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Organising RDM and Open Science Services: Case Finland and Aalto University

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Abstract

This paper describes how the Finnish Ministry of Education and Culture launched an initiative on research data management and open data, open access publishing, and open and collaborative ways of working in 2014. Most of the universities and research institutions took part in the collaborative initiative building new tools and training material for the Finnish research needs. Measures taken by one university, Aalto University, are described in detail and analysed, and compared with the activities taking place in other universities.

The focus of this paper is in the changing roles of experts at Aalto University, and organisational transformation that offers possibilities to serve academic personnel better. Various ways of building collaboration and arranging services are described, and their benefits and drawbacks are discussed.

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Introduction

Open science has become a significant way of promoting science and increasing its societal impact. Open access publishing, open data, new methods and tools enabling openness, and open culture (including new skills and knowledge) are the main building blocks of the open science paradigm. However, before we can talk about opening and sharing data, we have to learn to manage research data so that the use and reuse of data is possible. Universities of applied sciences and research institutions would like to learn how to "do RDM" better, what processes, services and roles help them to support researchers and their data needs.

The literature on open science and its necessary requirement, research data management (RDM), consists of numerous reports and case studies from practitioners' perspectives. For example, reports by Online Computer Library Centre (OCLC) with their valuable insights into universities and their RDM processes[1], reports by Research Data Alliance (RDA) and its working groups[2] and interest groups[3]. Furthermore, several conferences contribute to the knowledge base and RDM papers, most notably the IDCC, RDA and euroCRIS conferences.

In addition, the practitioners in higher education institutions (HEIs) – especially in libraries – and in organisations providing support and services to HEIs, have studied practical and technical aspects of RDM, and published these findings as reports in web sites and working papers.

In order to find out how common the topic RDM is in scientific journals, I conducted a search with "research data management" as a keyword, in the title of the article, or in the abstract of the article in order to find out if there is something we can call "the RDM literature". The reason for choosing RDM as a search word is that RDM is, in my mind, a prerequisite for sharing data, software or methods. Based on the search, carried out on the 18th of October 2018 in the Scopus database, 186 articles were found of which 174 were articles and 12 review articles, 16% of the articles were open access articles.

Based on the articles in the Scopus database, academic interest towards RDM became more prominent in 2014, when 27 articles were published with RDM as one of the keywords of the article (see Figure 1).

1 Online Computer Library Centre (OCLC): https://www.oclc.org/research/publications/2017/oclcresearch-research-data-management.html
2 RDA working groups: https://www.rd-alliance.org/groups/working-groups
3 RDA interest groups: https://rd-alliance.org/groups/interest-groups

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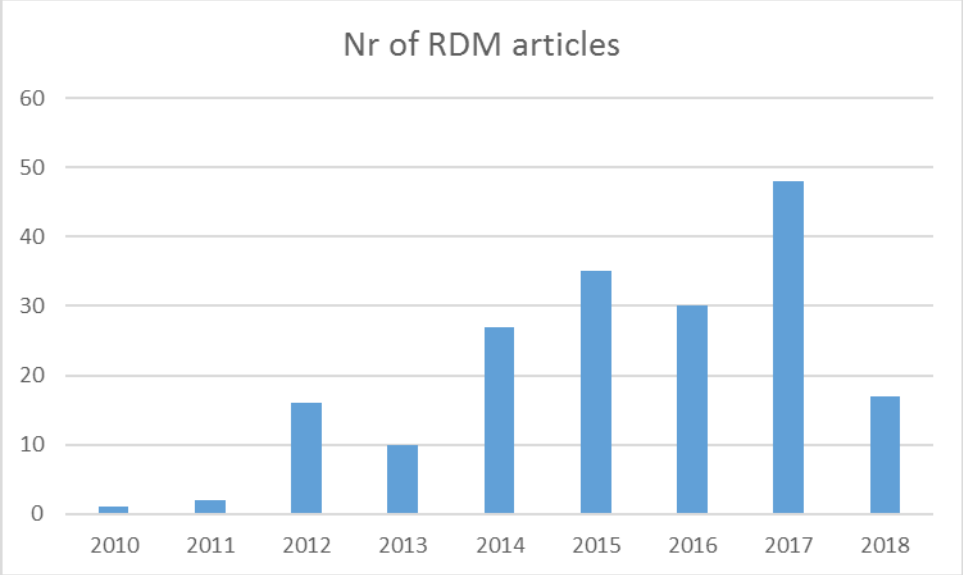

Figure 1. Number of RDM articles in the time-period 2010 – 2018.

When examining the subject areas of the articles, the most common subject areas are social sciences (44% of all the articles), computer science (19%), medicine (8%) and biochemistry, genetics and molecular biology (5%). Several subject areas are allowed.

There are12 authors that had authored more than three RDM articles. The most prolific authors are Cox, A.M. (University of Sheffield), Budroni, P. (University of Vienna) and Solis, B.S. (Austrian Social Science Data Archive). When we look at the affiliations of all RDM articles, the most prolific affiliations are University of Vienna, University of Sheffield and University of Pittsburg. Researchers whose affiliation is in the USA (29%) have authored most of RDM article followed by authors from the United Kingdom (14%); Germany (11%); Austria (6%) or Australia (5%).

Not surprisingly, the majority of the most prolific journals (those journals that have published more than four RDM articles during 2010 – 2018) are from information and library sciences, as depicted in Table 1.

There is, indeed, RDM literature and it has grown in the past four years. The articles investigate diverse areas, for example, how different institutional and individual factors affect the data sharing behaviour of authors (Zenk-Möltgen et al., 2018); opinion and behaviour of scientists regarding RDM (Schöfel et al., 2018), how to start RDM activities in universities (e.g. Wittenberg and Elings, 2017). The articles are usually case studies of one or several universities. Clement et al.'s (2017) paper is an interesting collaborative effort of small arts universities in the USA. Country view was present in a couple of articles, e.g. Switzerland in Burgi et al. (2017), and Zimbawe in Chigwada et al. (2017).

Table 1. The most prolific RDM journals in the time- period 2010 – 2018.

Source Title	Number of Articles
Voeb Mitteilungen (University of Vienna Library)	12
Ifla Journal	10
Program	7
ISPRS International Journal Of Geo Information	6
Journal Of Academic Librarianship	5
Liber Quarterly	5
New Review Of Academic Librarianship	5
Proceedings Of The Association For Information Science And Technology	5
Australian Academic And Research Libraries	4
Data Science Journal	4
Grey Journal	4
Insights The Uksg Journal	4
Records Management Journal	4

There are also studies on RDM websites of universities (e.g. Yoon and Schultz, 2017; Tripathi, Shukla and Sonker, 2017), and articles that focus on discipline-specific issues (e.g. Borghi and Van Gulick, 2017; Chen and Wu, 2017).

This objective of this paper is two-fold: to describe the Finnish landscape of RDM and open science during the last couple of years, and to deepen the understanding of the changes with the case study of Aalto University. At first, I describe the Open Science and Research initiative as one of active participant of the initiative. Secondly, I go through Aalto University's RDM and open science activities and explain the reasoning behind our decisions. Thirdly, I compare the most common data support roles and structures both internationally and nationally with our roles, and discuss the benefits and drawbacks of different service solutions.

The Finnish Open Science Scene

The Finnish Ministry of Education and Culture promotes open science in several ways, for example, through the Open Science and Research Initiative (ATT), which took place during 2014-2017. The objective of the initiative was for Finland to become one of the leading countries in openness of science and research by the year 2017, and to ensure that the possibilities of open science will be widely utilized in the Finnish society (Ministry of Education and Culture, 2014).

Other objectives of the initiative included promoting the trustworthiness of science and research, supporting the culture of open science within the research community, and increasing the societal impact of research and science. The Open Science and Research Initiative was based on a broad-based cooperation between ministries, universities, research institutions and research funders (Ministry of Education and Culture, 2014). See Figure 2 for the "big picture" of the initiative.

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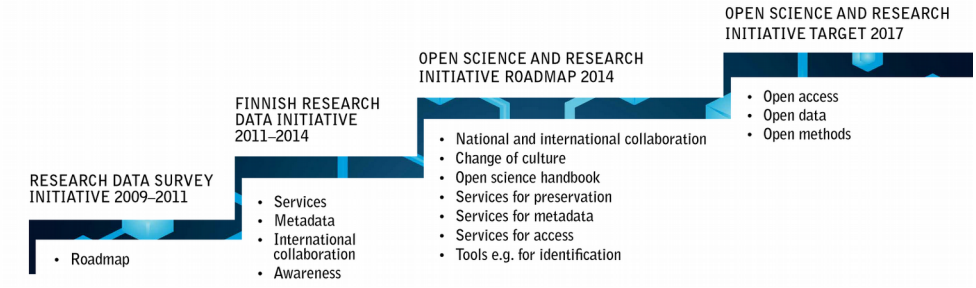

Figure 2. Open Science Initiative 2014 – 2017.

The results of the initiative were many. Before the start of initiative, most of the Finnish universities had open access policy that recommended or required the depositing of research output in the repository of the university. The number of open access (OA) publications is collected in conjunction with the yearly data gathering of the Ministry of Education and Culture. The share of peer-reviewed OA articles of the Finnish universities rose from under 30% in 2016 to nearly 40% in 2017. In the universities of applied sciences, the OA numbers are 50% and 56% (Ilva, 2018).

Only a few universities had a data policy before the initiative. Thanks to the initiative, all the Finnish universities now have data policies, as well as several research institutes and universities of applied sciences.

The common method of collaborating within the initiatives was to gather experts from HEIs to form expert groups that work on different aspects of RDM and open science. The national Computer Science Centre (CSC) coordinated the work and managed the administrative burden. The expert groups helped in defining the national services necessary for RDM and data sharing, and CSC built and continues to develop and maintain the services. One of the deliverables of the services expert group was the Framework for Open Science and Research Initiative using enterprise architecture methodology. This target architecture sets national principles for open science that govern data and services used in science and research, the exchange of information, and the development of e-services (Open Science and Research Initiative, 2016)

The most notable new services taken into use during the initiative are the national metadata catalogue (Etsin[4]), a tool for data management plans (DMPTuuli[5]), and long term preservation service (Fairdata-PAS[6]). In addition, a storage service (Ida[7]) was redesigned during the initiative, and we are expecting Qvain[8] (the metadata descriptor service) in the beginning of 2019. All the services are – at least for now – free of charge for researchers.

Because the level of awareness of both researches and service personnel on RDM and open science was low, a massive training program was undertaken during the initiative. The training took place as workshops and webinars. However, most of the participants of the training events were from service units, thus the awareness level of researchers did not arise as expected during the initiative.

After the initiative, the Open Science objectives of the Ministry of Education were formulated in May 2018 as follows:

4 Etsin: https://etsin.fairdata.fi
5 DMPTuuli: https://www.dmptuuli.fi
6 Fairdata-PAS: https://www.fairdata.fi/en/fairdata-pas
7 IDA: https://ida.fairdata.fi/login
8 Qvain: https://www.fairdata.fi/en/qvain/

- **The main objective:** Finland is recognised as a vanguard for open science. Open science is an everyday part of the research process.
- **Sub objective 1:** The services and support for researchers are close-by and accessible. Local support services benefit from national centralised and coordinated services.
- **Sub objective 2:** Open science practices and standards are interoperable with international solutions.

However, these basic principles were not elaborated further at that time. Only in late 2018, the coordination of the next national Open Science initiative started. As with earlier initiatives, this initiative is also based on collaboration of motivated experts. The expert groups focus on the following four themes[9]: open publications, open data, open research community and open learning. The model of RDA Plenary is followed in the work of the new initiative; expert groups work on sub-themes and present their work in the bi-yearly plenaries. For example, the first task of the strategic group of the open science initiative is to formulate the Finnish strategic objectives for open access publishing taking into account the principles of Plan S[10].

The benefits of collaborative work are clear; more experts to solve difficult problems, support from initiative in training and administration, and very importantly, the Ministry pays for the building and development of common services. However, there are drawbacks as well: collaborative efforts tend to be somewhat slower and the services do not always work as expected.

RDM and Open Science Services at Aalto University Before 2016

Aalto University was formed when the Helsinki University of Technology, Helsinki Business School and School of Arts and Design merged in 2010. The new university combines business and technology with arts. Aalto University has four technical schools, one business school and one art and design school. The merger is, in many ways, the reason why Aalto University was not in the forefront of open science movement in Finland. Unifying the services and processes of the new university took a lot of time and energy. On the other hand, the merger gave Aalto University the permission – or even demanded – new ways of offering services for researchers.

The content and organising of RDM and open science services at Aalto University were typical to how RDM services were organised in other international and national universities. The division of labour was as follows:

- Research and Innovation (RIS) advises researchers on recognising grant possibilities, assists in grant writing (also DMPs), and help with legal questions and project management. Each school has its own school team with experts in all of these fields.
- With the implementation of a new research information management system, Pure based ACRIS in 2016, publication metadata are inserted in ACRIS, and

9 Open Science: https://avointiede.fi/fi/etusivu
10 Plans S principles: https://www.coalition-s.org/

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the full text open access publications are transferred to the institutional repository (AaltoDoc).

- The reporting unit of the university is in charge of reporting the publications and their openness to the Ministry of Education and Culture. Ministry of Education and Culture is the biggest funder of Finnish universities. According to the funding model, it is possible to receive 13% of overall funding based on the quality and quantity of publications.
- IT Services (ITS) offers roadmaps and enterprise architecture to facilitate understanding of technical services suitable for RDM needs. The main task of ITS is to guarantee the storage and computing resource either on its own or in collaboration with national computing centre. In addition, ITS coordinates the digitalisation project.

Policies

The Open Access (OA) policy was signed in 2014 with a rather mild formulation: Aalto University recommended OA publishing but did not demand it. It was only after the most influential international and national funders requiring OA publishing that researchers started considering opening their research results. The percentage of OA publications has steadily increased from 11.2% in 2014 to 30.8% in 2017 at Aalto University. In the national comparison, Aalto University is below average in the percentages of OA publications.

The data policy was signed in 2016 after a lively discussion in the university. What part of data is published, when, how data is curated, and in which repository the data is stored are strategic decisions of the principal investigator who takes into consideration agreements, commercial interests, policies and the law when making decisions. The main aim of the data policy is the optimal use and reuse of data. Societal impact can be reached by sharing data or commercialising it – or in the best case, doing both.

Aalto RDM and Open Science Programme, Services and Roles 2016 – 2020

After the data policy was published, there was a need for a concrete RDM action plan. Representatives from RIS, ITS and Learning Centre established a RDM working group in 2016 in order to carry out the planning and implementing of RDM activities.

The main objectives of the working group were the following: 1) Increase the visibility and impact of Aalto research, 2) Create a long-term vision for RDM activities, 3) Increase the RDM awareness, 4) Plan and implement RDM services and training, and 5) Follow RDM development worldwide and in Finland in order to bring the best RDM practices to Aalto researchers, and participate in national and international work in the area.

During the two first years of the activities (2016 – 2017), the following concrete tasks were agreed on:

1. Strengthen the open access publishing of research articles.

2. Promoting Data Management Planning Tool, DMPTuuli. Finnish HEIs implemented an electronic system for writing and sharing DMPs as a sub-project of the Open Science and Research initiative.

3. Metadata catalogue for Aalto's datasets: ACRIS was chosen as the metadata catalogue because publication metadata is already in ACRIS and research data is often linked to research publications. The metadata of data are transferred to the national metadata catalogue, Etsin.

4. Data publishing: Several domain-specific and general purpose (especially Zenodo) open repositories are recommended for opening and sharing data.

5. Comprehensive service for storage, back-up and collaboration: The solution includes Aalto-specific and national services. Aalto ITS focuses on designing services that are not covered by national and international services.

6. Combining openness and innovation: Aalto University has published Principles for Commercialization of Intellectual Property and Practical guide for intellectual property. The primary aim in commercialization of intellectual property is to maximize the societal impact through optimal utilization of results produced.

7. Awareness building activities that started with building an instructional RDM and open science website.

Data Agents

In 2017, we were struggling to find new ways of reaching researchers and informing them about RDM and open science. We followed the example of "innovation agents", that is, researchers who help their colleagues in departments to recognise commercialisation possibilities of their research, and decided to hire part-time support people for research data questions.

We started with 12 data agents in five schools out of six. Research services pays 10–50 % of the wages of the data agents. The main task of data agents is to offer practical help to their colleagues. At the start of the work, we did not define the area of responsibility of each data agent very strictly, because we hoped that data agents would find the suitable way of working in their environment. Some departments are very challenging, whereas in some departments, researchers need comprehensive RDM skills, and are thus much more receptive to RDM messages. The task of the data agents is to ensure that the research data are managed properly and it is, indeed, possible to open data. If the opening of data is not possible for some reason, the metadata of the data has be published in Aalto's metadata catalogue.

At the beginning of their work, data agents got acquainted with RDM and open science training material. Data agents started preparing the promotional material for their department or school. The training material was customized for their discipline. We focused on material that was easily distributable, i.e. short cheat sheets on open data and different aspects of RDM: storage, repositories, citations, persistent identifiers et cetera. In addition, data agents chose a RDM related project they were interested in, for example, training colleagues to use GitHub, evaluating open repositories, experimenting with different modes of promotional and training events.

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We heard examples of data support in some other European universities and wanted to find out if our data agent role was similar to the data support roles elsewhere. Higman (2018) conducted interviews in six European universities in order to find out how the research data support was organised in these universities. She concluded that there are three main data support roles. The role that requires the least amount of senior support is the role of a data champion. Champions are volunteers working in promoting better data management in their departments. The tasks of data champions vary, but they usually conduct training in RDM and related issues. Data champions are not paid wages but can be offered e.g. travel grants. University of Cambridge has currently over 50 data champions working in over 30 units of the university (Higman, 2018).

Another data support role is a data manager who dedicates their time for the data support efforts in a couple of chosen research projects and their data management needs. Data manager's work is financed either internally of by the external project funding. The focus is on providing practical data support rather than a cultural change (Higman, 2018).

The most comprehensive data professional role is a data advisor or data steward. They are employed as full-time data support personnel whose goals are to raise awareness of research data management and open science, and by doing that change the culture of the university. Data stewards provide discipline-specific knowledge in different units of the university. This role is typical when the senior management is committed to research data management and cultural change (Higman, 2018).

Aalto's data agents do not fit neatly in any of the Higman's roles, but share traits with the roles of data advisor and data champion. In the future, we hope to have more involved data agents in every school who could commit at least 50% of their working time for RDM activities. We are also considering recruiting a person for managing data in the most important projects.

Restructuring of the Learning Centre (Former Library)

At Aalto University, "library" as the name of an organisation unit disappeared in 2015, and was replaced with the name Learning Centre. As the name indicates, the focus of the activities was on serving the needs of students and lecturers, and providing a platform for Aalto-wide collaborative activities in the renovated building. Since the amount of printed material has decreased continuously, the Learning Centre was able to offer space for academic activities: individual or group work, spaces for conferences, workshops and art exhibitions, and maker spaces and studios with infrastructure.

In the beginning of 2018, the library activities were divided between four service units: Learning Services (LES) was the new home for those 25 professionals who were responsible for face-to-face services. Three experts moved to Leadership Services (LSS) and three to ITS. 25 professionals joined Research and Innovation Services (RIS) to work either in Library Resource team; taking care of books, journals and contracts with publishers, or Open Science and ACRIS (OSA) team to advise with publishing, open science, RDM, research information system ACRIS, and bibliometrics.

The reorganisation started with individual one-on-one discussions with the personnel of the Learning Centre in order to find out the expertise and wishes of each individual. The process continued with discussions with current supervisors. The goal of the reorganisation was not to cut personnel headcount but to organise the work better. The heads of new teams were recruited after their teams had been chosen, and the new organisation took effect in the beginning of 2018.

Even though reorganisation succeeded somewhat smoothly, there were challenges, too. Some of the personnel were not selected for the teams they had indicated as their first choice, and that caused dissatisfaction. In addition, outsiders, such as the Finnish Union of University Researchers and Teachers, commented that the reorganisation threatens the basic conditions of research and education. Furthermore, the fact that there was no "Director of Library" was said to hinder national collaboration.

The goal of the organisational change is to focus on customers and customer needs. The best solution from the point of view of researchers is to get the support as a fluent and integrated service process. Even though it is possible to achieve well-functioning processes when several services units offer parts of the service, it is easier when the same service unit offers the service. Previously, the silo thinking between service units, sub-optimisation of processes and inadequate flow of information lead to less than perfect solutions.

Open Science and ACRIS (OSA) team

At the creation of the new team, the main tasks of OSA team were specified as follows:

1. Validating and curating scientific and artistic research outcome in the research information management system, ACIRS.
2. Advising researchers in RDM and open science questions, and developing services for OA publishing, RDM and sharing data.
3. Maintaining and developing the publication platform, which is used for publishing Bachelor, Masters and Doctoral dissertations.
4. Carrying out publication analyses for the tenure track process.

Open Science and ACRIS (OSA) team continued with its former tasks on the publication platform and publication analyses, and took new and expanded responsibilities. Some of the old tasks were transferred to other units. The first six months after the reorganisation were busy in formulating the purpose of the team, and planning the collaboration with other Research and Innovation (RIS) Unit teams; pre-award, post-award, innovation and entrepreneurship and legal team.

The main activities of OSA team during the first year of its existence have consisted of internal training, organising the school teams, and collaboration in arranging training and events. I will next present these activities and speculate on what kind of activities might be successful in the future.

Internal training

We organised several internal training session within the team and with other RIS employees. The topics of training varied from legal and copyright issues, DMPs and commercialisation process. In addition, a data agent presented his research process in order to give practical examples of the issues that RDM advisor might face. We also learned how to validate dataset in the ACRIS-system.

In the future we might try "flipped classroom" in the weekly team meetings by asking the team members to familiarise themselves with a topic that is of interest to them and present the results to the rest of the team. In addition, we need to learn more about IT solutions and innovation activities in order to write better instructions with a

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holistic view instead of giving instructions in silos. There is also need to focus on the data management needs of Aalto's big infrastructures.

Those team members that are ambitious and interested in learning new things, thrive in the present environment. However, new demands and relatively hectic schedule are not for everybody. How to ensure the coping with workload is an issue that has to be addressed.

Organisation of school teams

Six members of the team were appointed as liaisons for the six schools. They have dual role in the school teams, on one hand, they are responsible for the validity of ACRIS information, including datasets, and on the other hand, they advise on RDM and open science questions with data agents and other RIS team members. The school liaison sits at the school's premises with the rest of the school team one to four days a week, and takes part in the regular internal meetings and meetings with researchers, research groups and research projects. In the future, the OSA team will hold the responsibility for advising on DMP for funding applications, and grant writers can concentrate on advising on grant application. Team members also help with the EU reporting when it comes to publications.

Since OSA team members now have the basic theoretical knowledge on RDM and open science, the best course of action is to start working on practical cases: strive to get to know the researchers, understand the research and research data of their school; take part in the start meetings of the research project; and comment on DMPs.

Collaboration and awareness building activities

The OSA team, other RIS employees and data agents have arranged bigger and smaller events at Aalto University during 2018. In the internal collaboration afternoon, the before mentioned groups got acquainted with each other, and started planning how to collaborate in their schools. The research methods, tools and data vary from school to school, and services have to be customised to a certain extent to fit the needs of different schools and departments.

A data day was organised on May 25th to celebrate the beginning of GDPR. It was aimed at Aalto University's researchers. Circa 80 participants attended workshops and talks. Some data agents have arranged weekly meeting in their department, and some have tried to attract researcher to short info session with coffee and cookies. We have also experimented with open science roadshows in a couple of schools. We advertise the roadshow in advance, and bring presentations and open science and RDM material to the departments. The success of these events have varied, in some schools we have not been able to reach researchers, whereas in other schools several researchers have attended the roadshow.

In the future, we must integrate our efforts better with the events arranged by departments and schools. For example, if a department arranges an event focusing on research, we want to be there. The most important thing is that we get an unambiguous support from the department heads for our RDM and open science work.

Discussion

When the data policy was published in 2016, the discussion centred around opening and sharing data, and caused objections, especially from researchers who collaborate with

industry and rely on the data of their corporate partners. Researchers emphasised confidentiality and legal issues as barriers to sharing data. Thus, when communicating we now emphasise managing data instead of opening data aspect of open science.

Good quality data is essential for high-class research – it is the greatest asset of research. We talk about "real DMPs" instead of only talking about "funders' DMPs" (those DMPs that are required by funders). We emphasise the need for data planning for all research groups and departments, not only for those projects whose PI applies for external funding, since they are the minority of the researchers. Akers (2014) found out in University of Michigan that only 17% of academic staff were involved in funding applications and needed to fill the official DMP.

During 2019, we focus on reaching more researchers by offering training and workshops. In addition, we repeat the survey we conducted in 2017 on the state of awareness among researchers. The main aim is to get an understanding on the amount and type of data that are collected and analysed at the university.

We also turned to the examples of other Finnish universities when considering what to do differently. We have, after all, the same national infrastructure at our disposal. The three biggest universities in Finland, University of Helsinki (HY), Tampere University (Tampere3) (a merger between University of Tampere, Tampere University of Technology and Tampere University of Applied Sciences starting its activities in the beginning of 2019), and Aalto University all have slightly different approaches to RDM. At HY, the library is a strong actor in RDM activities, but several other units are also involved in supporting research. A support e-mail acts as the first contact point for any issues on data. The DMP advising is a well organised process that is supported with DMPTuuli.

Even though Tampere University has not yet started its activities, Tampere3 has already a data policy at place. One of the merging universities, University of Tampere has an interesting data support role; a data management specialist in health sciences. The person in this role has a PhD in computer sciences and his tasks are to promote the use of longitudinal data and national registers and the utilization of digital tools in research, and open science. He also supports research projects in their data management at all stages of the research and develops the data collection and management policies in the faculty. This role is close to research advisor/steward role in Higman's (2018) categorisation. In addition, it includes tasks for data manager. The strengths of this role is the close collaboration with researchers and discipline-specific specialisation.

Conclusion

The Finnish way of developing open science is working together in nation-wide initiatives. Finland is a relatively small country where we rely more on collaboration than competition. The Open Science and Research Initiative succeeded in bringing university personnel interested in RDM together. Now we are reaping benefits of experts representing different universities knowing each other based on the earlier collaboration. In my mind, even though RDM and open science services are important they do not constitute the competitive advantage of any university, but form a part of the research support services portfolio. That is why a nationwide collaboration makes sense.

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