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Key Aspects of Open Data in Finnish RDI Cooperation between Higher Education and Businesses

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ABSTRACT

The article highlights aspects that should be considered during an open Research, Development, and Innovation (RDI) process cycle to improve the utilization of research data and foster open cooperation between higher education and businesses. The viewpoint here is in publicly funded joint research projects of the universities of applied sciences (UAS), the concept is, however, applicable in other higher education and research organizations as well. There are various challenges related to research data management in general as well as to the openness and reuse of data and results. The findings of this article are based on the results of a two-day expert workshop, and these results are interlinked with five phases of an open RDI process cycle: planning, implementation, documentation, sharing, and commercialization. Various drivers and barriers can be identified in different stages of the process. On a general level, special attention must be paid to critical factors such as ownership and sharing of data and results, confidential information and business secrets as well as following the requirements of the Open Science (OS) policies of the participating organizations and funders. This article also highlights several best practices that should be considered in each phase of an open RDI process cycle with businesses.

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1. INTRODUCTION

In this article, the opportunities and challenges of an open operating culture are discussed in the context of how Higher Education Institutions (HEIs) and businesses can utilize an open Research, Development, and Innovation (RDI) models in cooperation projects. More specifically, the article introduces key issues relating to research data management in cases where HEIs and businesses produce research data in publicly funded joint projects. The purpose of the article is to highlight the aspects that should be considered in each phase of an open RDI process cycle to improve the dissemination and reuse of such research data in the future. The use of these open RDI models needs to take into account the Open Science (OS) and research policies of the university as well as the requirements and restrictions of the funders and project partners.

RDI activities in HEIs are central to the growth of the economy [1]. Finland currently has 24 universities of applied sciences (UAS). RDI work is one of their mandated tasks. Actually, UAS are the only Finnish institutions that have been issued a statutory task in innovation activities, and they play an important role in the Finnish innovation and learning ecosystems [2–4].

The mission of the RDI work is to enhance the operations of businesses and public organizations, with a special focus on regional development. Thus, RDI activities are tightly linked especially with small and medium-sized enterprises (SMEs) as well as public and third-sector organizations, generating practice-oriented knowledge and competence for the region and beyond. The RDI activities of a UAS should meet the needs of these actors by aiming to find solutions and produce information that is directly usable. This means developing new methods, products, services, applications, and tools. The work is based on close interaction with various partners, complementing their knowledge by sharing their external insights and expertise. Therefore, there is an increasing need for more systematic and open interaction between higher education and businesses to enable successful cooperation [5].

As D'Este and Perkmann [6] described the interaction between academia and industry, the main forms of collaboration are joint research, contract research, and consulting projects. In addition, in the UAS sector, a typical cooperation form is the student project, which usually arises from various challenges in a firm or organization.

The Ministry of Education and Cultures steers the activities of HEIs and acts as their main financial source in Finland. Funding for the UAS is allocated based on their performance, measured with both education and RDI indicators. In addition, UAS receive financing from external sources, especially for their RDI activities, which account for about 60% of EU funding [7].

The main focus in this article is on the joint research, which refers here to formal RDI-based business collaboration and is mainly externally funded by public funders, e.g., EU funds, ministries, and communities. Typically, there can be multiple businesses and higher education partners in a joint research project, producing a large amount of research results and data. The viewpoint here is on applied research in Finnish UAS, but the concept of the open RDI process cycle can also be applied in other higher education and research organizations.

2. OPEN OPERATIONAL CULTURE IN THE FINNISH CONTEXT

The culture of academia is becoming more transparent [8]. Also, in the Finnish UAS system, it is easy to see an ongoing transformation into more open working methods, especially in RDI projects. Indeed, the well-known guideline—“as open as possible, as closed as necessary”—is gradually becoming a reality.

Open RDI refers to an operational and cultural mode where research methods, processes and data, results, and publications generated by RDI projects are transparently available and exploitable as widely as possible [9]. The objective of open RDI is to increase the quality, visibility, and effectiveness of research projects. Open policies promote cooperation, thereby intensifying co-creation and generating new knowledge and innovations in the interplay of UAS and industry.

The mechanisms that transform research results into economically effective practical applications have not yet been widely and thoroughly investigated [10, 11]. The trend of increasing cooperation between industry and universities, however, is intensifying on two different fronts because of the growing need for new innovations in the field of business and the increasing steering efforts from policymakers to maximize the commercialization of research results [12]. At the same time, OS policies and practices give rise to uncertainty when striking an optimal balance between openness and ownership [13].

Open operational culture has been developed systematically in Finnish higher education and research institutions for several years. An important factor behind this development is the OS and Research Roadmap [14], published in 2014 by the Ministry of Education and Culture, which encourages academia to promote both openness and the FAIR principles of findability, accessibility, interoperability, and reusability. Since then, the related progress and overall maturity of open operational culture at universities have been evaluated three times [15–17]. According to the evaluations, the higher education and research institutions—especially the UAS—have managed to significantly improve their performance in operating culture during these years.

3. METHODS

The findings of this article are based on the results of a two-day expert workshop. There were 15 RDI experts from the Finnish UAS sector participating in the workshop. The expertise of the participants was related to business cooperation, project management, and information services, including data management and open publishing. The aim of the workshop was to have an open dialog and gather viewpoints and experiences related to open RDI activities with businesses: what kind of challenges have already been faced and what aspects should be taken into account in the future. The aim was also to find out the best practices that could be shared and further developed in open collaboration. The method of the workshop was based on the action research process, which contains the following stages: planning phase, selecting issues, collecting data, and analyzing results [18].

The workshop was divided into three phases. During the first session, all participants discussed in small groups what kind of data management challenges and issues have arisen in their own business cooperation projects. All relevant experiences, questions, and observations were then gathered and classified according to the five phases (planning, implementation, documentation, sharing and commercialization) of the open RDI process model [19]. As the result for the first day, five full flip chart sheets of issues, themes, and problems related to the data management of joint university–business RDI projects were completed.

In the next day's session, the work was continued to deepen the understanding of the open business cooperation based on the findings of the first session. The participants elaborated on the earlier viewpoints in small groups regarding each of the phases of the RDI process cycle, contributing to them one by one. The facilitator of each phase summed up the key results of their own part of the cycle. At the end of the workshop, there was a final vote in which each participant was allowed to select the three most important findings for each phase of the cycle. Based on the results, a list of key challenges and best practices in the university–business cooperation projects was formulated as discussed below.

4. RESULTS

The expert workshop raised several aspects that need to be considered to improve the dissemination and reuse of research data. The main findings of the workshop are presented in the next sections according to the five phases of the open RDI process model. In each phase, there are various factors that support or prevent open cooperation. Figure 1 presents the most important drivers (green) and barriers (red) in the open cooperation process between HEIs and businesses.

4.1 Planning of an Open RDI Project

An agile collaboration related to data management should begin at the start of a project. According to the results of the action research process, it is crucial to agree with business partners on the policies of the project, the course of actions, and the open operation models as early as possible in the RDI project planning process. It is useful to discuss and agree on the use and the ownership of the background data and materials to enable the appropriate level of openness of the final outputs. The best way to reduce the emergence of complex problems is to foresee the risks. It seems that at first, businesses may be suspicious of transparent operation models, and it might take some time to appreciate the benefits openness might bring. However, some business organizations are immediately interested in openness and transparency and see the potential and new possibilities with it.

A data management plan (DMP) is an important tool for the planning phase of an open RDI project. Although it may sometimes be seen as a bureaucratic necessity, a well-functioning DMP is at best a living document of comprehensive practical relevance. DMPs facilitate the management of the entire life cycle of the project and help to specify many key issues such as preservation, sharing, ownership, access rights, transparency, and liabilities.

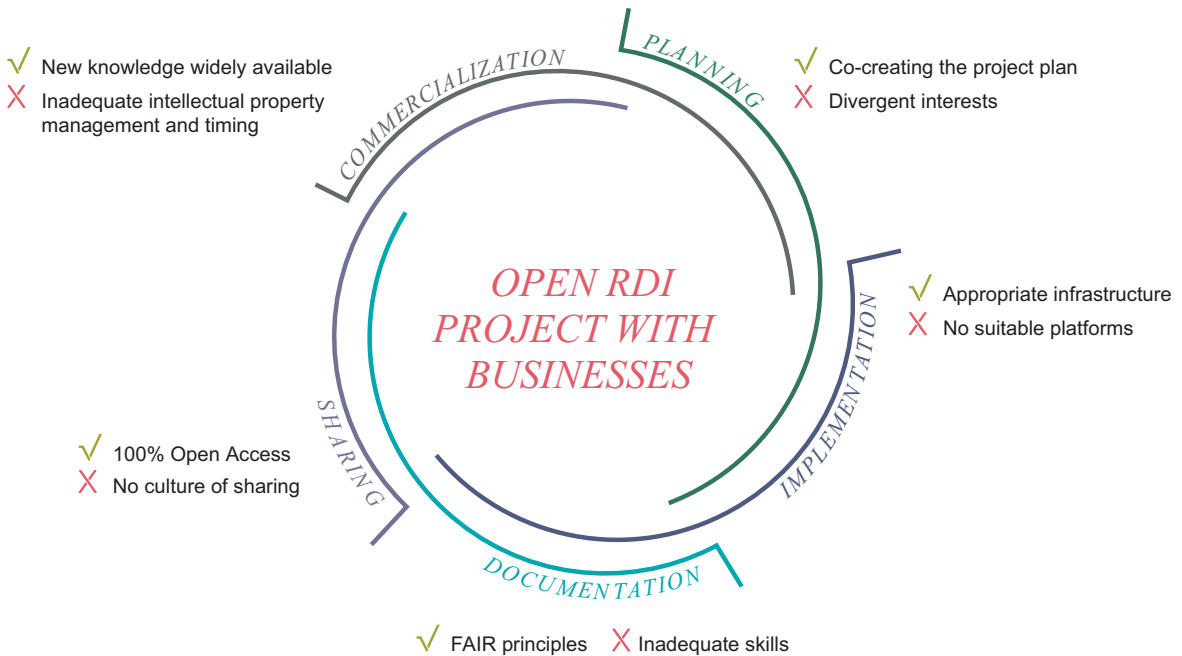


Figure 1. The most important drivers and barriers to open RDI cooperation between HEIs and businesses.

The plan needs to be drafted and implemented in cooperation with all involved parties, starting from the planning phase of an open RDI project and should be regularly updated to keep the key data management aspects in mind throughout the project. However, a DMP should always be considered a tool to be used only on the level of detail and as extensively as required by the project.

4.2 Implementation of an Open RDI Project

The expert workshop participants emphasized that during the implementation phase, it is good to accurately select the software, file formats, and platforms to be jointly used. It is worth paying attention to the fact that the business partners do not necessarily have the same software as universities, which may cause challenges and extra expenses. Also, not all higher education software or device licenses are available for commercial exploitation. It is also recommended to use research tools whose metadata complies with the standards of the field in question. Only in that way are data sets easily transferable from one service provider to another.

It was also concluded that a well-adapted infrastructure is needed for a successful open RDI project. It is good to critically analyze the platforms where the research data are stored. Commercial cloud services are easily accessible storage locations for businesses, but their data security is not always adequate. If the data contain business secrets or other kinds of confidential information, more secure storage should be considered.

4.3 Documentation of the Results of an Open RDI Project

The workshop results highlighted that the Open Data and results are not necessarily usable from the businesses' points of view. Despite the data being open and FAIR, the businesses (especially the SMEs) might not have the ability to reuse data in practice due to, e.g., inadequate skills. Indeed, the universities of applied sciences have a very important intermediary role in guiding the businesses to find the most useful data sets and help them to understand and use the data to develop their operations.

During the RDI process, it is particularly important to ensure access to collected data by different partners. Still, if the data contain personal data or other confidential data, it should be accessed only by persons entitled to their use.

All the identifiers of the collected data that are not crucial for the work should be removed, and, if necessary, the data should be anonymized as early as possible. This is essential especially for the preservation of trade secrets. When combining different data sources, businesses can be more easily identifiable than individuals. For example, a rare industry, business size, or location might reveal the company the collected data refer to, which makes careful anonymization even more critical.

4.4 Sharing the Results of an Open RDI Project

Based on the findings, a culture of sharing is typically still developing. Thus, it was recommended to agree with businesses (in as much detail as possible) which parts of the data and results can be published and in what time frame. Patenting plans, for example, can affect the project schedule. Guidance given by project funders should also be taken into account, as sometimes funding bodies restrict or require a certain kind of openness. In any case, different parts of data can have different degrees of openness (from fully open to fully closed), which can help to meet the requirements of each stakeholder.

In principle, only anonymous data can be opened. If the actual material cannot be opened, it is usually still possible to publish the metadata or other related descriptive data. However, particular care should be taken to avoid accidentally opening confidential material because even metadata can sometimes reveal too many confidential matters concerning business secrets.

When publishing project results, it is advisable to use open publishing channels, allowing publications to reach their target audience most effectively. Businesses generally do not have access to publications behind pay walls, so fully open publishing channels should be used or the article should be saved in an open publication archive under the terms provided by the publisher.

4.5 Commercialization of the Results of an Open RDI Project

Only open and shared data sets and research results contribute to their efficient exploitation and further use. A key issue highlighted in this process was that in the UAS sector, and it is very important to speed up innovations and also enhance the commercial use of research results and data. Open operational models

promote the efficient use of research results. The effectiveness and importance of publicly funded projects will be greatly improved if the results generated are utilized after the completion of the project. In this way, they benefit as many as possible and can create possibilities for new innovations.

Still, inadequate intellectual property management skills and bad timing may prevent the successful use of results. For example, if a business wants to apply for a patent, universities have to be sure not to publish too much and too fast because no public documents are allowed to disclose the invention before the patent application is submitted. This might cause problems if the researchers want to publish as fast as possible and the businesses do not.

5. CONCLUSIONS

As the results based on the action research process demonstrate, there are various drivers and barriers in the open RDI process regarding cooperation between HEIs and businesses. Data-related issues should be managed carefully from the beginning of the project and continued systematically during the whole life cycle of the open RDI project. When cooperating with business partners, attention must be paid to many critical factors, such as ownership and sharing the data and results, confidential information, and business secrets.

During the life cycle of an RDI project (Figure 1), it is possible to make use of transparent policies and to act in a pro-transparency manner. It is therefore useful to highlight what aspects should be considered at each phase of an open RDI process cycle with businesses. The findings indicate that there are several best practices that need to be considered. First, open RDI projects should follow the requirements of OS policies of organizations and funders. A shared understanding of open practices and the goals should be formed at the start of the project. Trust among all partners is vital. Second, a data management plan—on an appropriate level of detail—should be created in co-operation with partners and monitored and, if necessary, updated accordingly during the project. All reuse of existing data should be encouraged and supported. Third, it is important to discuss and agree on who is responsible for documenting, storing, archiving, and sharing data. The costs and resources needed should be considered, while the FAIR principles are followed. Fourth, data ownership agreements and IPRs, together with discussing the data-sharing policy with partners, are crucial.

Practices of OS at HEIs are constantly evolving [20]. Comparing the results more widely and internationally, the general cooperation barriers have been discussed more thoroughly by Alunurm, Rõigas & Varblane [21], who found that many barriers to cooperation between higher education and industry can be mitigated by drivers at corresponding stages of the cooperation life cycle. They also found that such cooperation is rarely a question of resources, but rather a question of finding a suitable format. Kunttu [22] discovered three key aspects in lowering barriers were (1) building personal trust, (2) adoption of partner processes, and (3) consensus on the utilization of research results. In line with these aspects, this study showed that they are also key elements for a successful open business cooperation project.

Different goals for utilizing the data between higher education and the business sector are significant because of issues also reflected in cooperation in general [21, 23–26]. However, with the help of the open RDI life cycle model, these basic disparities in data utilization—stemming from the juxtaposition of the academic and the commercial—can be potentially reformed. For example, through the simultaneous utilization of different parts of data sets—instead of taking turns using the data as a whole—the barriers for cooperation may begin to diminish in an organic manner. On the other hand, if the data utilization by the academic partner is agreed to take place at a later stage in the data life cycle based on, e.g., an embargo period, the barriers are also significantly lowered.

It is obvious that the culture of higher education is changing in a more open and FAIR direction. Sharing data can speed up innovation and enhance the involvement of businesses and other working life organizations in research processes that traditionally take place in the more closed environments of universities. However, the study also raised several questions. Are higher education and businesses together able to create, share, and reuse data in practice? Despite the data being findable, accessible, interoperable, and reusable, are businesses capable to use them? Is the operating culture of businesses moving in a more open direction? How these factors play out in real life could be a fruitful avenue for further research. Still, the open RDI process model needs to be repeatedly tested and further developed together with businesses. In order to promote an open operational culture and Open Data sharing practices in projects, it is crucial to find the most successful ways to clear the barriers of open RDI.

AUTHOR CONTRIBUTIONS

S. Päällysaho (seliina.paallysaho@seamk.fi) is the corresponding author and was responsible for building the framework of the article. J. Latvanen (jaana.latvanen@seamk.fi) co-designed the framework of the article and contributed improvements to the text. A. Lehto (anttoni.lehto@turkuamk.fi), J. Riihimaa (jaakko.riihimaa@haaga-helia.fi), and P. Lahti (pekka.lahti@haaga-helia.fi) participated in the data-gathering and contributed to the writing and revising of the manuscript. A. Kärki (anne.karki@samk.fi) clarified the ideas and concepts in the paper, and H. Puhakka-Tarvainen (helen.puhakka-tarvainen@karelia.fi) proofread and contributed improvements to the text. All authors contributed to the manuscript writing and reviewed the final version of the article.

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