

Key Aspects of Open Data in Finnish RDI Co-operation between Higher Education and Businesses Postprint

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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.

Full Text

Preamble

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

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Abstract

This article highlights critical aspects that should be considered throughout an open Research, Development, and Innovation (RDI) process cycle to improve research data utilization and foster open cooperation between higher education and businesses. The viewpoint focuses on publicly funded joint research projects involving universities of applied sciences (UAS), though the concepts are applicable to other higher education and research organizations as well. Various challenges relate to research data management and to the openness and reuse of data and results. The findings are based on a two-day expert workshop and are interlinked with five phases of an open RDI process cycle: planning, implementation, documentation, sharing, and commercialization. Different drivers and barriers emerge at each stage. At 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, and compliance with Open Science (OS) policies of participating organizations and funders. The article also highlights several best practices that should be considered in each phase of an open RDI project cycle involving businesses.

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1. Introduction

This article examines the opportunities and challenges of an open operating culture in the context of how Higher Education Institutions (HEIs) and businesses can utilize open Research, Development, and Innovation (RDI) models in cooperative projects. More specifically, it introduces key issues relating to research data management when HEIs and businesses produce research data in publicly funded joint projects. The purpose is to highlight 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. Using these open RDI models requires taking into account the Open Science (OS) and research policies of the university as well as the requirements and restrictions of funders and project partners.

RDI activities in HEIs are central to economic growth [1]. Finland currently has 24 universities of applied sciences (UAS), for which RDI work constitutes a mandated task. Indeed, UAS are the only Finnish institutions with a statutory mandate for innovation activities, and they play an important role in Finnish innovation and learning ecosystems [2-4]. The mission of RDI work is to enhance the operations of businesses and public organizations, with special focus on regional development. Thus, RDI activities are tightly linked 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. UAS should meet the needs of these actors by developing new methods, products, services, applications, and tools that provide directly usable information. This work is based on close interaction with various partners, complementing their knowledge by sharing external insights and expertise. Consequently, 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 main forms of academia-industry collaboration are joint research, contract research, and consulting projects. In the UAS sector, a typical cooperation form is the student project, which usually arises from various challenges within a firm or organization. The Ministry of Education and Culture steers HEI activities and serves as their main funding source in Finland. UAS funding is allocated based on performance measured with both education and RDI indicators. Additionally, UAS receive financing from external sources, especially for RDI activities, which account for about 60% of EU funding [7].

This article focuses primarily on joint research, referring here to formal RDI-based business collaboration that is mainly externally funded by public funders such as EU funds, ministries, and communities. Typically, multiple businesses and higher education partners participate in a joint research project, producing substantial research results and data. While the viewpoint centers on applied research in Finnish UAS, 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

Academic culture is becoming more transparent [8], and in the Finnish UAS system, an ongoing transformation toward more open working methods is evident, particularly in RDI projects. The well-known guideline— “as open as possible, as closed as necessary” —is gradually becoming reality. Open RDI refers to an operational and cultural mode where research methods, processes, data, results, and publications generated by RDI projects are transparently available and ex-

exploitable as widely as possible [9]. The objective 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 between UAS and industry.

The mechanisms that transform research results into economically effective practical applications have not yet been widely and thoroughly investigated [10, 11]. However, the trend of increasing cooperation between industry and universities is intensifying on two fronts: the growing need for new innovations in business and increasing policy-maker efforts to maximize the commercialization of research results [12]. Simultaneously, OS policies and practices create 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 driver is the OS and Research Roadmap [14], published in 2014 by the Ministry of Education and Culture, which encourages academia to promote openness and the FAIR principles of findability, accessibility, interoperability, and reusability. Since then, the progress and overall maturity of open operational culture at universities have been evaluated three times [15–17]. According to these evaluations, higher education and research institutions—especially UAS—have significantly improved their performance in open operating culture during these years.

3. Methods

The findings are based on a two-day expert workshop with 15 RDI experts from the Finnish UAS sector. Participants' expertise related to business cooperation, project management, and information services, including data management and open publishing. The workshop aimed to foster open dialogue and gather viewpoints and experiences regarding open RDI activities with businesses: what challenges have been encountered and what aspects should be considered in the future. It also sought to identify best practices that could be shared and further developed in open collaboration. The workshop method followed the action research process, which includes planning, issue selection, data collection, and results analysis [18].

The workshop comprised three phases. In the first session, participants discussed in small groups what data management challenges and issues had arisen in their business cooperation projects. All relevant experiences, questions, and observations were gathered and classified according to the five phases of the open RDI process model: planning, implementation, documentation, sharing, and commercialization [19]. This first day resulted in five full flip-chart sheets of issues, themes, and problems related to data management in joint university-business RDI projects.

On the second day, work continued to deepen understanding of open business cooperation based on the first session's findings. Participants elaborated on earlier viewpoints in small groups for each RDI process cycle phase, address-

ing them sequentially. Each phase facilitator summarized key results for their portion of the cycle. At the workshop's conclusion, a final vote allowed each participant to select the three most important findings for each cycle phase. Based on these results, a list of key challenges and best practices in university-business cooperation projects was formulated, as discussed below.

4. Results

The expert workshop identified several aspects that must be considered to improve research data dissemination and reuse. The main findings are presented below according to the five phases of the open RDI process model, with various factors supporting or hindering open cooperation at each stage. Figure 1 [Figure 1: see original paper] 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

Agile collaboration related to data management should begin at the project's start. The action research process revealed that agreeing with business partners on project policies, courses of action, and open operation models as early as possible in the planning process is crucial. It is useful to discuss and agree on the use and ownership of background data and materials to enable appropriate openness of final outputs. The best way to prevent complex problems is to foresee risks. Initially, businesses may be suspicious of transparent operation models, and it might take time to appreciate the benefits openness can bring. However, some business organizations are immediately interested in openness and transparency, recognizing the potential and new possibilities it offers.

A data management plan (DMP) is an important tool for the planning phase of an open RDI project. Although sometimes viewed as a bureaucratic necessity, a well-functioning DMP is at best a living document of comprehensive practical relevance. DMPs facilitate management of the entire project life cycle and help specify key issues such as preservation, sharing, ownership, access rights, transparency, and liabilities. The plan must be drafted and implemented in cooperation with all involved parties from the planning phase and should be regularly updated to keep key data management aspects in mind throughout the project. However, a DMP should always be used only at the level of detail and as extensively as required by the project.

4.2 Implementation of an Open RDI Project

During the implementation phase, it is important to carefully select the software, file formats, and platforms to be used jointly. Business partners do not necessarily have the same software as universities, which may cause challenges and extra expenses. Additionally, 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 field standards, as this makes datasets easily transferable between service providers.

A well-adapted infrastructure is needed for successful open RDI projects. It is important to critically analyze platforms where research data are stored. While commercial cloud services are easily accessible storage locations for businesses, their data security is not always adequate. If data contain business secrets or other confidential information, more secure storage should be considered.

4.3 Documentation of the Results of an Open RDI Project

The workshop highlighted that open data and results are not necessarily usable from businesses' perspectives. Despite data being open and FAIR, businesses (especially SMEs) might lack the ability to reuse data in practice due to inadequate skills. Universities of applied sciences therefore have a crucial intermediary role in guiding businesses to find the most useful datasets and helping them 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. However, if data contain personal or other confidential information, access should be restricted to authorized persons only. All identifiers in collected data that are not crucial for the work should be removed, and data should be anonymized as early as necessary. This is essential for preserving 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 data refer to, making careful anonymization even more critical.

4.4 Sharing the Results of an Open RDI Project

The findings indicate that a culture of sharing is typically still developing. It is therefore recommended to agree with businesses in as much detail as possible which parts of data and results can be published and in what timeframe. Patenting plans, for instance, can affect project schedules. Guidance from project funders should also be considered, as funding bodies sometimes restrict or require certain types of openness. In any case, different parts of data can have different degrees of openness (from fully open to fully closed), which helps meet each stakeholder's requirements.

In principle, only anonymous data can be opened. If actual material cannot be opened, it is usually still possible to publish metadata or other descriptive data. However, particular care must be taken to avoid accidentally opening confidential material, as even metadata can sometimes reveal too much about business secrets. When publishing project results, it is advisable to use open publishing channels to reach target audiences most effectively. Businesses generally do not have access to publications behind paywalls, so fully open publishing channels should be used or articles should be deposited in open publication archives under publisher terms.

4.5 Commercialization of the Results of an Open RDI Project

Only open and shared datasets and research results contribute to their efficient exploitation and further use. A key issue highlighted in this process is that in the UAS sector, it is very important to speed up innovations and enhance the commercial use of research results and data. Open operational models promote efficient use of research results. The effectiveness and importance of publicly funded projects will be greatly improved if results generated are utilized after project completion, benefiting as many stakeholders as possible and creating possibilities for new innovations.

However, inadequate intellectual property management skills and poor timing may prevent successful use of results. For example, if a business wants to apply for a patent, universities must ensure they do not publish too much or too quickly, as no public documents are allowed to disclose the invention before the patent application is submitted. This can cause problems if researchers want to publish as quickly as possible while businesses do not.

5. Conclusions

As demonstrated by the action research process results, various drivers and barriers exist in the open RDI process regarding cooperation between HEIs and businesses. Data-related issues should be managed carefully from the project's beginning and systematically throughout the entire open RDI project life cycle. When cooperating with business partners, attention must be paid to critical factors such as ownership and sharing of data and results, confidential information, and business secrets.

During an RDI project's life cycle (Figure 1), it is possible to employ transparent policies and 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 several best practices that need consideration. First, open RDI projects should follow OS policy requirements of organizations and funders, forming a shared understanding of open practices and goals at the project's start. Trust among all partners is vital. Second, a data management plan—at an appropriate level of detail—should be created in cooperation with partners, monitored, and updated as necessary 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, considering costs and resources while following FAIR principles. Fourth, data ownership agreements and IPRs, together with discussing data-sharing policy with partners, are crucial.

Open Science practices at HEIs are constantly evolving [20]. Comparing these results more widely and internationally, 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 of finding a suitable format. Kunttu [22] discovered three key aspects for lowering barriers: (1) building personal trust, (2) adopting partner processes, and (3) reaching consensus on utilization of research results. In line with these aspects, this study shows they are also key elements for successful open business cooperation projects.

Different goals for data utilization between higher education and the business sector are significant, reflecting issues also apparent in cooperation generally [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 academic and commercial perspectives—can potentially be reformed. For example, through simultaneous utilization of different parts of datasets—instead of taking turns using the data as a whole—barriers to cooperation may diminish organically. Alternatively, if academic partner data utilization is agreed to occur at a later stage in the data life cycle based on, for example, an embargo period, barriers are also significantly lowered.

It is evident that higher education culture is changing in a more open and FAIR direction. Sharing data can accelerate innovation and enhance involvement of businesses and other working-life organizations in research processes that traditionally occur in more closed university environments. However, this study also raises several questions: Are higher education and businesses together able to create, share, and reuse data in practice? Despite data being findable, accessible, interoperable, and reusable, are businesses capable of using 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. The open RDI process model needs repeated testing and further development together with businesses. 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.

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