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Developing Open RDI and Education in Finnish Universities of Applied Sciences

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ABSTRACT

Open Science (OS) and Research has reached mixed maturity levels in Finland. The meaning of the national project in the ecosystem of Finnish universities of applied sciences (UAS) is to enhance and elaborate OS and Open Education (OE) activities. Future actions were defined based on a survey and interviews carried out in the Finnish UAS sector during 2018 and 2019. The aim of both data collections was to evaluate the current status and attitudes towards open Research, Development, and Innovation (RDI) among staff members. Another purpose was to define the need for internal support services concerning open RDI and OE and to identify knowledge gaps. The results revealed several gaps in understanding OS and OE initiatives. Real-life actions were mostly vague, and the respondents experienced the need for support. On the other hand, the attitudes towards open RDI were positive, and the issue aroused questions and reflections. This study revealed gaps in knowledge and actions in Finnish UAS sectors. These results have been the basis of development actions such as joint workshops, educational webinars, and common instructions. The future plan includes the establishment of an experts' network for supporting open RDI and Education.

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1. INTRODUCTION

According to recent evaluations, Open Science (OS) has reached mixed maturity levels in the universities of applied sciences (UAS) in Finland. As a novel development in the Finnish context, Open Education (OE) is also defined as part of OS in the higher education sector, albeit it has not been formally evaluated. A nationwide development project called "Open Research, Development and Innovation work, open learning, and the innovation ecosystem of Finnish UAS" is currently in place to support open Research, Development, and Innovation (RDI) and OE [1].

Finnish universities, together with the research community, created a national Declaration for OS and Research 2020–2025. This declaration defines a vision describing how OS should be part of researchers' and scientists' work. In this declaration, the goals are defined for research culture, open access to research publications, open access to research data and methods, as well as OE and educational resources [2].

In Finnish UAS, open RDI refers to an operational and cultural practice where research methods and data, results, and publications produced by RDI projects are as open as possible [3]. The aim of open RDI in the UAS sector is to enhance and support its quality, visibility, and effectiveness. This approach promotes cooperation and heightens co-creation in addition to producing new knowledge and innovations in the interaction between the UAS field and society [3].

OE is an expanding concept, and since 2000, openness of education has increased rapidly. At the moment in Finland, the development of Open Educational Resources (OER) is supported by the Ministry of Education and Culture by creating the Library of Open Educational Resources (aoe.fi) [4]. As Li Yuan and Stephen Powell point out in their white paper, OE has potential in ensuring access to education for all, and Higher Education Institutions (HEIs) also need to develop new ways to deliver that education [5].

Future actions to further promote open RDI and Education in the Finnish UAS sector will be partly defined based on a survey and interviews carried out during 2018 and 2019. This article discusses the methods, results, and possible implications of these studies. The aim of both studies was to evaluate the current status and attitudes towards open RDI among the staff members of UAS. In addition, their purpose was to define the need for internal services that support open RDI and OE and to identify knowledge gaps within the selected universities involved in the questionnaire.

2. METHODS

Two methods were selected for the data collection targeting staff members of Finnish UAS: 1) an online survey and 2) qualitative interviews. The survey was designed according to the general principles of the development project, while the interview themes were defined in reference to some previous survey results via a co-creation process among topic specialists. The survey was open for all UAS, while the interviews were conducted in selected institutions. Both studies were conducted in Finnish, and the results being reported in this article are translations.

Online survey questions covered the perceived knowledge, practices, and attitudes towards open RDI, also enabling the collation of any additional insights relating to the topic. The survey was targeted at lecturers, managers, experts, and other staff members working in the Finnish UAS sector, with special emphasis on staff working actively in RDI. A total of 275 responses from 21 (out of 23) UAS in Finland were received, the response rate per institution varying from 2 to 54 (Md13). Anonymity was ensured at every step (data collection, analysis) prior to the dissemination of results.

In the survey design, we included both multiple-choice and 5-point Likert scale questions, out of which 16 Likert scale questions are covered by the article. As mentioned above, these 16 Likert scale questions address knowledge, practices, and attitude towards open RDI activities. In addition to the quantitative approach, we received a total of 355 responses to the following four open-ended questions included in the study:

- Tell about good practices in open RDI. (87 responses)
- How might students better connect to open RDI actions or utilize its results? (114 responses)
- How to enhance the openness of the various parties involved in RDI? (91 responses)
- Other comments and feedback from the questionnaire. (63 responses)

The qualitative analysis of the survey's open-ended questions was done using a Gioia-type method [6, 7] and Atlas.ti software [8].

The target groups for the interview study were RDI personnel (*n*=31), teachers (*n*=23), and other staff members active in RDI, including support services such as libraries, IT services, and project administration (*n*=23) (total *n*=77). The research data were collected from nine different universities of applied sciences through focus group and individual interviews between April and September 2019. The number of interviewees ranged from 5 to 15 people at the organizations participating in the study.

The interviews were based on a thematic frame that allowed questions to extend and broaden the initial answers. Interviews usually lasted about an hour. Not all interviewees responded to every section of the theme frame. The reason was either that they had no connection with the issue-at-hand, or the interviewer had not asked the question for some other contextual reason.

The interviews were recorded and later transcribed by the interviewers. The transcribed material was anonymized and combined for quantitative and qualitative analysis into a single textual material. No individual respondents or UAS can be identified from the final combined data. The research data of both data sets will be stored in a data repository and opened to further use under Creative Commons licenses.

3. RESULTS

3.1 Survey

The vast majority of the disciplines in the Finnish UAS sector were represented in the online survey, and the distribution of the respondents among these disciplines was relatively even (Figure 1). Of the respondents, 62% spend most of their working time on RDI-related tasks. The central results of the online survey Likert-scale questions are presented in Table 1.
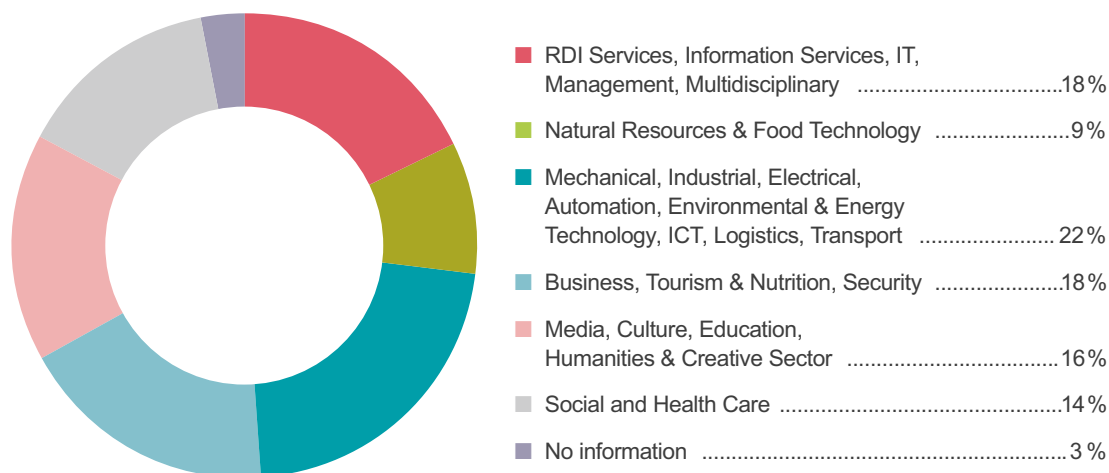

Figure 1. Distribution of online survey respondents.

- ■ RDI Services, Information Services, IT, Management, Multidisciplinary 18%
- ■ Natural Resources & Food Technology 9%
- ■ Mechanical, Industrial, Electrical, Automation, Environmental & Energy Technology, ICT, Logistics, Transport 22%
- ■ Business, Tourism & Nutrition, Security 18%
- ■ Media, Culture, Education, Humanities & Creative Sector 16%
- ■ Social and Health Care 14%
- ■ No information 3%

According to the results, the respondents generally have a positive attitude towards open RDI activities. Three quarters slightly or fully agreed with the statement that an open presentation of a project idea is useful for project planning (Q5). Well over half (66.6%) of the respondents slightly or fully agreed with the principle of opening their RDI data (Q19). Only 21.4% were slightly or fully reluctant to share their results for free (Q20). Similarly, 61.8% of the respondents slightly or fully agreed that they aim to make publications out of the same content for different publication formats (Q12). Furthermore, 57.8% of the respondents slightly or fully agreed that publishing related to RDI activities is important, even if the publications would not reach a large or desired audience (Q18).

Considering the skills and knowledge of the respondents, 67.6% slightly or fully agreed that they understand what the open RDI concept means (Q1). The principles of open publishing were known or somewhat known to more than half of the respondents (Q2). More than half of the respondents agreed or slightly agreed that they know how to use open data in research (Q4). However, comprehension of the related concepts of the data management plan (Q3) and research infrastructure open access policies (Q6) was remarkably lower, with only about one in three respondents slightly or fully agreeing with the statements that they comprehend the respective concepts. Less than half of respondents slightly or fully considered that they possess the necessary skills to carry out open RDI activities (Q7).

Table 1. Distribution of the Likert scale responses (*N*=275) in the online survey.

	Topic	Total N	Fully disagree %	Slightly disagree %	Not disagree or agree %	Slightly agree %	Fully agree %
(Q1) I know what open RDI means.	Knowledge	275	5.5	14.2	12.7	42.9	24.7
(Q2) I am familiar with the principles of open publishing.	Knowledge	275	5.5	19.3	20.0	34.5	20.7
(Q3) I understand the idea of a data management plan.	Knowledge	275	16.4	25.1	24.0	23.3	11.3
(Q4) I understand how open data can be utilized in research.	Knowledge	275	6.2	17.8	18.5	37.8	19.6
(Q5) I find that an open presentation of a project idea promotes project planning.	Attitude	275	0.7	5.1	18.2	37.1	38.9
(Q6) I am aware of what the open access policy for RDI environments means.	Knowledge	275	16.4	30.2	26.2	20.4	6.9
(Q7) I consider that I have the necessary skills to implement open RDI activities.	Knowledge	275	7.3	18.9	27.6	34.5	11.6
(Q8) I receive support from my organization to promote and conduct openness in RDI activities if I need it.	Practices	275	8.4	22.5	18.2	28.7	22.2
(Q9) I have included external stakeholders in creating a project plan and included their ideas in it.	Practices	275	9.1	6.2	17.1	30.2	37.5
(Q10) I've made or been involved in making a management plan for the RDI project's research data.	Practices	275	34.5	21.1	17.8	15.3	11.3
(Q12) When publishing RDI results, I try to make publications out of the same content to many publications of different levels (e.g., scientific publications, professional publications, popular publications, and blogs).	Attitude	275	5.5	12.0	20.7	30.9	30.9
(Q13) When planning or implementing RDI work, I can easily find out what other RDI projects or key actions have been done in Finland in the past on the same topic.	Practices	275	16.4	38.5	22.9	20.0	2.2
(Q15) In my view, the ownership and utilization of inventions and/or other intangible capital in RDI projects have been agreed so clearly and comprehensively from the outset that the ambiguity associated with them does not prevent transparency in the reporting and publication of results.	Practices	275	8.7	23.6	38.5	24.0	5.1
(Q18) Publishing on RDI activities and its results is important, even if the publications would not reach many readers or the desired recipients.	Attitude	275	7.6	17.8	16.7	32.0	25.8
(Q19) I would be willing to open the research material/data created in my RDI activities for others to utilize, using some open license (e.g., Creative Commons).	Attitude	275	2.2	5.8	25.5	33.1	33.5
(Q20) I do not want to share all the information I have generated in RDI projects for free because it can be valuable to me.	Attitude	275	26.5	27.3	24.7	15.6	5.8

Regarding open RDI practices, half of the respondents agreed or slightly agreed that they can receive support in open RDI activities from their organization if needed. About one-third agreed or slightly agreed that the ownership, use of inventions, etc., in RDI projects are initially agreed upon in a clear and comprehensive manner (Q15). Only 26.6% slightly or fully agreed that they had been involved in making a management plan for the RDI project's research data (Q10). Finally, only 22.2% of the respondents slightly or fully agreed that when planning or implementing RDI work, they can easily find out what other RDI projects or key actions have been done in Finland in the past on the same topic (Q13).

In the open-ended responses, only 71 of all the responses touched on the actual topic of openness in RDI. Students' participation generated the most responses (114), indicating the importance of enhancing the connection between RDI and students' activities and needs. The respondents hoped that the management would set a common goal with better integration of RDI with teaching and learning. Many respondents felt that open RDI is promoted in public speeches, but little resources or actual managerial processes are provided. Some respondents held the view that openness in RDI requires them to divulge all ideas openly and share any intermediate results freely—such misunderstanding resulted in their unwillingness to promote open RDI. Other comments discussed a variety of other topics such as inefficiency of RDI, lack of trust between RDI operators, lack of resources within the organization, and defects in the RDI financing rules and practices.

3.2 Interviews

The interview study uncovered more detailed information on attitudes and the knowledge gaps towards open RDI practices in Finnish UAS. The knowledge gaps were defined by looking at responses given by the interviewees and picking the proportion of those interviewed who were not aware of a particular theme—the higher the percentage value, the greater the knowledge gap. The key results of the interviews are described in the following sections. The results are grouped according to the basic phases of the open RDI process: planning, implementation, termination, and reporting.

3.2.1 Planning an RDI Project

In relation to the planning of an RDI project, six different themes were raised in the interviews (Figure 2). About a third of the respondents (n=68) knew what was meant by data management, while the rest identified the concept only superficially or not at all. The data management planning tool (DMPTuuli) available nationally for research institutions was typically unfamiliar, as less than a quarter of those interviewed identified the tool, and only a few had used it. The respondents identified several challenges relating to the drawing up of a data management plan: lack of time, lack of guidelines, challenges regarding ethical questions, and a culture of activity that did not encourage investment in data, among others. However, the interviews also uncovered the fact that a lack of data management design at the planning stage may lead to challenges in the material collection phase (a 66% knowledge gap in data management).
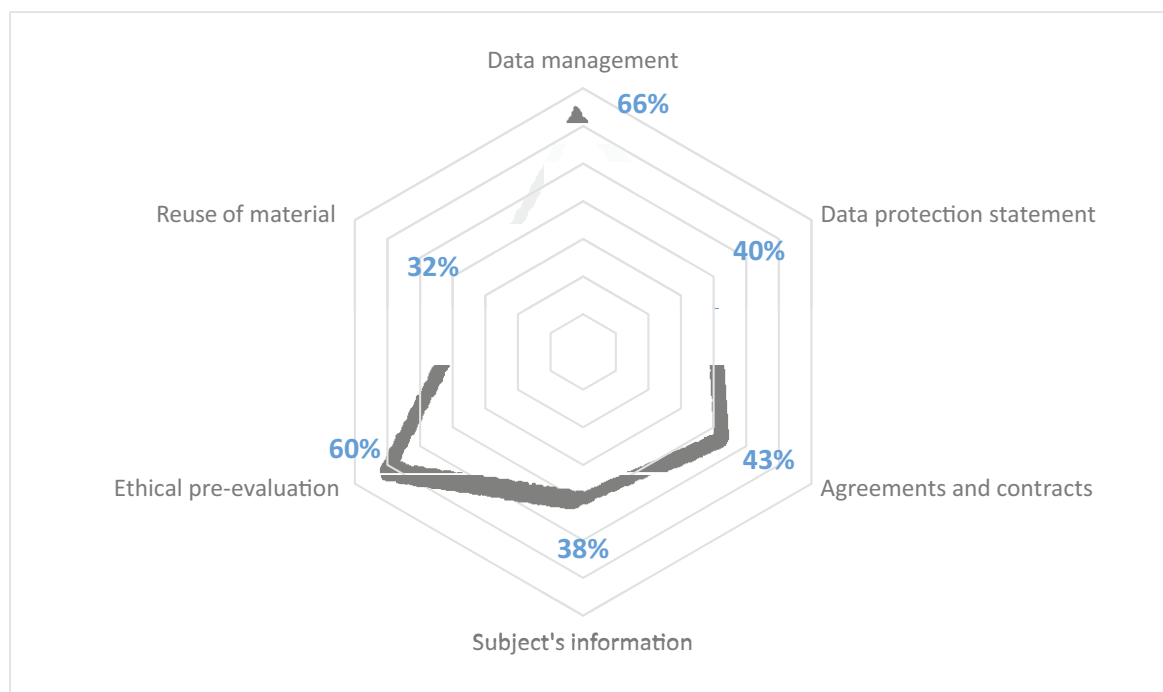
Figure 2. Knowledge gaps in planning an RDI project.

More than half of the respondents (*n*=68) expressed knowing what the data protection statement was or had some understanding of the matter. However, not everyone could specify when a data protection statement should be utilized. On the other hand, some of those interviewed had produced such statements. In addition, some of the interviewees had asked for help from the university's data protection officer because they did not know enough about the topic themselves (40% knowledge gap in the data protection statement).

Little more than half of the respondents (*n*=65) knew, at least on some level, what kind of agreements and contracts should be taken into account by their own institution when planning an RDI project. However, they did not have more specific information on how the opening of the materials and results should be integrated into the process. It was also revealed that the respondents typically did not know how to open data and other results (43% knowledge gap in agreements and contracts).

Of the respondents (*n*=69), almost two-thirds knew well or at least in some way how and when research subjects should be informed. However, most respondents did mention that the subject's information was a matter of good scientific practice. The need to look at the issue consistently in RDI projects was raised, as was the need for common guidance at their institution (38% knowledge gap in subject's information).

More than half of the respondents (*n*=67) did not know when an ethical pre-evaluation should be done. Some of the respondents, however, knew the matter quite well. In general, respondents broadly discussed ethics and its importance in research (60% knowledge gap in ethical pre-evaluation).

Although only a third of the respondents (*n*=65) had reused previously collected and open research material themselves, another third of the respondents thought they knew how to seek and find it, if required. However, knowledge of existing open research data and their use was still low among the respondents. It was revealed in the interviews that the concept of open research material was still unknown and that the concept was often confused with open access publishing (32% knowledge gap in the reuse of material).

3.2.2 Implementation of an RDI Project

Three different themes were highlighted in relation to the implementation of an RDI project (Figure 3). Regarding collecting and storing the material, the interviewees were asked about their understanding of data storage at their institution. Of the respondents (*n*=69), about a quarter did not have specific information regarding how storing was or should be done. The general perception based on the responses is that archiving practices varied and depended on the researcher as well as on the project. Storing practices typically varied a lot, everyone having their own way of handling it. In addition, it became clear that researchers often kept data sets on their own computers or flash drives. Some ideas on how to store data were presented by the respondents, emphasizing the role of the home organization. The UAS should provide and instruct the location where to store data securely and also indicate the location in which forms and documents containing sensitive information should be saved (25% knowledge gap in storing the data).
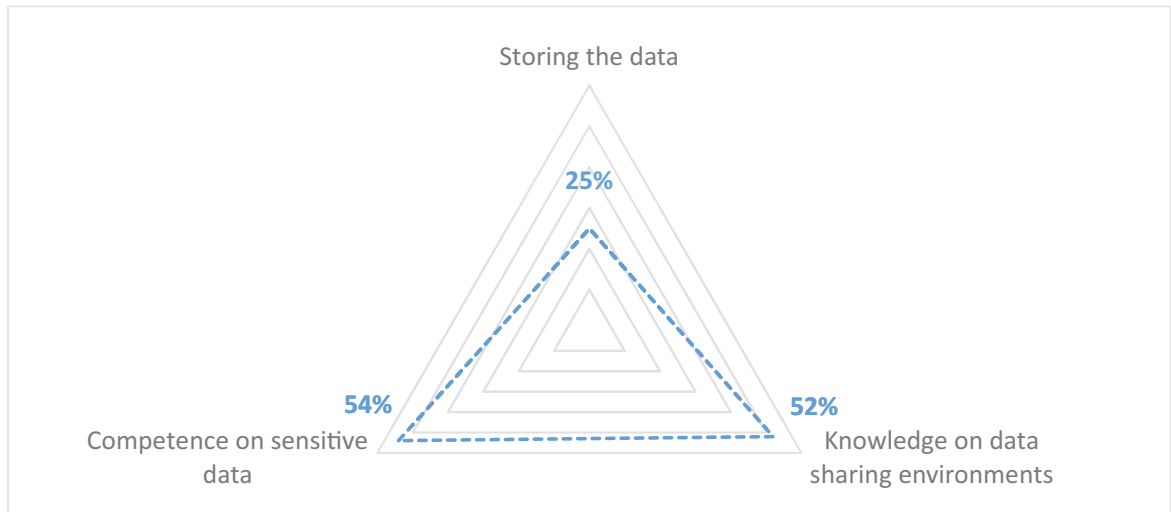

Figure 3. Knowledge gaps in implementing an RDI project.

Data sharing practices were explored by asking the interviewees where the analysis typically took place when multiple users were involved. Of all the respondents (*n*=56), only a small percentage had analyzed data sets with others, but nearly half (48%) of those interviewed knew environments where data sharing could be done safely. The actual usability of the several different locations and possibilities presented by the interviewees (the university's own servers, different cloud services) could only be judged by the nature of the data they were managing at a given time (knowledge gap in knowledge on data sharing environments 52%).

Based on the answers, there was little competence regarding data protection and sensitive data, with 54% of the respondents (*n*=71) not knowing how to answer the question relating to the topic (knowledge gap in competence on sensitive data 54%).

3.2.3 Terminating and Reporting an RDI Project

Seven different themes were explored in relation to terminating and reporting an RDI project (Figure 4). Of those interviewed (*n*=61), little more than half (56%) had considered matters relating to the preservation and discoverability of the material. The discussions typically revolved around publications and other outputs. Very little was known about the preservation of the research materials and the data. The materials were kept in different places, but there were few clear practices on the organizational level (knowledge gap in knowledge about data preservation 44%).

Around half (49%) of the interviewees (*n*=55) were relatively well informed of what metadata means. On the other hand, access rights were obscure for almost everyone. There were different practices and certain knowledge, but even more ambiguity, conjecture, and sometimes false perceptions. However, many interviewees were able to describe the essentials regarding both metadata and access rights. There were also those who did not wish to make guesses relating to the concepts as well as those who knew both concepts very well (knowledge gap in metadata 49%; knowledge gap in access rights 57%).

In terms of opening and preserving results as well as assessing the need for preservation, the analysis of the answers had to be based on interpretation—more heavily than usual—of what the respondent meant by their answer. However, the main portion (51%) of those interviewed (*n*=55) had no idea about who would be responsible for opening the results, and about 62% of respondents (*n*=53) had no knowledge about who should evaluate the need for preservation in detail. The diversity of responses gave an indication that things were not clearly agreed upon, or at least that the information had not reached all actors (knowledge gap in responsibility for opening the results 51%; knowledge gap in consideration of the need for preservation 61%).

The majority (72%) of respondents (*n*=57) knew about the various possibilities of publishing quite well and were also encouraged to publish. In some UAS, additional incentives were even used to increase the publication rate. Respondents were familiar with various publishing channels, including open ones. However, not everyone knew enough about the possibilities of publishing, particularly about open access publishing. Support for publishing varied by organization (28% knowledge gap in publishing).

By their own account, a surprisingly high portion (73%) of respondents (*n*= 64) was able to anonymize research data. However, some of those interviewed had no need for that competence. It is also possible that at least a few of those interviewed did not have to handle qualitative data, the anonymization of which was significantly harder than was the case with quantitative data. Getting help from their own university was sought from different parties, and the supporting unit that could aid in the matter varied from university to university (27% knowledge gap in anonymization).
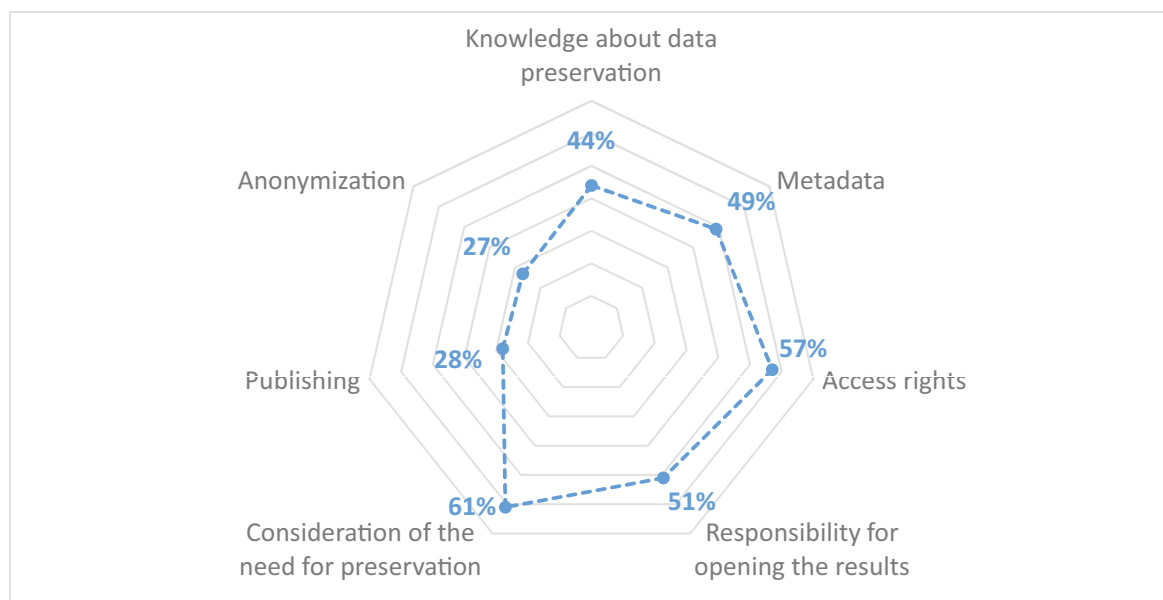
Figure 4. Knowledge gaps in termination and reporting an RDI project.

4. CONCLUSIONS

The online survey results support understanding of the current state-of-the-art in expertise, practices, and points of view on open RDI among the experts in Finnish UAS. The interview and survey studies both support that UAS lecturers, managers, experts, and staff members working in RDI activities generally express a positive attitude towards and motivation in conducting open RDI. However, our survey study indicates that the results of RDI activities are not considered easily accessible by many and that some concepts central to the issues in openness are not fully understood or implemented as part of RDI activities. Further, this result gains support in the interview data: a third of the survey respondents knew the idea of a data management plan. This notion is in line with the interview results, as well. The survey results suggest that the possible ambiguity related to the ownership of the results might hinder openness in RDI, as well as the lack of experience in issues such as data management planning. Thus, conditions for improving the availability of RDI results should be further promoted.

Also, the interview results show a lack of competence among UAS on open RDI practices. The main challenges were particularly related to the planning of an RDI project. For example, there was little competence in the design of a data management plan as well as an ethical review. The data management tool (DMPTuuli) was at the time of the interviews still quite unknown, even though the tool had been developed together with the UAS researchers and some universities had adapted it to their own planning processes. However, it is worth noting that not only the ability to generate a data management plan is needed, but also the skills and resources to implement data management in reality. In future research, it

could be addressed how well the data management plans correspond to the actual practices. Indeed, the interviewees were more well–informed about the implementation practices of the RCI project. Regarding the terminating and reporting of the RDI project, respondents were poorly familiar with the preservation and opening of the research data and access rights of the results.

The same can be said of enhancing the interplay between RDI and pedagogical approaches to UAS education. As long as teaching and RDI are separate functions pursuing their own distinctive goals, there remains a tension between their representatives which cannot be reconciled purely by adding to the current pool of know-how about the OS. Open approaches, however, as a point of view and a starting point for developing UAS activities as a whole, can have a positive effect on the integration of RDI work and student activities. Advancing an open operational culture in general is naturally an ever-present target, but also more specific goals can be uncovered based on the results of the studies.

Based on these results, the RDI activities need to be developed so that the data collected and used will meet the FAIR principles better. Opening RDI results like inventions, products, and educational materials should be supported by the organizations, which means agreeing on the open platform and licensing protocols. All of these improvements would also promote the natural integration of RDI and education as a whole because they also enable heightened participation in RDI activities for students. Open publishing of RDI results seems to be well-supported and agreed on in the UAS sector. When instructions are drawn up clearly, structures and operations are organized properly, and the staff is educated and given proper resources and tools to work with, open RDI would prevail in the Finnish UAS sector.

The results of these two studies paralleled the survey across Europe 2017 among researchers, where open access publishing was also relatively well-known, but a general lack of awareness of OS practices was reported [9].

Based on these results, the Finnish UAS sector aims to respond to the development needs shown already in the national openness report 2019 [10]. An adequate understanding of the role and practices of open RDI and Education needs to be ensured. This study revealed the gaps in knowledge and actions in the Finnish UAS sector, and these results have been the basis of development actions such as joint workshops of data management, educational webinars in licensing, common instructions in GDPR, and research ethics. The future plan also includes the establishment of an experts' network for supporting Open EDI and Education.

AUTHOR CONTRIBUTIONS

A. Kärki (anne.karki@samk.fi) is the corresponding author and was responsible for building the framework of the article. S. Päällysaho (seliina.paallysaho@seamk.fi) participated in gathering and analyzing the data and contributed to the writing and revising of the manuscript. K. Jaalama (kaisa.jaalama@aalto.fi) was responsible for the coordination and management of the online survey and the investigation of the Likert-scale questions. J. Talvela (juhani.talvela@aalto.fi) analyzed the qualitative, open-ended questions from the

survey results and produced a qualitative insight into the views, opinions, and considerations of the UAS respondents towards open RDI. A. Lehto (anttoni.lehto@turkuamk.fi) added to the interpretation of the results and the overall logic of the article. H. Hyyppä (hannu.hyyppa@aalto.fi) supervised the design and implementation of the online survey. All authors contributed to the manuscript writing and reviewed the final version of the article.

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