-EU network for increasing conversations around open science, cultivating awareness, fostering

openness, and equipping the researchers and innovators with the necessary tools to champion the open science agenda.

2. To apply the consistent application and internalisation of the principles listed in the European Code of Conduct for Research Integrity (ECoC) across the consortium establishing dissemination, innovative training programme and novel tools.
3. To develop a series of commonly agreed principles and training workshops by which to disseminate how intellectual property and knowledge transfer will be managed within the consortium. We aim to remove traditional obstacles to innovation and revolutionise the way the public and private sector works together to bring research developments and advancements to the marketplace for societal benefit.

The individual partners of the RUN-EU alliance are all at different points on the pathway to develop open science practices. This report will highlight the current scenario on the capacities of the research teams to comply with open science principles and practices, identifying the main gaps to be addressed through training and education.

It will form the basis for the RUN-EU PLUS deliverable on mainstreaming open science and the basis for the content of the training workshops that will be developed. Also, it will serve as discussion paper on open science for respondents and ambassadors in the RUN-EU PLUS project.

The focus of this report is on the findings of an audit of the open science skills and education offerings across our RUN European University, in addition to a discussion on factors related to the implementation of open science in our individual universities. The themes are derived from the eight ambitions outlined by the European Commission (2019). They include open data, European Open Science Cloud (EOSC), new generation metrics, future of scholarly communication, rewards, research integrity & reproducibility of scientific results, education and skills and citizen science.

2. The Method in Collecting the Information

The information on the current open science practices was gathered from the RUN-EU PLUS partners by use of a questionnaire (see Annex 1).

The questionnaire was designed using the eight ambitions of open science as outlined by the European Commission (2019): open data, EOSC, new generation metrics, future of scholarly communication, rewards, research integrity & reproducibility of scientific results, education and skills and citizen science. Also, some questions of the Dutch National Coordination Point Research Data Management (LCRDM) self-assessment tool to measure the FAIR-ness of an organization (De Bruin et al., 2020) were used. This questionnaire functioned as the basis for the GAP analysis.

Respondents of the questionnaire were members of RUN-EU PLUS work package 5 (Mainstreaming of Open Science Practices). This group consists of project leaders, librarians and researchers. After completing the questionnaire, they were interviewed by the work package 5 leader to add more information concerning open science.

The focus in this report is on the findings of the audit of the open science skills and education, but also discusses factors related to the actual implementation of open science in the universities, inspired by the forementioned eight ambitions outlined by the European Commission (2019).

3. Research Integrity & Reproducibility Scientific Results

One of the eight ambitions concerning open science of the European Commission (2019) is research integrity: all publicly funded research in the EU should adhere to commonly agreed standards of research integrity. To clarify what is expected of researchers within the universities, guidelines, policies and best practises related to open science have been reviewed.

3.1. Publication Guidelines and/or Publication Policies

Two universities do have their own publication guidelines. At some universities, guidelines are currently under development and one university is developing a university Academic Strategy, in which publication guidelines will be included. The other universities rely on the guidelines and requirements of the research funding authorities.

HAMK clearly states in their policy “HAMK staff are recommended to publish primarily in open access publications. Other publications will be, in parallel archived to the Theseus open repository.” (Häme University of Applied Sciences, 2017), whereas at IPCA the publication policy is aligned with national practices.

3.2 (Research) Data Guidelines and/or Research Data Policies

The same universities that have publication guidelines also have research data (management) guidelines. Most universities use research data management guidelines as required by national funding authorities.

Due to GDPR, every RUN-EU partner university has a data management policy in place, in which guidelines for research data are included. However, due to the specific character research data may have, some aspects are not mentioned, for example publishing data and (data) infrastructure.

3.3 Checklist with Steps to take before Publication

None of the universities have a specific policy checklist with steps for publication, although there is support arranged for publication through the research offices. Researchers can request direct advice from support units, which are differently organised by each university.

Several universities have websites to support researchers with information on publishing. The organisation of research support is discussed in more detail in section 6.1.

3.4 Roadmap for Researchers where to find Support in each Phase in the Research

While there may be no specific roadmaps available in the universities that help guide researchers to the support they might need in the several phases of their research, the research offices are available to provide guidance and direction. NHL Stenden uses the “Landelijk Integraal Onderzoeksondersteuningsmodel voor hogescholen” (National Integral Research support model for Universities of Applied Science, Coombs et al., 2020) for showing researchers which expertise is needed in which research phase.

3.5 Open Science in University Audit Protocols

HAMK mentions the university has been audited by the Finnish Education Evaluation Centre (FINEEC) and there is encouragement to put open science as a criterium for higher education institutes.

Both national and EU research funding systems now all have directives towards open science and some of the RUN-EU member countries are currently drafting their National Open Research Forum (NORF) protocols, policies and procedures.

3.6 Article Processing Charges

Article processing charges (APCs) are the costs for open publication which are deposited by the author or the publishing organisation. In this way an author can publish in a journal by the golden route (the journal is publishing the article open access immediately and permanently, whereas the authors maintains their copyright).

Most APCs are included in the national funding awards and several universities mention “read and publish” deals. These are deals in which reading and payment for publishing are bundled into one single contract. IPCA and IPL have these contracts organised on a national level, in the other countries these contracts are mostly negotiated by a consortium of participating universities.

Three universities do financially support open publishing by paying APCs. At SZE, researchers can ask, under certain conditions, for a publication fee for publishing articles via the Publication Support Programme. FHV has a fund for open access publications in journals on an

individual first-come, first-served basis during the year, which researchers can access via the library. A similar system is available at TUS.

3.7 Ethical Committee and Awareness of Scientific Integrity

There is a strong relationship between the European Code of Conduct (ALLEA, 2017) and open science as it states:

“Researchers, research institutions and organisations ensure access to data is as open as possible, as closed as necessary, and where appropriate in line with the FAIR Principles (Findable, Accessible, Interoperable and Re-usable) for data management.”

The Research Ethics Committee is responsible for monitoring compliance to the European Code of Conduct of Research Integrity.

All partners have variously organised research ethics committee structures. Most universities have a permanent Ethics Committee in place, and at one university an Ethics Committee is formed whenever a problem concerning scientific integrity is reported.

Promoting awareness concerning scientific integrity differs between universities. In some universities this is centralised. At TUS, for example, there is a core module students must participate in, and for researchers there is an online research integrity programme. At SZE, a Scientific Council has been set up to promote awareness about academic integrity. Within other universities this is more decentralised: workshops are available on specific subjects (for example plagiarism). Some universities use websites and intranet pages to create awareness.

HAMK organises kick-off meetings for projects where research support members are present for, among other things, advising on scientific integrity issues and open science publishing.

3.8 Creating Awareness about Open Science

Mostly, awareness is created via training provision, usually in the form of workshops and presentations about open science. Chapter four discusses this in more detail. Websites, intranet sites and libguides (output of a content management system used by libraries) are often mentioned as well.

Also, awareness campaigns launched when implementing tools and by connecting on (inter)national events, for example Open Access Week are also described. At IPCA there are lot of activities organised (conferences for instance) where the outcomes are openly published.

3.9 Open Science Community

Open science communities are independent, bottom-up local communities comprising members of various scientific disciplines and career stages, who want to learn more about open science (National Programme Open Science, 2021).

There are no open science communities in the RUN-EU universities. Only Finland mentions an open science community on a national level.

3.10 Inter(national) Open Science Networks

All RUN-EU university partners recognise their national open science networks, and they receive information from these platforms. There is also active involvement in national open science networks.

Most of the national networks involved relate to repositories, research data alliance, open science theme groups and library organisations. There is also a network for copyright information points mentioned.

3.11 Identified GAPS in Research Integrity and Reproducibility in Scientific Results

GAP themes	Explanation
Publication Guidelines	A publication guideline that emphasizes the importance of open science and recognizes it as a preference (and how to put it into action) will contribute to the number of open science published outputs by researchers.
Research Data Guidelines	Further expansion of data policy to research data policy, including research data management and FAIR data.
Checklist for taking steps in open publication	Using a checklist can make it easier for researchers to oversee what steps they need to take to openly publish.
Roadmap for researchers	Having an overview of which expertise should be called in at what point in the research process makes it easier for researchers to plan what

	needs to be done in which phase (which also makes the work process of open publishing more efficient).
Article Processing Charges	Clarity on Article Processing Charges in relation to projects between RUN-EU partners.
Awareness Ethical Committee	Clarity that FAIR data is also part of scientific integrity.
Creating awareness	While the RUN-EU universities already deliver workshops and provide support, awareness can also be organised in other ways to bring open science to everybody's attention.

4. European Open Science Cloud (EOSC)

Another ambition of the European Commission (2019) is a “federated ecosystem of research data infrastructures [that] will allow the scientific community to share and process publicly funded research results and data across borders and scientific domains”. This European Open Science Cloud can be visited online. To determine the extent to which universities already contribute to open infrastructures, a series of questions were posed about research output published in repositories.

4.1 Repositories used for Open Access Publications

Every RUN-EU university partner uses a repository for open access publications. The majority use their own repository, but Zenodo and repositories in partnership are also mentioned. The output to other (national) repositories is frequently stressed.

Whereas some repositories publish only open access documents, others also contain articles with limited access. HAMK reports that 86 % of their publications are open access (via the green or golden route) in 2021. IPL mentions a percentage of 84.6 % open access article from all the 6059 articles published at iconline.ipleira.pt.

Some repositories do not contain many open publications. Different reasons are mentioned:

- The repository is not popular among researchers because students also publish in it.
- The overall amount of publications each university publishes.
- Some universities only have a repository in place for a few years now.
- Researchers who are also employed at another university and publish in the repository of that university.
- Researchers upload publications in ResearchGate and are under the impression this equals open publishing.

4.2 Repositories used for publishing FAIR data

Whereas every university recommends a repository for open access, this does not account for saving and sharing FAIR data. Some universities do not provide advice on repositories for FAIR data. One university mentions a national repository for social sciences and humanities and one national repository for technical data. Another university advises use of a national research data storage and Zenodo. The number of datasets already published ranges from “not known” and “none” to five published datasets.

4.3 Repositories used for Open Code/Open Sourceware

Not all universities advise on open-source ware. If recommended, GitHub is mentioned as a repository to save shared codes. Two universities indicate numbers of software published on the platform, with one comment that it was difficult to ascertain which are research projects and which are student projects. IPCA publishes software on the university website.

4.4 Identified GAPS in Repositories

GAP themes	Explanation
Advice on repositories FAIR data	Although some universities do recommend repositories for FAIR data already, not everyone does. If the use of FAIR Data repositories is supported it is easier to comply to “Researchers, research institutions and organisations provide transparency about how to access or make use of their data and research materials” (ALLEA, 2017).
Sharing open sourceware/codes	Although some universities already recommend repositories for open data, not everyone does for open sourceware.
Awareness creating FAIR datasets	The number of published datasets should increase in the coming years.

5. Saving and sharing research data

FAIR open data sharing should become the default for the results of EU-funded scientific research according to the European Commission (2019).

FAIR data is Findable, Accessible, Interoperable and Re-usable whereas open data is openly shared. Open data is not automatically FAIR data, for example, if it has no metadata or README files it is not re-usable or findable. On the other hand, FAIR data is not always open: personal data, national security and competitiveness are reasons not to openly publish data. FAIR data is as open as possible, as closed as necessary. FAIR data is preferred above open data.

5.1. Saving and Sharing Data during Research

Most researchers use the standard IT environments such as Microsoft (One Drive, Teams, SharePoint) and Google Drive. They also save their data on local hard drives.

In the technical domain there are different storage platforms used, such as a Google big query database via script on a virtual Google machine. HAMK describes a project where drone images are shared immediately open at the IDA repository. This is an example of early sharing research data. NHL Stenden has implemented Research Drive, i.e. a research environment for saving research data and collaborating with other educational and governmental institutions, as well as external companies.

5.2 Archiving Data after Research

The repositories used for archiving data, are mentioned by survey respondents, but also the IT environments used during research. Only one university currently has a dedicated internal central data archive, for saving data after research has been completed.

5.3. Used Tools for Research Data Management

HAMK uses DMP Tuuli, which is a tool to create, review, and share data management plans that meet institutional and funder requirements, which is supported by the HAMK research support function of the university.

NHL Stenden uses Research Drive for their research data, with support on, among other things, authorisation matrices by the advisor research data management (e.g., data steward). Other universities use various systems or are currently implementing new systems.

5.4 Identified GAPS in Research Data

GAP themes	Explanation
Unambiguous use of the terms open data and FAIR data	Unambiguous use of terms helps avoid confusion.
Archives	Universities, except one, do not have a dedicated central archive for saving data after research has been completed.
Early sharing research data	There is one example given of early sharing research data, even before analysing. More experience in early sharing is needed.

6. Education and Skills

All scientists in Europe should have the necessary skills and support to apply open science research routines and practices. The European Commission (2019) classifies these open science skills in four categories, which are aligned to the EU's Open Science Monitor.

These categories, which have been used in the questionnaire, include:

- Skills and expertise necessary for open access publishing.
- Skills and expertise regarding research data, data production, management, analysis/use/reuse, dissemination and a change of paradigm from “protected data by default” to “open data by default” respecting legal, and other constraints.
- Skills and expertise to act in and beyond one’s own scholarly and disciplinary community.
- Skills and expertise resulting from a general and broad concept of citizen science, where researchers interact with the public to enhance the impact of science and research.

6.1. Organisation of Research Support

As stated in the RUN-EU PLUS Human Capital Resource Strategies GAP analysis - Deliverable 4.1- (Kallioniemi-Chambers, Friman, Hailikari, Moane & Murray, 2022) there is variation of the research service names (e.g., Research Services, Project Office, The Graduate Studies and Research Office (GRO)) across the RUN-EU PLUS partner universities. There is also variation in how broadly one research service unit is required to cover all support for researchers: HAMK has a multidisciplinary team (library and information services, strategic communications, IT services, data protection officer, project services, research integrity support, publication services, data services, technology transfer, project management and researcher recruitment) providing administrative research support services, whereas in other universities services are more decentralised.

There are also some differences in the defined target groups. For example, some partners mention that the postgraduate students are also their target group besides individual researchers, research groups and faculties.

6.2. Skills and Expertise necessary for Open Access Publishing

All the RUN-EU universities offer support for researchers on open access publishing (gold, green and hybrid route, licenses and copyright). Currently half of the universities offer training and workshops on these topics. Most of the training/workshops are not obligatory for researchers or student but are offered on an ad hoc basis.

Both IPL and SZE offer workshops on all the topics within open access publishing (gold, green, hybrid route, licences and copyright). They also offer these workshops on beginner and intermediate level.

Although there is support on open access at most RUN-EU universities, and workshops and training are offered in more than half of the universities, almost all the universities mention that not even 50 % of the organisation is well informed on the topic of open access.

Support on open access is provided by different departments, publication services, research services, library and research units.

6.3 Skills and Expertise regarding Data

The importance of research data management is that data can be made public more easily because a plan has already been made in advance, in which it is clear which data will be shared publicly and which not.

Regarding skills and expertise on managing research data, the same position as in open access publishing is evident across the RUN-EU partner universities. Most universities have organised support (through different departments) but only IPL offers workshops on all topics but only at beginner level. Most of the other universities have no workshops regarding data or offer only workshops on RDM (HAMK and SZE).

Some of the universities offer this support on research data management (RDM) by different departments depending on the topic (e.g., ICT, Library, Law etc) while others offer the support by a Research Unit who offers support on all different topics.

Also, some universities do not offer workshops themselves but use workshops that are developed and delivered on a national level. IPL is the only university to offer support on all topics (by the library) and offers (basic) workshops on all topics regarding data.

Guidance on data management or FAIR data is also offered through intranet sites or libguides. TUS, for example, has two libguides: <https://ait.libguides.com/ManagingResearchData/Home> and <https://ait.libguides.com/DMPs>

6.4 Skills and Expertise to act and beyond one's own Scholarly and Disciplinary Community

The questionnaire also explored the topics of research integrity and ethics skills, GDPR, and intellectual property rights.

The support systems for research integrity and ethics are already organised at most universities. Training workshops on this topic are organised at three of the universities. Three of the universities also think that more than 50% of the organisation is well informed on research integrity and ethics.

All the universities have organised support on GDPR and three of the universities have created workshops. Surprisingly only two of the universities think that more than 50% of the organisation is well informed on GDPR.

Intellectual property rights (IPR) support is available at all universities but only three universities offer workshops in this area. SZE thinks that more than 50 % of their university is well informed on intellectual property rights.

To conclude: most universities offer support on all three topics (research integrity and ethics skills, GDPR and IP) with workshops and training available at some of the universities. Most universities offer support on one or two of the topics, only TUS provides training in all three topics.

On all the topics support is given by different staff members or departments although some have research units or research offices who provide the support.

6.5 Skills and Expertise regarding Citizen Science

Citizen science is described by the European Commission (2020) as:

“The voluntary participation of non-professional scientists in research and innovation at different stages of the process and at different levels of engagement, from shaping research agendas and policies, to gathering, processing and analysing data, and assessing the outcomes of research. Active engagement with citizens and society has the potential to improve research and its outcomes and reinforce societal trust in science.”

Only a few universities have experience with research projects involving citizens collecting data, testing, validating and/or collecting information. Most of the universities have no support for citizen science or organised any training in this field.

This is the field that is least developed within open science across the RUN-EU alliance. Section 10 discusses citizen science as an ambition of the European Commission.

6.6 Identified GAPS in education and skills

GAP themes	Explanation
Training in Open Access	Currently half of the universities offer training but at most universities it is not part of a programme but given ad hoc when it is requested.
Training and support in data management	Only a few universities offer training in this area. Most universities are still developing support in this area. Support is mostly done by the library. Support by writing data management plans and data management paragraphs is not usual at every university, as is advising on map structures and authorisation matrices.

Citizen Science	Neither support nor trainings are organised on citizen science. For most universities this is a new topic that still must be developed.
Awareness of open access, FAIR data, acting beyond own scholarly community and Citizen Science	Most respondents suggest more than 50% of the organization is NOT well informed on open access and FAIR data. Similar response was obtained for citizen science and cooperation outside the own scholarly community.

7. Rewarding Open Science

The European Commission (2019) wants research career evaluation systems to fully acknowledge open science activities in the future. The European Code of Conduct of Research Integrity (ALLEA, 2017) states that “Research institutions and organisations reward open and reproducible practices in hiring and promotion of researchers”. Several factors are important before a researcher can be structurally rewarded in open or FAIR publishing.

7.1. Central Monitoring

None of the universities use a central monitoring system to monitor open research output. Some universities mention central monitoring, via yearly reporting, output found via Web of Science or Scopus or Scival.

7.2. Themes Open Science Career Assessment

Themes presented in the Open Science Career Assessment include research output, research process, service and leadership, research impact, teaching and supervision and professional experience (O’Carroll et al., 2017b).

Only IPCA mentions that “all dimensions are considered and assessed for research/career evaluation. Varying weights of importance are applied depending on the respective assessment procedure”. At the other RUN-EU universities currently none of these themes are used to assess research activities.

7.3 Rewarding Researchers

Rewarding open science is generally accomplished by the research funders during the proposal application stages, who positively assesses open science efforts. Also, the possibility to request Article Processing Charges at three universities can be considered as rewarding.

None of the universities mention other rewards for activities involving open research, for example through enhanced communication and outreach activities (though this is done using social media platforms) or the awarding of open science research prizes.

7.4 Identified GAPS in rewarding Open Science

GAP themes	Explanation
Central monitoring on open research output	None of the universities use a central monitoring system to monitor open research output.
Rewarding on research output, research process, service and leadership, research impact, teaching and supervision and professional experience	Attention to rewarding should be enhanced, not only to open output but also to other activities involving open science.
Fully acknowledge open science activities in research career evaluation	Open science activities are not fully acknowledged in career evaluation and development at several RUN-EU partner universities.

8. New generation Metrics

New indicators must be developed to complement the conventional indicators for research quality and impact, to do justice to open science practices, according to the European Commission (2019). The classic way of measurement, bibliometrics, is based on the number of researcher citations. But there are also other ways to describe the impact of research.

The Declaration on Research Assessment (DORA) recognises the need to improve the ways in which researchers and the outputs of scholarly research are evaluated. This can be for example the number of times a study is mentioned on social media, how many people from what field attended a presentation or how a study has carried over into education or business. This is called altmetrics.

8.1 Impact Measurement

Impact is measured at four RUN-EU universities, mostly based on citation databases as Scopus, SciVal and Web of Science. Only TUS mentions the use of alternative metrics with both the freely available Altmetric tool and PlumX metrics via Elsevier subscriptions. Both of which are limited to article level analysis.

8.2. Identified GAPS in Impact Measurement

GAP themes	Explanation
Creating awareness on altmetrics	Because a lot of applied research is published in trade journals, metrics following scientific databases is not sufficient.
Indicate and accept tools to measure altmetrics	In rewarding impact of research, other tools, in addition to the classical forms for measuring the reach of the research, must be included.

9. Future of Scholarly Communication

The European Commission (2019) thinks all peer-reviewed scientific publications should be freely accessible, and the early sharing of different kinds of research outputs should be encouraged.

9.1 Early Sharing of Research Output

All peer-reviewed articles can be published via the green route by publishing pre-prints in a repository, but not all peer-reviewed articles by RUN-EU universities are published open access via the green route or via the golden route.

Within RUN-EU there are some examples of the university publishing its own open journals:

ETFI (The European Tourism Futures Institute - the link between research at NHL Stenden and the field of tourism and recreation) publishes his own open access journal: [Journal of Tourism Futures](#). At HAMK, there are three [open access online journals](#) (HAMK Unlimited Professional, HAMK Unlimited Journal and HAMK Unlimited Scientific) and they also have [open access publication series](#).

HAMK and SZE are the only universities which mention experience with the open reviewing process, whereas HAMK also participated in the early sharing of data. There are no experiences mentioned with pre-registration via the Open Science Foundation (OSF).

9.2 Identified GAPS in early scholarly communication

GAP themes	Explanation
All peer-reviewed articles published open access, at least via de green route	Not all peer-reviewed articles by RUN-EU universities are published open access.
Creating awareness about open review processes	Experience with the open reviewing process can be expended.
Creating awareness about pre-registration of research	Experience with pre-registration of research can be expended.

10. Citizen science

The last of the eight ambitions of the European Commission (2019) is citizen science: “The general public should be able to make significant contributions and be recognised as valid European science knowledge producers”.

10.1 Citizen Science in the Universities

IUCA, IPL and HAMK already have experience with projects involving citizens in the collection of data, by testing, validating and/or collecting information.

Most universities state that there is no special attention to citizen science as a standalone concept, although others acknowledge to be at the beginning in promoting citizen science.

10.2 Identified GAPS in Citizen Science

GAP themes	Explanation
Creating more awareness about citizen science among researchers	Researchers can ask the public to make significant contributions to research.

11. Conclusions

Across RUN-EU partner universities there are many ongoing developing activities concerning Open Science. By working together on these topics, the universities can strengthen each other, by learning from universities with more experience on certain subjects and by developing together awareness, support and training, whereby training is one of the deliverables in the RUN-EU PLUS work package 5 (Mainstreaming of Open Science Practices). Also because of the connection to (inter)national networks, developed knowledge of these networks can be exchanged within the RUN-EU project.

All the universities provide support in publishing open articles, but there are some key challenges and goals concerning FAIR data and sourceware as well as the factors to enhance contribution to open science activities. They are listed as the following:

- Most university respondents to the survey think more than 50% of the organisation is not well informed on open access and FAIR data. Similar responses were provided to questions relating to citizen science and cooperation outside university scholarly communities. This may be a reflection of the number of university academics actively involved in research activities that would result in these types of dissemination outputs and activities.
- The absence of detailed training programmes in most universities about FAIR data, research data management and sourceware.
- Most workshops are taught at beginner level.
- Universities mention GDPR and intellectual property in their workshops, but there are not specialized workshops on the subject on all universities.
- Provision of greater clarity of what is expected of researchers within the university guidelines, policies and roadmaps related to open science can be developed and promulgated at an institutional level.
- The number of published open articles can be improved, including are not specialized workshops on these subjects in all universities, by publishing all peer-reviewed articles openly, whether through the green route or not.
- Storing and sharing research data is done in various ways, often using environments that are not specifically created for storing and sharing research data which may increase the risk of data loss. In addition, an infrastructure for archiving research data needs to be implemented at most universities.
- Attention to rewarding open science activities (research output, research process, service and leadership, research impact, teaching and supervision and professional experience) should be enhanced through dedicated monitoring of these activities.

- Organisation wide knowledge about altmetrics must be improved.
- Experience with early scholarly communication can be expanded.
- Citizen science is a field to explore further.

The identified challenges and gaps provide a strong base for discussions regarding researcher training programmes and workshops in RUN-EU PLUS. The Open Science Ambassadors and respondents in work package 5 Mainstreaming Open Access will discuss this with regards to the workshops on open science to be developed, but also RUN-EU PLUS work package 4 Human Capital Resource Strategies can review the GAP results in creating reward structures for open science best practise in the Research and Career Evaluation System. The information gathered for this report will assist us in providing themes in the workshops open science to be developed.

12. Discussion and Outlook

The focus of the RUN-EU PLUS survey on open science practices across the RUN-EU consortium, on which this report is based, was on the audit of the open science skills and education, but also included factors related to the actual implementation of open science in the universities, given by the eight ambitions open science of the European Commission (O'Carroll et al., 2017a). Throughout the audit clear strategic and administrative structural differences of how the RUN-EU member universities engage with their open science agenda were identified. For example, some universities in RUN-EU profile themselves as universities of applied sciences, therefore their requirements concerning open science can be different. For this reason, a separate digital competence centre for practice-based research (www.dccpo.nl) has been established in the Netherlands, in which the research support of universities of applied science co-operate. Another key difference is in the available support structures, in most of our universities staff have multiple roles with associated duties side by side making open science just one of many priorities. A real consequence is that less time can then be devoted to development of open science practices.

By acting together in the field of open science, the universities will strengthen each other, but it can also be expected that differences will be encountered. As stated in the RUN-EU PLUS Human Capital Resource Strategies GAP analysis - Deliverable 4.1- (Kallioniemi-Chambers, Friman, Hailikari, Moane & Murray, 2022) collaboration between staff and researchers should be further developed, although there are great variations in how research support is organised.

The knowledge and skills of the research support staff, while not included in the questionnaire, is a key resource across our network and one we intend to maximise in our endeavours to promote the open and citizen science agenda within our RUN European University.

Similarly, library staff knowledge of Open Educational Resources is affiliated to open science because these open lesson materials can help disseminate research findings, and often the teaching materials form part of a study.

Legal issues did receive some exposure in the questionnaire in the form of intellectual property and GDPR questions, but discussing contracts with cooperating parties, such as publishers or collaborating research institutions and companies were not mentioned. This is again an area where the actual knowledge held with the university libraries will be crucial.

The RUN-EU PLUS project has developed a Data Management Plan – Deliverable 2.2 – which presents the approach of the RUN-EU consortium to data management to ensure that RUN-EU PLUS data is 'FAIR' (Findable, Accessible, Interoperable, and Re-usable).

By creating the Open Science Ambassadors Network and delivering workshops, awareness and knowledge of open science themes will be created within the RUN EU network and other institutions, both in scientific and professional fields.

As mentioned in Deliverable 5.2., the OSAs play a crucial role in the establishment of an open science culture within the alliance. They represent the topic within each organisation and collaborate with the OSAs of the other partners. OSAs serve as linking pin between RUN- EU PLUS work package 5 ‘Mainstreaming of Open Science Practices’ and their own organisation, increase conversations around open science, cultivate awareness for open science, foster openness to embed open science in daily work and establish necessary tools of the open science agenda. Also, OSAs will convey the importance of the subject to stakeholders within the organisation and findings and advice from the organisation back to the work package (Vorarlberg University of Applied Sciences, 2022). There are no open science communities in the RUN-EU universities. The OSA network could possibly function as a beginning of a RUN-EU open science community.

The ambassadors also provide advice on themes and content in the open science workshops being developed by the RUN-EU PLUS project. The identified challenges and gaps provide a strong base for discussions regarding the Open Science workshops. The joint development of workshops on the various themes will increase the level of expertise of researchers and research support staff within RUN-EU. By attending the workshops participants will have a better understanding of the opportunities for open publishing. The same applies for others outside the RUN-EU project because workshops will be shared as Open Educational Resources.

Because of the annual evaluation of these workshops, with results and feedback from participants, these workshops will be improved, and knowledge on themes will be further developed.

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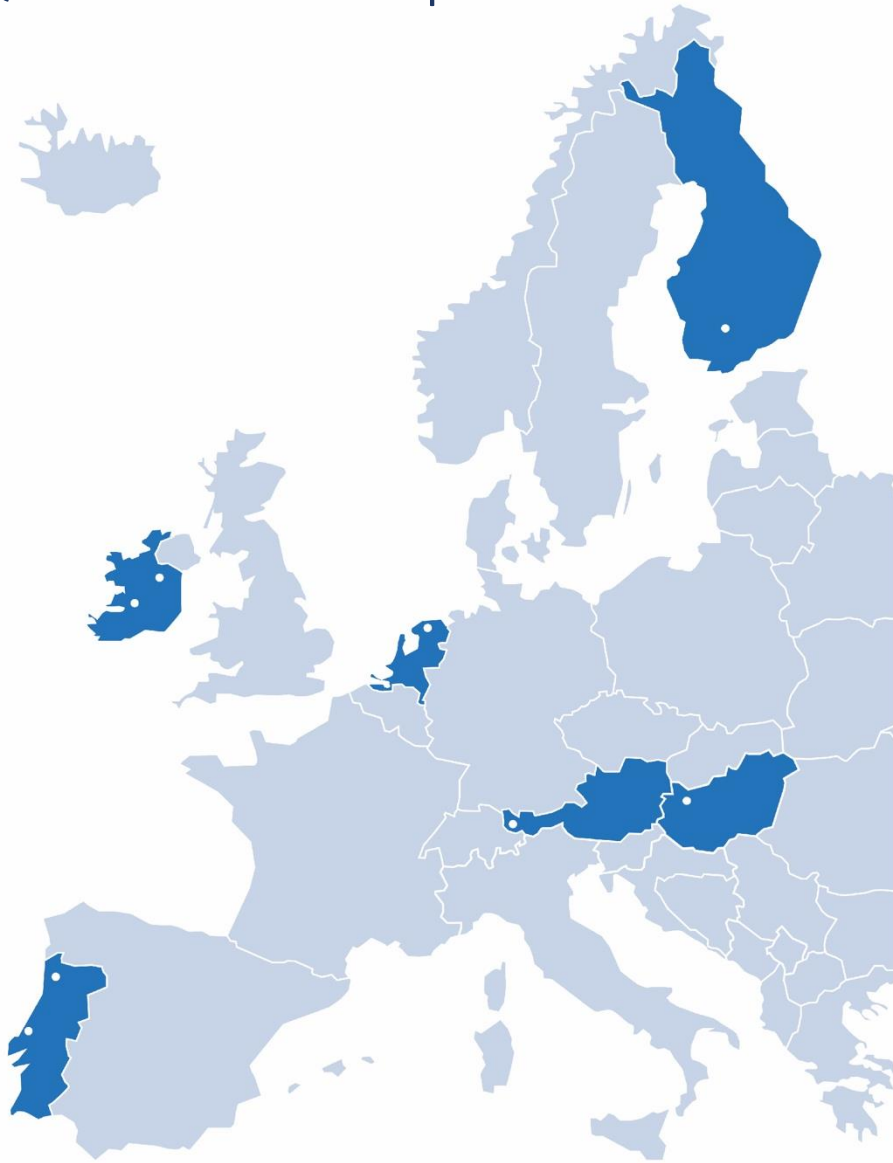
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Annex: Themes and Questions in the template of the GAP analysis



D5.1. Questionnaire GAP analysis and education on open science skills

GAP analysis

11th March 2022

[INSTITUTE NAME]

Questionnaire GAP analysis training and education in open science skills

In Workpackage 5: Mainstreaming Open Science in the RUN-EU+ project one of the deliverables is making an Audit map and GAP analysis in training and education on open science skills:

T5.1 Audit map and GAP analysis in training and education on open science skills

| M1-M8 | Task Leader: NHL Stenden; Co-leader: FHV; Participants: All – At the beginning of this task NHL Stenden will do a refinement of the methodological approach carrying out minor adjustments considered to be necessary at the light of a greater performance regarding the activities planned, providing partners with clear and effective guidelines for their implementation as well as preparing related tools.

Within this task, an audit and ‘gap analysis’ of Open Science practices and skills within RUN EU+ R&I platforms will be performed to enable the capacitation of the Alliance members to fully commit with open science principles and practices.

This questionnaire will function as the basis for the GAP analysis. It not only covers the actual training and other educational activities practiced in the universities, but also has questions about factors related to the actual implementation of open science in the universities. The themes are derived from the eight ambitions outlined by the European Commission¹. They include Open Data, European Open Science Cloud (EOSC), New generation metrics, Future of scholarly communication, Rewards, Research integrity & reproducibility of scientific results, Education and skills and Citizen science.

1 Research integrity & reproducibility scientific results

All publicly funded research in the EU should adhere to commonly agreed standards of research.

1.1 Is in your organisation a

- 1.1.1 Publication Guideline and/or a Publication Policy?
- 1.1.2 (Research) Data Guideline and/or a Research Data Policy
- 1.1.3 Checklist which steps to take before publication?
- 1. 1.4 A roadmap for researchers where to find support in each phase in the research?
- 1.1.5 Audit Protocol for research groups that includes open science?
- 1.1. 6 Fund for Article Processing Charges? If yes, what’s the policy?
- 1.1.7. Is there an Ethical Committee?

If yes, please attach documents

1.2 How does the organisation create awareness around open science?

1.3 How does the organisation create awareness around scientific integrity?

1.3 Is there an open science community within your organisation?

¹ European Commission. (2019). *Open Science*. Consulted on march 1st, 2020, via [ec_rtd_factsheet-open-science_2019.pdf](https://ec.rtd.factsheet-open-science.2019.pdf) (europa.eu)

1.4 Do you cooperate with other (inter)national open science networks?

Opportunity for any comments:

2 European Open Science Cloud (EOSC)

The European Open Science Cloud (EOSC) is the open environment which brings together institutional, national, and European stakeholders, initiatives and infrastructures.

2.1.1 Which repositories does your organisation advice to use for open access publications?

2.1.2 How many publications are published in this repository by your organisation?

2.1.3. How many publications are published *open access* in this repository by your organisation ?

2.2. 1 Which repositories does the organisation advice to use for publishing FAIR data?

2.2.2 How many datasets are published in this repository by your organisation ?

2.3.1 Which repositories does your organisation advice to use for publishing open codes/open sourceware?

2.3.3 How many codes/sourceware are published in this repository by your organisation?

Opportunity for any comments:

3 Open Data

FAIR) and open data sharing should become the default for the results of EU-funded scientific research. FAIR data is Findable, Accessible, Interoperable and Re-usable data. It does not always have to be open. Open data is openly shared but does not have to be FAIR. For example, openly shared data with no metadata or without READ-ME is not FAIR data.

3.1 Which systems do researchers use for saving and sharing data during their research?

3.2 Which systems do researchers use for archiving data after their research?

3.3 Are there any tools for Research Datamanagement your organisation advices to use (for example DMP online, notebooks, etc)?

If yes, which tools?

If yes, how are these tools supported?

3.4. How is support organised concerning Research Data Management and FAIR data?

Opportunity for any comments:

4 Education and skills

All scientists in Europe should have the necessary skills and support to apply open science research routines and practices.

4.1 Skills and expertise necessary for open access publishing ²	Is there support (and by whom)	Are there workshops organised in the university on the subject for researchers Yes/no and on which level (beginner/intermediate/advanced)	Do you think that more than 50 percent of the in your organisation is well informed about the subject?
Gold, green, hybrid route			
Licences (for example CC Licenses)			
Copyright			

4.2 Skills and expertise regarding research data, data production, management, analysis/use/reuse, dissemination, and a change of paradigm from “protected data by default” to “open data by default,” respecting legal, and other constraints	Is there support (and by whom)	Are there workshops organised in the university on the subject for researchers Yes/no and on which level (beginner/intermediate/advanced)	Do you think that more than 50 percent of the in your organisation is well informed about the subject?
Research Datamanagement			
Findability in FAIR data (for example repositories, Persistent identifiers, metadata)			
Accessibility in FAIR data (for example authentication, archiving, handling requests)			
Interoperability in FAIR data (for example preferred formats,			

² The four themes are derived from the categories of Open Science Skills in “Providing researchers with the skills and competencies they need to practice Open Science” by the European Commission in 2017 (doi: 10.2777/121253)

vocabularies, units of measurement)			
Re-usability in FAIR data (for example: READ-ME files and licenses, quality control)			
Research Software Publishing			
Research Software Management			
Finding data for re-use			

4.3 Skills and expertise to act in and beyond one's own scholarly and disciplinary community	Is there support (and by whom)	Are there workshops organised in the university on the subject for researchers Yes/no and on which level (beginner/intermediate/advanced)	Do you think that more than 50 percent of the in your organisation is well informed about the subject?
Research integrity and ethics skills			
GDPR			
Intellectual Property Rights			

4.4 Skills and expertise resulting from a general and broad concept of citizen science, where researchers interact with the public to enhance the impact of science and research	Is there support (and by whom)	Are there workshops organised in the university on the subject for researchers Yes/no and on which level (beginner/intermediate/advanced)	Do you think that more than 50 percent of the in your organisation is well informed about the subject?
Adequately include citizens in research design and processes			
Involving citizens in the collection and analysis of research data			

Capacity to communicate, explain and discuss research outcomes to the public			
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5 Rewards

Research career evaluation systems should fully acknowledge open science activities.

5.1 Is there central monitoring on research output?

If yes, how?

5.2 Is there central monitoring on open research output?

If yes, how?

5.3 Does your organisation use the themes as described in the Open Science Career Assessment Matrix (see figure 1) to assess other research activities (research process, service and leadership, research impact, teaching and supervision and professional experience)?

If yes, which ones and how are they assessed?

5.4 Do researchers who are practicing open science get rewarded?

If yes, how?

Figure 1 - Open Science Career Assessment Matrix (OS-CAM) representing the range of evaluation criteria for assessing Open Science activities

Open Science Career Assessment Matrix (OS-CAM)	
Open Science activities	Possible evaluation criteria
RESEARCH OUTPUT	
Research activity	Pushing forward the boundaries of open science as a research topic
Publications	Publishing in open access journals Self-archiving in open access repositories
Datasets and research results	Using the FAIR data principles Adopting quality standards in open data management and open datasets Making use of open data from other researchers
Open source	Using open source software and other open tools Developing new software and tools that are open to other users
Funding	Securing funding for open science activities
RESEARCH PROCESS	
Stakeholder engagement / citizen science	Actively engaging society and research users in the research process Sharing provisional research results with stakeholders through open platforms (e.g. Arxiv, Figshare) Involving stakeholders in peer review processes
Collaboration and Interdisciplinarity	Widening participation in research through open collaborative projects Engaging in team science through diverse cross-disciplinary teams
Research integrity	Being aware of the ethical and legal issues relating to data sharing, confidentiality, attribution and environmental impact of open science activities Fully recognizing the contribution of others in research projects, including collaborators, co-authors, citizens, open data providers
Risk management	Taking account of the risks involved in open science
SERVICE AND LEADERSHIP	
Leadership	Developing a vision and strategy on how to integrate OS practices in the normal practice of doing research Driving policy and practice in open science

	Being a role model in practicing open science
Academic standing	Developing an international or national profile for open science activities Contributing as editor or advisor for open science journals or bodies
Peer review	Contributing to open peer review processes Examining or assessing open research
Networking	Participating in national and international networks relating to open science
RESEARCH IMPACT	
Communication and Dissemination	Participating in public engagement activities Sharing research results through non-academic dissemination channels Translating research into a language suitable for public understanding
IP (patents, licenses)	Being knowledgeable on the legal and ethical issues relating to IPR Transferring IP to the wider economy
Societal impact	Evidence of use of research by societal groups Recognition from societal groups or for societal activities
Knowledge exchange	Engaging in open innovation with partners beyond academia
TEACHING AND SUPERVISION	
Teaching	Training other researchers in open science principles and methods Developing curricula and programs in open science methods, including open science data management Raising awareness and understanding in open science in undergraduate and masters' programs
Mentoring	Mentoring and encouraging others in developing their open science capabilities
Supervision	Supporting early stage researchers to adopt an open science approach
PROFESSIONAL EXPERIENCE	
Continuing professional development	Investing in own professional development to build open science capabilities
Project management	Successfully delivering open science projects involving diverse research teams
Personal qualities	Demonstrating the personal qualities to engage society and research users with open science Showing the flexibility and perseverance to respond to the challenges of conducting open science

Opportunity for any comments:

6 New generation metrics

New indicators must be developed to complement the conventional indicators for research quality and impact, to do justice to open science practices.

6.1 Is impact (metrics and altmetrics) measured in your organisation?

6.2 If yes, how is impact (metrics and altmetrics) measured in your organisation?

Opportunity for any comments:

7 Future of scholarly communication

All peer-reviewed scientific publications should be freely accessible, and the early sharing of different kinds of research outputs should be encouraged.

7.1 Does your organisation have experience with the early sharing of different kinds of research outputs:

Open peer review?

Pre-registration?

Other namely:

8 Citizen science

The public should be able to make significant contributions and be recognised as valid European science knowledge producers.

8.1 Are there projects within the organisation that use citizen science?

If yes, how?

8.2 Is there special attention to citizen science withing the organisation?

If yes, how?

9 Completion

9.1 Did you miss subjects in this questionnaire?

If yes, which one(s)?

Thank you for completing this questionnaire.



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