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# The Role of Higher Education Institutions in Open Innovation

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**ZHAW - Zurich University of Applied Sciences**
**School of Management and Law - Institute of Innovation and Entrepreneurship:**
Silvana Jud, Research Associate
Devon Wemyss, Research Associate
Dr. Angela Beckenbauer, Head Center for Business Innovation
Prof. Claudio Cometta, Deputy Head Institute of Innovation and Entrepreneurship

**Ressort Research and Development:**
Dr. Martin Jaekel, Head of R&D Unit


Zurich University of Applied Sciences

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## Summary

While cooperation between higher education institutions (HEI) and relevant industry partners has a long history in Switzerland leading to impactful innovations, the discussion on promotion of these collaborations has been limited. These types of collaborations, referred to as forms of Open innovation (OI), in the HEI context in Europe has gained traction as a result of the European Union Open Innovation 2.0 policy and the open science movement in general. This white paper addresses this Swiss context and aims to provide an initial understanding of those involved in OI and their roles in implementing OI practices, and ways in which to address the challenges of promoting OI in Swiss research projects. It highlights the challenges Swiss researchers face when working in OI projects and provides recommendations for additional support.

A literature review and interviews with researchers and experts identified 13 (non-exhaustive) aspects of OI from the HEI perspective that are implemented in research projects, such as using collaborative methodologies, incorporating early user involvement, or implementing flexible IP contracts. Therefore, in this white paper OI is broadly defined as encompassing the diverse practices, encompassing the 13 aspects, in projects where HEIs collaborate with external partners.

In addition to the findings from our literature review, we identified specific activities that support OI at three different levels within HEIs: the strategic, enabler, and project levels. The strategic level provides an enabling environment in which researchers can work. The enabler level, if present, acts as a facilitator for researchers. Finally, the project level is where researchers implement OI in projects. Considering the position of any partner within an OI project, the literature identifies different contributions such as expert, power, process, or relationship. Traditionally, researchers and the HEIs have contributed expertise. However, OI allows for new roles to be actively explored and shaped. For example, HEIs can assume the roles of relationship catalyst, process facilitator, or relationship broker.

To explore researcher's experiences in OI projects, a Swiss-wide survey of researchers was conducted to examine the prevalence and challenges of the 13 aspects of OI. The results suggest that there is no single shared experience as each of the 13 characteristics of OI projects was judged as highly difficult by some researchers, and much less so by others. There are, however, characteristics that were judged generally more challenging than others, such as including multiple disciplines in a task, actively managing partners, and working with roughly defined project outcomes. Additionally, many researchers had not experienced all the OI aspects and thus skills may lack due to inexperience.

The challenges of researchers in this context are key to understanding how to promote OI in an HEI environment. The results of this research shows, that the following should be addressed: lack of capacity in research teams due to the complexity of OI projects and need for flexibility, legal risk and high administration cost for the HEIs, and the high cost of additional project tasks which emerge only during the project due to its design (e.g. iterative design). The current lack of experience concerning some of the lesser-known OI aspects might be addressed by research funding for HEI projects with an OI-related methodological approach (including collaborative methodologies or iterative design aspects), alternative measures for success suggested by the proposing team, sharing resources, or the involvement of multiple competitors in the project team.

The diversity of practices involving OI in HEIs implies that the roles of the researchers working in these projects may be evolving. Researchers are, therefore, advised to reflect on their roles and on how this aligns with the HEI strategy as a whole. A funding call for OI projects that promotes role exploration, is Swiss-focused yet flexible in partnerships, and considers the challenges of OI implementation would be an important additional funding source in Switzerland.

# Contents

# 1. Introduction

Open innovation (OI), as an aspect of open science and a focus of the European Union Open Innovation 2.0 policy, is emerging as a relevant form of R&D for higher education institutions (HEIs). However, compared to other European countries, OI has not yet been widely discussed in the Swiss national context (cf. Austrian Federal Government, 2019). The existence of this gap is striking considering that two thirds of R&D and innovation investments in Switzerland stem from the private sector (Swiss Federal Statistical Office, 2019) and that there is a tradition of collaboration between HEIs and the private and public sectors.

Over the past 30 years, a general rise in collaborations between companies and other actors has been observed, which has disrupted traditionally inwardly focused innovation management (Hagedoorn & Duysters, 2002). Collaboration partners have included HEIs (see triple-helix approach, university-industry collaborations, etc.), with collaborating parties sharing research results, human resources, or infrastructure for direct implementation or improvement of existing systems and products (Lee, 1996). These practices by HEIs, in essence, go beyond basic research to explore potential in new state-of-the-art applications (Gassmann, Enkel, & Chesbrough, 2010).

While industry and HEI partnerships are not new, their importance is increasing in more cross-disciplined, digitally connected, and quickly evolving business areas. In Switzerland, as we see the emergence of new fields such as FinTech and EdTech, supporting collaborative innovation processes has become of interest to federal HEI research funding programs. In an effort to go beyond mere industry collaboration, the European Commission has been giving particular weight to the societal relevance of innovation through co-creation, dialogue, and collaboration for a quadruple helix approach to innovation, which also includes citizens (European Commission, 2019).

In the context of this white paper, OI has been defined as *practices or methods within research projects involving collaboration of diverse partners, disciplines, and practices beyond institutional boundaries*. This definition only slightly differs from the established definition of OI by Chesbrough (2003) in that the perspective is HEIs, which do not have direct commercial interests. Nonetheless, these exploratory practices still aim to have an impact beyond what one partner could achieve alone. In this context, we consider what innovation practices could look like.

At HEIs, OI is both researched and practiced, usually separately. Little research has been conducted to understand current OI activities and the potential of OI methods from the perspective of HEIs (Ollila & Elmquist, 2011). On the other hand, many researchers work with external partners in a variety of constellations. It is therefore likely that they are already including aspects of OI methods in their research. The roles and practices of HEIs in these types of exploratory research projects, especially in Switzerland, are not yet fully understood, however (Ollila & Elmquist, 2011).

This white paper aims to provide an initial understanding of OI practices at Swiss HEIs through a literature review, interviews with practitioners and experts at different levels, and a Swiss-wide survey of researchers. It investigates the use of OI practices in research projects and the perceived challenges in their implementation.

# 2. Enquiry into Open Innovation Practices

*Open innovation activities exist at multiple levels*

In identifying which OI practices occur at HEI, several actors need to be considered. A literature review has revealed a coherent structure consisting of three levels where OI activities can be found within an

HEI. We identified them as: the strategic, enabler, and project levels (see Figure 1). The three levels are interconnected and interdependent, with institutional support coming top-down and reputational quality being driven bottom-up, thus each level has a fundamentally different role within the HEI.

Decisions and actions at the *strategic level* provide a framework for action at the enabler and project levels. These might take the form of an internal OI strategy or some kind of internal project funding.

The *enabler level* supports researchers in their research projects with OI practices by offering institutionalized services such as support in writing or editing research proposals. One of the most common forms of support is a technology transfer office (TTO), where, for example, services concerning intellectual property (IP) regulations are bundled and handled for all projects. From an HEI perspective, the enabler level aims to streamline processes involving researchers and industry, and is, therefore, a multiplier for collaborations. We see the potential for this enabler level to take on new roles, such as facilitating spin-off and start-up creation, providing maker spaces, or analyzing data, such as at ETH Zurich and the EPFL Swiss Data Science Center[1].

The *project level* encompasses all research projects in HEIs that are implementing different OI practices. Up to now these are mainly driven by the researchers themselves when they decide to incorporate OI aspects into their research projects or structure their projects in an open and collaborative way to best meet the needs (Padilla-Meléndez & Garrido-Moreno, 2012). Once their enabler and strategic levels have been set up to fulfil a broader spectrum of functions, HEIs can leverage the potential at the project level to greater effect.

Interactions with outside actors who form the core of OI mainly occur at the project and enabler levels, whereas the strategic level provides a strategic framework and an institutional setting for the interactions with outside actors. Importantly, the actors identified at these three levels may not recognize themselves as such explicitly, nor may they see their work as integral to implementing OI.

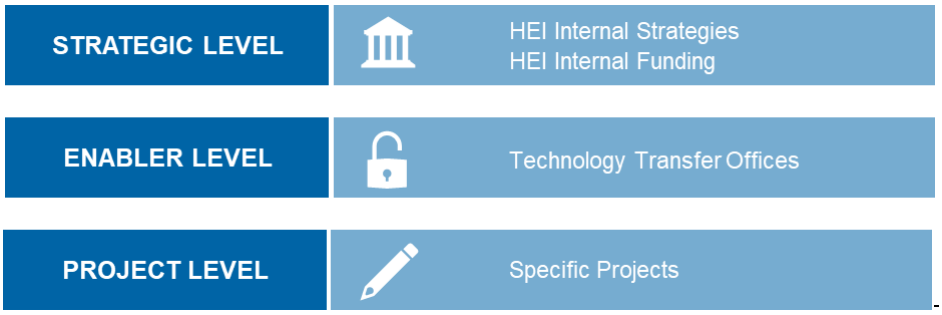


*Figure 1 Actor levels within an HEI where OI activities occur*

*Newly emerging functions supporting open innovation*

Within the traditional mandates of HEI activities (i.e., education, research, and outreach), education and research have been typically internally-focused activities, while outreach has taken the form of scientific article publication and patenting, and is sometimes formalized in a TTO focusing primarily on knowledge transfer. Outreach activities tend to involve unidirectional transfer from the university outwards, mainly as press releases and managing IP. However, positive developments are happening. The MIT Technology Licensing Office, for example, is making knowledge transfer more efficient and impactful through measures such as ready-to-sign non-exclusive license agreement templates and enabling more flexible IP contracts (MIT, 2018). In the UK, a national initiative has been launched for

[1] https://datascience.ch/ (as of Nov. 2019)

universities to valorize their IP more (Chapple, Lockett, Siegel, & Wright, 2005). In addition, an increasing number of HEIs are starting to consider a bi-directional transfer between academia and practice (Alexander & Martin, 2013), which includes more collaboration with external partners and the introduction of OI practices (Chesbrough, 2003; Johnston, Robinson, & Lockett, 2010).

Nevertheless, the various characteristics of OI projects pose challenges for the traditional transfer activities at HEIs: For example, TTOs may have insufficient communications resources to facilitate industry-HEI projects or lack the expertise in drawing up flexible IP contracts (Bruneel, D'Este, & Salter, 2010). Alexander and Martin (2013) found that some TTOs are within larger structures which limit the ability to create synergies between different outreach channels, such as patents, publications, or student placements. As OI can include various types of partners, establishing connections to the civil society, government, or NGOs can be new territory for an HEI (Halibas, Sibayan, & Maata, 2017).

Based on these challenges, as well as the internal positioning of TTOs as well as contract management, and legal advisory units, each HEI may design and implement an OI strategy that is unique to its context and current working culture. Due to this flexibility in implementation, we see potential in using existing structures to support more OI activities at HEIs. However, it appears that these structures may require reconfiguration in order to prioritize new output (e.g., not only focusing on licensing) and remove bureaucracy (Siegel, Waldman, Atwater, & Link, 2003). In this context, all three actor levels described above play a role in facilitating and implementing OI practices.

*Existing funding for OI-activities*

Beside a supportive HEI environment, there are structures that support industry-academia collaborations, but have not, so far, specifically supported OI activities.

In Switzerland, there are various industry associations[2] which support networking activities involving HEIs, with the goal of increasing visibility for and interaction within their industry or interest group. In addition, Innosuisse - Swiss Innovation Agency, supports 10 national thematic networks (NTN) to foster the building of knowledge networks on selected topics[3]. However, these two mechanisms are very much focused on a single topic and/or a single industry in the scope of which (vertical) collaborations along the value chain are encouraged. Different collaborative processes across and within industries such as OI projects involving horizontal collaborations, even between competitors, are not explicitly a part of these programs and will still take some effort to create.

In November 2019, Innosuisse introduced the NTN Innovation Booster initiative, a new instrument to give SMEs "a competitive edge through cooperation with partners along the value chain and by incorporating the knowledge, skills and technologies of the universities."[4] This instrument can be seen as a first step towards funding OI collaborations between HEIs and private-sector partners. It promotes applied research at the fuzzy front end of innovation (Reid & De Brentani, 2004) and supports collaborations aimed at verifying market potential through early-stage testing. By integrating OI methodologies to test ideas quickly and iteratively, an NTN Innovation Booster provides a new approach to promoting high-potential ideas. While they provide funding in multiple stages in order to

[2] https://www.sgv-usam.ch/%C3%BCber-den-sgv/mitglieder (as of Nov. 2019)

[3] https://www.innosuisse.ch/inno/en/home/be-connected/nationale-thematische-netzwerke.html (as of Nov. 2019)

[4] https://www.innosuisse.ch/inno/en/home/be-connected/nationale-thematische-netzwerke/ntn-innovation-booster.html (as of Dec. 2019)

provide more flexibility, the instrument does not provide support for the challenging IP issues arising between partners at this stage.

The Swiss National Science Foundation (SNSF) also has several programs to support innovation and research. The BRIDGE[5] program (a research fund created by the SNSF and Innosuisse) supports both young and experienced researchers in developing existing research results into impactful applications or services for society. In addition, SNSF has created its Sinergia[6] grant. As the name suggests, Sinergia grants promote synergy by funding research projects involving two or more disciplines. To achieve breakthrough research, SNSF values collaborative efforts to combine expertise to open up new research fields. Finally, the SNSF National Research Programme[7] funds solution-oriented inter- and trans-disciplinary research with a unique focus on citizen participation and communication of the final results to the public.

Aside from these instruments, the vast majority of public funding allocated for innovation in Switzerland goes to projects based on calls for proposals, which are thematically very open or loosely focused on a research area (e.g., natural sciences, engineering, biotechnology, or nanotechnology). These calls for proposals in the context of innovation are mainly issued by Innosuisse and usually concern industry-academia collaborations. This instrument, however, has no particular provisions for OI approaches.

Other than pure industry-academic collaborations, Swiss funding schemes still lack wide incorporation of civil society, public administration, or cross-sector consortia. As mentioned above, Innosuisse typically provides funding for industry-academic collaborations with a focus on a commercial product outcome and thus limiting funding for non-commercial R&D and innovation investment.

Some federal offices and state secretariats (e.g., the Swiss Federal Office of Energy, the Swiss Federal Office for the Environment, and the State Secretariat for Economic Affairs) have the means to finance studies or research projects; however, this funding is relatively limited in scope as well as volume. Unfortunately, these funding approaches do not focus on intensifying collaboration, such as through public procurement of innovation or pre-competitive procurement, which is seen as an important and impactful driver of innovation (Loerincik, Mandron, Duclos, Marchand, & Wemyss, 2019).

Furthermore, there is a broad spectrum of private foundations in Switzerland that support research. Foundations define their themes individually, and these can range from personal preference to strategic research interests. Importantly, many foundations support context-embedded research which has a direct relevance and impact on society (e.g., Mercator[8], Gebert-Rüf[9], or Avina[10]), thus promoting collaboration between civil society, public administration, and academia because this is necessary for addressing complex topics.

At a European level, the European Commission issues a very broad range of calls for project proposals incorporating aspects of OI (e.g., co-design with users, industry-academia-collaborations, public procurement of innovation, or industry-industry collaborations). However, meeting the requirements for such European projects can be extremely difficult in terms of the configuration of partners for such

[5] http://www.snf.ch/en/funding/programmes/bridge/Pages/default.aspx (as of Dec. 2019)
[6] http://www.snf.ch/en/funding/programmes/sinergia/Pages/default.aspx (as of Dec. 2019)
[7] http://www.snf.ch/en/funding/programmes/national-research-programmes-nrp/Pages/default.aspx (as of Dec. 2019)
[8] https://www.stiftung-mercator.ch/de/stiftung/ueber-die-stiftung-mercator-schweiz/ (as of Dec. 2019)
[9] https://www.grstiftung.ch/de.html (as of Dec. 2019)
[10] https://www.avinastiftung.ch/en/ (as of Dec. 2019)

a consortium (i.e., minimum number of partner countries or companies, combination of types of partners, etc.).

*Identifying roles of HEIs in open innovation practice*

Within OI projects, much literature has been dedicated to understanding the roles assumed by different partners to successfully run OI projects (Gemünden, Salomo, & Hölzle, 2007). Champion and gatekeeper roles have emerged in the literature as prevalent and are often cited concerning four different areas of contribution: expert, power, process, and relationship (Gemünden et al., 2007; Goduscheit, 2014; Hauschildt & Kirchmann, 2001). A champion is an active promoter of a project, who aims for both internal coordination and external alignment of partners to address a specific challenge (Hamadi, Leker, & Meerholz, 2018). On the other hand, a gatekeeper mainly contributes expertise and process support by allowing the flow of knowledge to the right partners at the necessary moments (Gemünden et al., 2007).

While individuals (or groups of individuals) from one organization acting within projects take and create these roles, they ultimately define the positioning of their organization in the consortium. Thus, the role that a researcher assumes in a collaborative project also defines how the HEI is perceived. As shown in Table 1, researchers can explore various roles in a project, whereas the contributions and characteristics of typical roles depend on the presented challenges in a project.

*Table 1 Contributions of roles of open innovation actors*

| **Contribution of actor**[a] | **Role Characteristics**[b] | **Challenges Addressed**[c] | **Exemplary Roles** (differ by focus and project phase) [d] |
|---|---|---|---|
| **Expert** | Has specific knowledge; insights on technologies or methods | Knowledge gaps | *Resource-based role*<br>*Contributor*<br>*Inventor*<br>*Tester* |
| **Power** | Has control of resources; hierarchical power to drive project | Opposition between partners | *Driver*<br>*Orchestrator*<br>*Sponsor* |
| **Process** | Good communication skills; has coordination capacity; supervises deliverables; translates between disciplines | Management and intra-organizational difficulties, synchronization between partners, inter-organization barriers | *Accelerator*<br>*Action-based role*<br>*Facilitator*<br>*Boundary Spanner*<br>*Integrator*<br>*Informer* |
| **Relationship** | Has a broad network and is well-informed; exploitation of knowledge; fulfils dissemination activities | Interdependencies and cooperation difficulties | *Catalyst*<br>*Promoter*<br>*Broker*<br>*Mediator* |

Sources:
[a] (Goduscheit, 2014)
[b] (Goduscheit, 2014; Hamadi et al., 2018)
[c] (Goduscheit, 2014; Hamadi et al., 2018)
[d] (Gemünden et al., 2007; Goduscheit, 2014; Hauschildt & Kirchmann, 2001; Lundberg, 2013; Nyström, Leminen, Westerlund, & Kortelainen, 2014)

The roles described in Table 1 depend on the project phase and necessarily shift with time. Thus, an HEI must be able to respond flexibly to a changing role and potentially take on multiple roles within a project (Nyström et al., 2014). It is essential for all project partners to understand this as, ultimately, no single role defines the outcome or guarantees success of a project (Gemünden et al., 2007).

However, with consecutive projects, organizations become more accustomed to and skilled in certain roles, which potentially limits their flexibility but, on the other hand, strengthens their visibility as partners for specific contributions in future projects (Hamadi et al., 2018).

As each project with OI characteristics is unique, the role of the HEI has to be continually re-evaluated and refined. This provides an opportunity for exploratory research to broaden the skillset of HEIs. In the following, two research projects involving OI are described, and the roles of the HEI are shown in each case.

**1: Swiss Data Science Center captures resource-pooling advantages**

The Swiss Data Science Center (SDSC), jointly founded by ETH Zurich and EPFL provides pooled personnel and knowledge resources in the field of data science. The SDSC strives for an embedded R&D collaboration, where corporate data scientists are integrated in a team of peers at the SDSC. This allows the partner corporations to stay up to date in this fast-moving field and gives them access to a network of other experts. The corporate data scientists are paid by their company to work, for the project duration, at the SDSC on their company's specific projects. For the company, the SDSC provides readily available expertise, which can be drawn upon for specific projects. This pooling of resources by an HEI is quite unique for both the HEI and the company in question.

Considering the OI aspects of this approach, the SDSC model has various functions. SDSC mainly provide expert knowledge for complex applied projects dealing with big data or multidisciplinary applications originating in industry. The SDSC also drives and facilitates projects, providing both power and process support. Finally, yet importantly, in terms of relationship building, SDSC acts as a catalyst and broker at the onset of a collaboration.

**Possible roles of HEI**: Resource-based (expertise), Contributor (expertise), Driver (process), Facilitator (process), Catalyst (relationship), Broker (relationship).

**OI aspects**: Multi-disciplined actors work together, resources are shared and knowledge grows across multiple projects; a data platform that enables cross-project learning and sharing; open science approach

**2: Coopetition, or multiple competitor involvement, in initiatives in the Swiss hotel industry.**

The concept of coopetition (combination of cooperation and competition) involves multiple competitors working together but with both competition and cooperation in mind. While cooperation may appear to weaken a company's competitive standing, working together to benefit from synergies can result in a bigger market for all. Thus, all companies benefit from the joint innovation, yet they still remain in a competitive constellation by exploiting their personal benefits (Liu, 2013). This is where the HEI can play an important role: Without a (direct) private commercial interest, the HEI can act as a neutral entity bringing partners together to facilitate knowledge sharing and at the same time as a contributor.

In Switzerland, this form of coopetitive work, supported by an HEI, was accomplished in the hotel industry. The University of Basel's research chair on tourism collaborated with small and medium-sized hotels (all Gastrosuisse members) to develop a solution to the problem of market positioning. Through the support of the university, several different options for collaboration were developed, including the expected cost benefits. In addition, the HEI provided valuable expertise to contribute to the industry knowledge of the hotel partners, ultimately providing a better understanding of coopetition for all partners (Bandi, Lussi, Jung, Abderhalden, & Hämmerli, 2015).

**Possible roles of HEI** Contributor (expertise), Facilitator (process), Boundary-Spanner (process), Integrator (process), Catalyst (relationship), Broker (catalyst)

**OI aspects:** Opening up to external actors, working with potential competitors, implementing flexible IP practices

# 3. Current Open Innovation Practices at the HEI Project Level

*13 aspects of open innovation projects*

With this better understanding of the framework conditions for OI in Switzerland and the potential roles the HEIs could take, we investigated the experiences of researchers in Switzerland regarding research projects with OI aspects. Following the literature review and interviews with stakeholders within Switzerland and Austria, several shared characteristics of "an OI project" emerged (see appendix for details on interviews). As interviewees disagreed on what they considered to be an OI project, we used a broad definition (see Section 1) for the interviews and the subsequent online survey to capture different aspects of exploratory and collaborative projects. This resulted in the identification of 13 aspects defining OI practices in research projects, which can be broadly divided into three groups depending on the phase of the research process (see Table 2). This list of OI project characteristics is not meant to be exhaustive but rather reflective of the current projects that we encountered. It thus allows us to explore the current perception and understanding of OI in HEIs at the project level.

*Table 2 Aspects of open innovation incorporated into research projects by phase of the project*

| | | |
|---|---|---|
| **Planning and Initialization** | | |
| 1 | **Joint problem identification with external partners** | During the proposal writing phase or early on in the project, the problem to be addressed is jointly defined between the HEI and all project partners. This can ultimately result in a jointly defined goal for the project. |
| 2 | **Multiple competitor involvement** | The project team includes the HEI and private-sector partners (more than one) from the same sector. Thus, the private-sector partners may be competitors, but they will both benefit from the project results. Competition could also be considered between the HEI and public administrations, however to a much lower degree than in the private sector. |
| 3 | **Roughly defined outcomes that adapt with project development** | In the proposal, the outcomes are incomplete as the exact outcome of the project evolves with the results of the work. This acknowledges the lack of full understanding of a problem, or of how the projected outcome may look, at the proposal phase of the project. |
| 4 | **Flexible IP practices** | In collaborating with private-sector actors, the IP rights of the project output are defined in a way that benefits both the corporate partner that wants to exploit the product and the HEI that can build on the developed knowledge in future projects. |
| **Implementation** | | |
| 5 | **Collaborative methodologies** | (e.g., living labs, design thinking workshops, etc.)<br>Using collaborative methodologies during a research project to support interaction, for example, between the different stakeholders, between team members, or to gain insights from outside groups such as (future) customers or citizens. |
| 6 | **Iterative project development** | In phases of prototyping, testing, analyzing, and refining, for example, prior assumptions are tested and the project development may be adjusted based on the project results. The integration of the acquired knowledge ideally results in more accuracy in addressing the actual problem. |

| | | |
|---|---|---|
| 7 | **Early user involvement** | Testing an early version of a project outcome with users in order to gain practical implementation feedback and new perspectives. |
| 8 | **Active partner management** | The project lead, typically the HEI, manages the research process and methodologies as well as all project team partners, actively addressing differing work patterns, expectations, work cultures, and deliverables. |
| 9 | **Collaboration of multiple disciplines in a task** | Team members for specific project tasks are from different backgrounds with complementary expertise to implement a problem solution that integrates multiple perspectives. |
| 10 | **Traditional HEI dissemination activities** | This includes teaching, technology transfer offices, conference presentations, publications, spin-out founding etc.<br>The existing structures and functions at HEIs that serve to disseminate scientific findings and facilitate external collaborations are used. |
| **Publication, Transfer, and Evaluation** | | |
| 11 | **Publicly available project results** | Includes open access publications, websites, sharing on a best practice platform, etc.<br>A project step that consolidates, communicates, and disseminates the results of the project to a public space (digital or physical) is implemented. |
| 12 | **Open data** | The data collected in a project is stored and made publicly accessible after the project has been completed. The data is processed (organized, anonymized, etc.), so it can be used by others. |
| 13 | **Alternative indicators for project success** | Includes interconnectivity, joint partner publications, etc.<br>Projects are measured by alternative (compared to traditional) indicators. These are most likely defined individually for each project and respect the fact that OI project goals may be adapted during the work. |

## 4. Challenges to Developing Open Innovation Projects

*Researchers have a wide range of experiences.*

Based on the 13 identified OI characteristics of research projects, we empirically studied how researchers are challenged by these characteristics through an online survey. The online survey received 108 complete and valid responses from researchers from HEIs across Switzerland. Surprisingly, all identified OI characteristics were found to be challenging, albeit to different degrees. Figure 2provides an overview of frequencies of difficulty levels for each characteristic (more details are available in the appendix)..

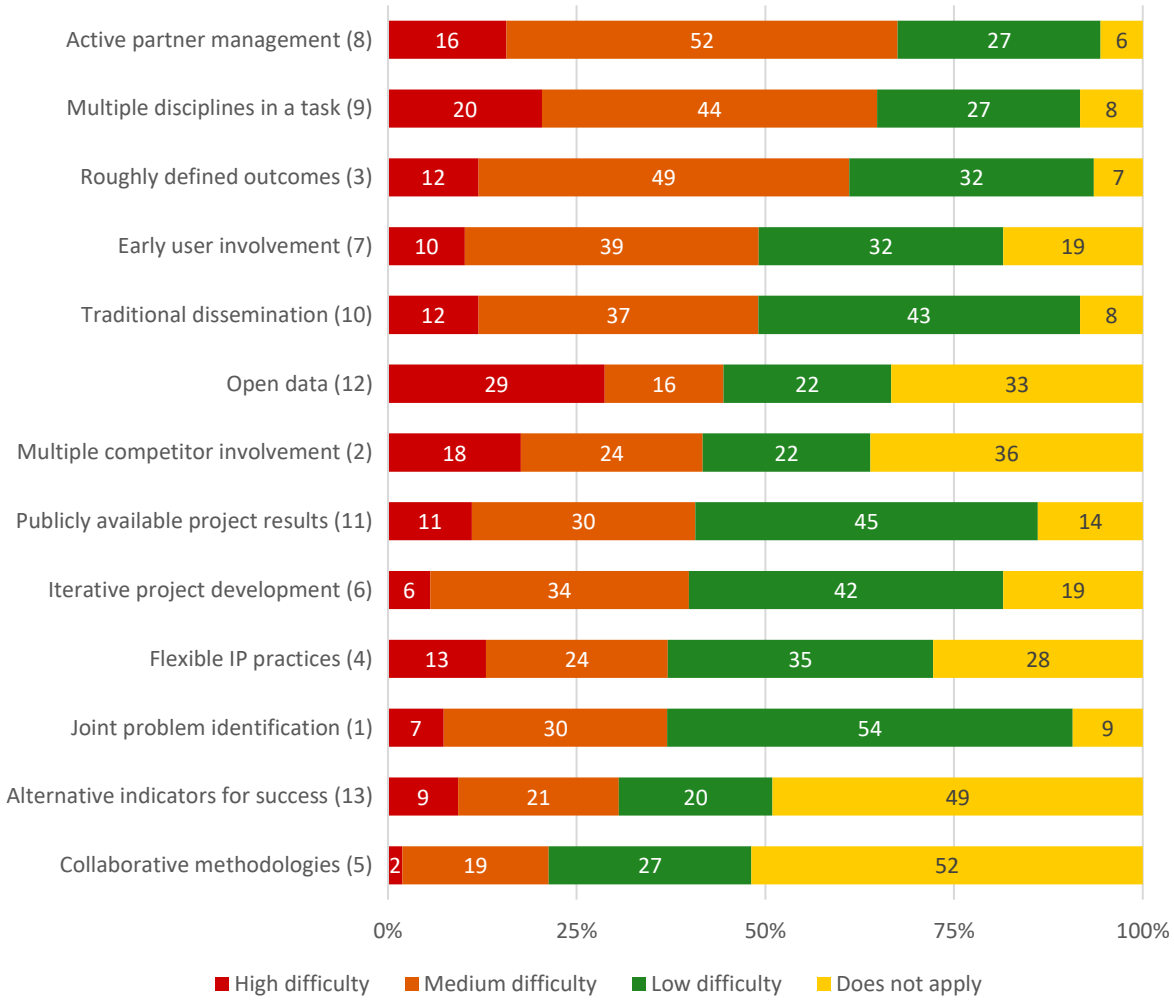


*Figure 2 Perceived challenges of various open innovation characteristics (N=108)*

*Challenges identified and experience gaps*

Notably, sharing data openly (12) was perceived as being a highly difficult issue by HEI researchers with experience in R&D and innovation projects with OI elements. The researchers provided open text answers in the survey to explain why they found this characteristic difficult, and many respondents said that they do not have sufficient experience with it. Thus, sharing data openly is potentially a relatively new element for most research disciplines.

The majority of the respondents had most difficulty (high and medium difficulty) with including multiple disciplines in a task (9), actively managing partners (8), and working with roughly defined project outcomes (3). Consequently, additional support could be provided to complement existing skills and resources.

Respondents had the least experience with using collaborative methodologies (5) or alternative indicators for success (13), as well as involving multiple competitors in the team (2). As these project characteristics are relevant for exploratory and integrative projects, it is important for more researchers to make active use of these elements in their projects.

*Three main difficulties of including OI characteristics in projects*

The survey further asked about the challenges experienced for the characteristics rated "highly difficult". The written responses are summarized in the appendix for each characteristic. However when looking at the overall responses, there are three reoccurring themes:

- A lack of absorptive capacity (time and capacity resources), meaning the ability of the research team to cope with changes to the project plan
    - Characteristics affected: roughly defined outcomes (3), iterative project development (6), active partner management (8), early user involvement (7), or joint problem definition (1)
- For the HEI, the legal risks are too high or risk management too demanding at different stages of the project
    - Characteristics affected: flexible IP (4), multiple competitor involvement (2), early user involvement (7)
- High costs of additional tasks due to project design are not supported by funding agencies
    - Characteristics affected: open data (12), publicly available results (11), collaborative methodologies (5), traditional dissemination (10)

# 5. Recommendations for Open Innovation Promotion in HEIs

The literature review on OI in HEIs, expert interviews, and survey on researcher challenges highlighted a few important areas when considering OI practices at Swiss HEIs:

- The **emerging roles of HEIs** in projects with OI aspects as perceived both internally and by partners
- The need to address the **challenges for researchers** in implementing OI aspects in their projects
- How to **encourage experience- and skill-building in terms of OI methodologies and practices** through directed project funding

The following sections go into each of these considerations in more detail, and a final section provides our final conclusions.

*Emerging roles of HEIs in projects with OI characteristics*

An HEI can assume unique roles within a cooperation framework of different practice partners (see Section 2). Especially if competitors are working together to solve a shared challenge (see OI Dimension 2), the project can greatly benefit from having a third party involved that is not limited by conflicting interests and can take on a mediator role. In projects with OI characteristics, it is important to actively define the roles the different partners will assume. Especially for HEIs, this setting can change the paradigm and expected contribution from an expert- or execution-oriented position to more active knowledge contributor and network facilitator roles. In fact, HEIs can develop many different roles; it is therefore not in the interest of a funding body to pre-define expected roles but rather to urge researchers to explore and define their role within an OI project themselves.

External partners end up perceiving the HEI as a unified entity, even when this is an aggregation of the different roles taken by individual researchers in collaborative projects. Ideally, the strategic level of the HEI reflect on the role of the HEI as a whole as well. In this way, an active role definition impacts the project level, as well as indirectly the enabler and strategic levels.

As can be seen in Table 1 on the role descriptions for HEIs, the internal organization of the HEI needs to generally function efficiently to fulfil these roles. The interplay and alignment between the strategic, enabler, and project levels when taking on a specific role in an OI project is critical (Goduscheit, 2014). However, this interplay should encourage the involved researchers to take on and explore different roles depending on the project phase and other situational needs.

*Supporting known challenges of OI characteristics in projects*

Researchers practicing aspects of OI also face practical daily challenges at the project level. It is therefore important to address these very routine obstacles. While a research project with OI aspects is not defined by incorporating any or all of the elements listed in the previous sections, in particular the barriers to implementing the more challenging aspects should be considered.

In the online survey, three aspects were rated as most difficult at the project level: (i) including multiple disciplines in a task (9), (ii) actively managing partners (8), and (iii) working with roughly defined project outcomes (3) . However, the analysis of the survey did not reveal whether these characteristics are themselves intrinsically challenging or whether the researchers lack experience in the implementation.

As mentioned in the previous chapter, integrating OI characteristics in a project is difficult due to three main obstacles:

- Lack of capacity to adapt to changes in the project plan
- Legal risks are considerably higher and novel at different stages of the project
- Additional costs due to project design are not covered thus methodology is limited

In order to increase methodological skills among Swiss researchers, project funding should take these challenges into account. For example, in projects that have iterative aspects, project phase (stage) funding could be implemented to give researchers the opportunity to continue their work after a first round of successful research and development. Similarly, a reserve fund could be implemented, in cases where a project iteration results in an extension of the project or requires additional team capacity.

*Gaining more experience in OI methodologies and practices*

The following four recommendations address specific aspects of the research design. More than a third of the survey respondents indicated that they do not practice these elements. By directly incorporating them into the requirements of a call for proposals, researchers could gain more experience in dealing with OI aspects.

(1) Stressing the importance and potential of structured methods for incorporating OI aspects: Several OI characteristics directly relate to the methods chosen by the researchers. These include roughly defining outcomes, an iterative design, collaborative methods, and early user involvement. Depending on the focus and intent of the outcome of the research, it may make sense to highlight the potential and preferential implementation of these methods in the call itself.
(2) Defining alternative, project-specific indicators of success: To move away from the conflicting tension between exploratory research and publishable outcomes, other metrics could be defined to support OI projects. These metrics could be defined by the project team itself, making them relevant to the actual project and its goals; or they could relate to specific OI

characteristics that are deemed important, such as the exchange and pooling of resources and information.

Where dissemination is of importance, the quality and quantity of outreach activities can be reported, including, where relevant, how results will be integrated into teaching material, how different stakeholder groups can receive and use results (such as whether the team's network was extended).

(3) Working in a transparent and shared way: While most of the researchers surveyed had experience with traditional public dissemination, making data open is less practiced (90% of data in Swiss repositories is from 3% of all Swiss researchers (Swissuniversities, 2019)).

Ultimately, not only project data can be shared but also additional resources such as IP, personnel, or infrastructure in order to capitalize on shared resources. A call for proposals could provide incentives for sharing resources and/or a framework for making such sharing transparent. Importantly, administrative efforts to facilitate sharing should be kept to a minimum or aggregated between projects to make the process most efficient.

(4) Specific support for multiple competitor involvement: Project teams could be incentivized to bring together competitors facing a shared challenge that can be more effectively solved in collaboration. This could result in horizontal collaborations in a supply chain, as opposed to traditional collaborative funding in the supply chain (i.e., vertically). It might be worthwhile to specifically incentivize such collaborations and roles of researchers by a call for proposals, particularly given the substantial investment by the private sector in R&D and innovation in Switzerland. However, managing a collaborative, yet competitive, environment will have spill-over effects in other areas which were highlighted as challenging for researchers, such as flexible IP and actively managing partners.

Explicitly incentivizing OI aspects in a call will likely increase the frequency of applying these methods in projects, and give researchers the opportunities to practice (and later share) them.

*OVERALL CONCLUSION: Multiple approaches to support OI aspects in Swiss research projects*

For an HEI involved in research projects with OI characteristics, many structural challenges exist which can be supported both from within the HEI and by funding bodies.

Within the HEI, direct support could be offered to the strategic, enabler, or project level. For example, an HEI could provide additional legal services for project proposals and implementation, or specific administrative tasks could be consolidated at departmental levels. In fact, we already see HEIs offering training to their staff researchers as a complementary offer beyond the educational mandates. Thus, HEIs should actively explore their roles in OI projects and take stock of the aspects they are familiar with and the challenges they face.

Promoting OI in research projects through project-based funding will further promote contextualized learning-by-doing among the researchers themselves when facing the OI challenges highlighted by the survey results. We propose three areas where funding agencies can foster OI: in promoting exploration of new actor roles in OI contexts, by addressing the practical challenges researchers face in the projects, and by supporting practitioners who lack experience with general OI practices.

Therefore, we see that a supportive environment within an HEI, as well as the opportunities available for projects involving OI aspects, support the active involvement of HEIs in these types of research projects. New roles for HEIs are emerging and constantly evolving as changes take place in the research contexts. Thus, roles should be reflected on and challenged at intervals, but they are also an evolving product of what is being practiced.

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# 8. Appendix

## Interviews

Semi-structured interviews were conducted with several experts to gain insight into the different views on and experiences with open innovation in an HEI context. The interviewees were selected to incorporate different perspectives. The interviews took place in August and September 2019 before the survey was developed and lasted about an hour each. Depending on proximity, the interviews were conducted either in person or via video chat.

The key insights from the interviews can be summarized as follows:

- Open innovation is understood broadly and not uniquely
- Open innovation is defined differently by actors at different levels (e.g., the quadruple helix model of the European Commission, 2019)
- Each actor group is faced with unique challenges when working in open innovation
- The different interests of stakeholders are sometimes difficult to align
- Researchers involved in projects are at the forefront of open innovation

| **Interviewees** | |
|---|---|
| Mag. Harald Hochreiter | Responsible for Open Innovation Strategy<br>Austrian Research Promotion Agency (FFG) |
| Dr. Martin Jaekel | Head of R&D Unit<br>Zurich University of Applied Sciences |
| Dr. Oliver Verscheure | Executive Director<br>Swiss Data Science Center |
| Prof. Andreas Rüst | School of Engineering<br>Zurich University of Applied Sciences |
| Prof. Stefano Brusoni | Technology and Innovation Management<br>ETH Zurich |

## Survey

The survey was published in September 2019 and was made available online to anyone interested in taking part (hence no representative sampling). The survey focused on the 13 aspects of open innovation projects (as introduced in Section 0) but also encompassed sociodemographic questions and two filter levels to include only researchers affiliated with an HEI who have worked in projects with external partners. The survey was disseminated widely in the Swiss research community through several newsletters.

A total of 153 respondents took part in the survey, 108 of whom passed two filter levels relevant to identify our target respondents and answered the core questions on the characteristics of open innovation projects.

## Institution type

Question:
What type of higher education institution are you currently affiliated with? (If more than one applies, please pick the main institution)

*Table 3 Institution types in survey results*

| N=153 | N |
|---|---|
| ETH / University | 45 |
| University of Applied Sciences | 84[1] |
| University of the Arts | 3 |
| Not affiliated with any higher education institution | 21[2] |

[1] 64 from ZHAW
[2] Respondents without an HEI affiliation were filtered out.

## Working with partners

Question:
Have you worked on a project(s) that has included partners from outside your higher education institution? If so, please indicate all applicable project partners.

HEIs conduct many projects with external partners. Only 7% (n=9) were not involved in projects with partners during the last five years. The other 93% (n=123) had worked on projects as follows:

*Table 4 Partner types in survey results*

| N=123 (multiple choice) | N |
|---|---|
| Yes, with private sector partners. | 97 |
| Yes, with public sector partners or NGOs. | 55 |
| Yes, with members of the general public. | 24 |
| Yes, with other higher education institution researchers. | 97 |
| Yes, one or more of the partners was from outside Switzerland. | 75 |

## Funding

Question:
Which of the following sources have funded your projects with external partners within the last five years? (Choose all that apply.)

*Table 5 Funding sources in survey results*

| N=108 (multiple choice) | N |
|---|---|
| Your higher education institution | 45 |
| Innosuisse (prev. CTI) | 62 |
| SNF | 41 |
| Other Swiss public funding (e.g., Swiss Federal Office of Energy, Canton of Bern, etc.) | 41 |
| Swiss foundation | 23 |

| | |
|---|---|
| Swiss private sector company | 36 |
| International private or public funding | 35 |
| Crowdfunding | 3 |
| Other: | 11 |
| Do not know | 2 |

## Dimensions of Open Innovation Projects

Question:
Now the focus is on your experiences in projects with external partners within the last five years at your current higher education institution. Report your general impressions on the level of difficulty of the following aspects.

*Table 6 OI experience in survey results*

| | Line Percentage | DNA / DNK[1] | Low difficulty | Medium difficulty | High difficulty | *N* |
|---|---|---|---|---|---|---|
| 1 | **Joint problem identification with external partners** | 9.3% | 53.7% | 29.6% | 7.4% | *108* |
| 2 | **Multiple competitor involvement** | 36.1% | 22.2% | 24.1% | 17.6% | *108* |
| 3 | **Roughly defined outcomes that are adapted as the project develops** | 6.5% | 32.4% | 49.1% | 12% | *108* |
| 4 | **Flexible IP practices** | 27.8% | 35.2% | 24.1% | 13% | *108* |
| 5 | **Collaborative methodologies** | 51.9% | 26.9% | 19.4% | 1.9% | *108* |
| 6 | **Iterative project development** | 18.5% | 41.7% | 34.3% | 5.6% | *108* |
| 7 | **Early-user involvement** | 18.5% | 32.4% | 38.9% | 10.2% | *108* |
| 8 | **Active partner management** | 5.6% | 26.9% | 51.9% | 15.7% | *108* |
| 9 | **Collaboration of multiple disciplines in a task** | 8.3% | 26.9% | 44.4% | 20.4% | *108* |
| 10 | **Traditional HEI dissemination activities** | 8.3% | 42.6% | 37% | 12% | *108* |
| 11 | **Publicly available project results** | 13.9% | 45.4% | 29.6% | 11.1% | *108* |
| 12 | **Open data** | 33.3% | 22.2% | 15.7% | 28.7% | *108* |
| 13 | **Alternative indicators of project success** | 49.1% | 20.4% | 21.3% | 9.3% | *108* |

[1] Does not apply / Do not know

Apart from having the aspects rated in terms of their difficulty, subjects were also asked to write what difficulties they had encountered in an open answer section. The subjects were randomly shown up to two aspects they had previously rated as difficult. In Table 7, the subjects' answers are summarized per aspect.

*Table 7 Text answers on OI experience from survey results*

| | | Topics mentioned in open answer section |
|---|---|---|
| 1 | **Joint problem identification with external partners** | • Finding the right contact person to stay committed to the project |
| 2 | **Multiple competitor involvement** | • Multiplied complications of projects due to competition considerations. Projects are weighed down by legal management (i.e., finding agreeing partners, contracts, IP rights, open discussions, financing)<br>• Distribution of responsibilities not clear |
| 3 | **Roughly defined outcomes that adapt with project development** | • Real project implementation causes de-prioritization of iterative elements (limited resource capacity, strict timelines; for some project partners, this is not possible, e.g., for public admin.)<br>• Changes can cause considerable redistribution of work which does not fit in budget<br>• Not everyone agrees on changes to be made, which can cause conflict or loss of interest |
| 4 | **Flexible IP practices** | • No capacity to deal with conflict, contractual problems, misaligned goals, bureaucracy<br>• Conflict between IP rights desired by company and HEI's interest in future research |
| 5 | **Collaborative methodologies** | • Methods not accepted by all partners |
| 6 | **Iterative project development** | • Iterations caused problems in synthesizing results due to multiple disciplines and poor management processes |
| 7 | **Early-user involvement** | • Difficult to find users<br>• Projects too immature to present to public; causes challenges with expectation management, presenting a clear project when it is not yet ready<br>• Legal restrictions |
| 8 | **Active partner management** | • Partners did not perform to expectations<br>• Partners end up working on their own to get things done, thus collaboration potential is lost<br>• Differing opinions had to be managed<br>• Large consortium means increased coordination challenge due to competing priorities, timelines, or geographical distance. |
| 9 | **Collaboration of multiple disciplines in a task** | • Conflict in determining importance of different aspects<br>• Finding a common language, working aims, or values<br>• Methodological differences and teams wanting to do what they are familiar with<br>• Lack of interdisciplinary thinking caused superficial discussions and less content-related collaboration |
| 10 | **Traditional HEI dissemination activities** | • Funding sources not always supportive of dissemination (Innosuisse, in particular for scientific publications, or cost/effort is underestimated)<br>• General disconnect between research and teaching (particularly lack of interest from external partner)<br>• Single discipline easier to disseminate (internal to scientific community) |
| 11 | **Publicly available project results** | • Open access is too costly<br>• Long or no approval by external partners before publication |

| | | |
|---|---|---|
| | | • Not sure how or lack of resources |
| 12 | **Open data** | • Great effort to make data available due to lack of routine, lack of a good platform, lack of quality of data management<br>• Lack of financial resources<br>• Resistance by project partner due to confidentiality |
| 13 | **Alternative indicators for project success** | • Some HEIs only measure scientific publications<br>• Consulting projects measured by economic effectiveness only<br>• Multi-disciplined work is harder as an academic career path<br>• Reporting indicators is not easy |