

# Four archetypes of Open Science Partnerships

## Connecting aims and means in open research collaborations

Maria Theresa Norn<sup>\*</sup>, Laia Pujol Priego<sup>\*\*</sup>, Irene Ramos-Vielba<sup>\*\*\*</sup> and Thomas Kjeldager Ryan<sup>\*\*\*</sup>

<sup>\*</sup>*mtn@ps.au.dk*

<https://orcid.org/0000-0001-7523-2920>

The Danish Centre for Studies in Research and Research Policy, Aarhus University, Denmark, and The Centre for Technology Entrepreneurship, Technical University of Denmark, Denmark

<sup>\*\*</sup>*laia.pujol@esade.edu*

<https://orcid.org/0000-0001-6796-729X>

Department of Operations, Innovation and Data Sciences, ESADE Business School, Ramon Llull University, Spain

<sup>\*\*\*</sup> *iravi@ps.au.dk; tryan@ps.au.dk*

<https://orcid.org/0000-0002-8998-0388>; <https://orcid.org/0000-0002-4763-5308>

The Danish Centre for Studies in Research and Research Policy, Aarhus University, Denmark

### 1. Introduction

A growing number of Open Science Partnerships (OSPs) have emerged around the world (Ali-Khan, Jean, and Gold, 2018; Ali-Khan et al., 2018; Gold, 2021; Gold et al., 2019). They are precompetitive public-private research partnerships that adhere to principles of open science. This includes putting the research outputs into the public domain and precluding participants from seeking Intellectual Property (IP) rights protection on such outputs from the partnership. More specifically, Gold (2021, p. 2) defined OSPs as “private-public collaborations that have certain common elements: open access publications, open sharing of data, tools and materials and the absence of intellectual property rights that restrict improvement or use of jointly created inventions.”

Therefore, the open principles that define OSPs differ markedly from standard practices in precompetitive research partnerships which often restrict the sharing of outputs and allow participants to secure the rights to any IP that may be developed in the collaboration (Stevens et al., 2016). Conversely, OSPs are typically aimed at removing “roadblocks not only to the sharing of information, but to its use” (Gold, 2021, p. 7). They seek to address long-standing challenges associated with the patenting of early-stage basic research, mitigating barriers to university-industry collaboration, and accelerating/strengthening the uptake of scientific research outputs in industry and society.

Despite the growing interest in OSPs, they have been the subject of limited scholarly attention, save for two prior studies on the Structural Genomics Consortium (SGC) (Morgan Jones et al., 2014; Morgan Jones and Chataway, 2021; Perkmann and Schildt, 2015). To counteract this situation, our aim is to shed light on the essence of OSPs, examining their similarities and differences. By furthering our understanding of key differences in how OSPs can be designed and deployed, we hope to inspire both further research into this growing form of collaboration and the potential development of new OSPs.

To this end, we conducted a comparative qualitative study of five OSPs in biomedicine. In this paper, we propose two crucial dimensions in OSP design - *research aims of the partnership* and *degree of industry orientation* - as the basis for four archetypes of OSPs.

These archetypes are intended to provide a starting point for researchers interested in a better understanding of the nature and scope of OSPs, and for practitioners wishing to ensure that means applied match the desired ends that motivated the OSP.

## 2. Data and method

The archetypes are developed based on a cross-country comparative study of OSPs within the biomedical field, in which the vast majority of OSPs has emerged. The selected OSPs were identified through internet searches and assessed according to the following criteria: (i) are public-private partnerships; (ii) involve formal, goal-oriented agreements among at least one public academic partner and at least one private sector partner; (iii) have explicit focus on open sharing of knowledge, data, tools, materials and other research outputs; (iv) preclude participants from seeking IP protection on outputs of the collaboration and have no (or minimal) restrictions on sharing and further use of research outputs; (v) are ongoing at the time of study or completed within the past five years.

Five OSPs met these criteria: The Structural Genomics Consortium (SGC); Open Targets (OT); The Enabling & Unlocking Biology in the OPEN (EUBOPEN); The Early Drug Discovery Unit (EDDU); and The Open Discovery Innovation Network (ODIN). These OSPs are briefly described in Table 1.

Table 1. Presentation of the five OSPs included in the comparative study

OSP	Brief description
Structural Genomics Consortium	SGC is a registered charity whose mission is to accelerate the discovery of new medicines using open science. Its research operations are funded by pharmaceutical companies, governments, and charities who both participate as research partners and in the governance of the partnership. SGC was founded in 2003 as a result of interactions between Glaxo-SmithKline scientists and officials from the Wellcome Trust, inspired by the Human Genome Project. There have been different phases since the beginning of the initiative, with each phase having different goals and different funders. The SGC is currently in its 5th phase (2020-2025). SGC is funded by a combination of philanthropic, government, and industry funding. Initially, the SGC was started with funding from the Wellcome Trust, GlaxoSmithKline, and the Canadian and UK governments. Today, the SGC has a broad range of funders and is operated at different laboratories in Canada, the UK, and the EU.
Open Targets	OT is a large-scale, multi-year partnership that uses human genetics and genomics data for systematic drug target identification and prioritisation. It was established in 2014 with seed funding from GSK as Centre for Therapeutic Target Validation, but was rebranded in 2016 as Open Targets. It's located at the Wellcome Genome Campus in the United Kingdom, and announced in 2019 that it had been renewed for another 5-year period.
EUBOPEN	EUBOPEN aims to generate open-access tools to unlock disease biology, primarily inflammatory related. The partnership is funded by the Innovation Medicines Initiative (IMI) who granted the project 65.8 million euros. The funding also includes cash and in-kind contributions from companies, non-

	EU partners, and partners associated with IMI. The project began in 2020 and has a duration of five years.
Early Drug Discovery Unit	EDDU is part of the umbrella of open science initiatives at the Neuro (the Montreal Neurological Institute-Hospital), a research and teaching institute at McGill University in Canada. In 2016, the Neuro implemented an open science initiative, which was established by the Montreal Neurological Institute (MNI) at the Faculty of Medicine at McGill University, initiated by the director and executive team of the MNI. The open science initiative at the Neuro was originally launched as a five-year experiment (2016-2021). EDDU is an open collaboration among academia, industry partners, and funding partners with the aim to accelerate drug discovery and improve access to treatments for people suffering from neurological diseases. It was initially launched in 2015 as the iPSC/CRISPR Platform with a focus on Parkinson's disease. In 2019, the iPSC/CRISPR Platform became known as EDDU. EDDU lists both philanthropic and industry partners.
Open Discovery Innovation Network	ODIN is a 3-year pilot project (2020-2023) funded by the philanthropic organisation the Novo Nordisk Foundation. It is anchored at Aarhus University in Denmark. It is a platform where academic and industrial researchers can co-create research projects that will help pave the way for better and more efficient drugs in the future. ODIN provides funding for collaborative projects among researchers at Aarhus University and private sector firms. These projects are selected on a competitive basis.

The dimensions and archetypes proposed in the paper have been developed based on: (i) a review of relevant literature, (ii) desk research on the five selected OSPs, and (iii) semi-structured interviews with representatives of each of the OSPs, which were undertaken in late 2021 and early 2022 to identify common features and relevant singularities across OSPs. A preliminary set of possible dimensions for characterising OSPs was then explored in a second round of interviews in early 2023. Resulting ideas for archetypes were presented and discussed at an online workshop held in March 2023 with representatives from the OSPs covered in the comparative study. Thus, the proposed archetypes draw on findings from the comparative study as well as insights and experiences from practitioners developing and leading OSPs initiatives.

### 3. Results

#### *Two key dimensions. How OSPs differ and how this matters*

Our comparative study reveals significant differences across OSPs designs. These differences set the conditions under which the OSP will operate and ultimately shape its outcomes. We consider two crucial dimensions: the *research aims of the partnership* and the *degree of industry orientation*. Both dimensions address key motivations for the establishment of the OSP and its intended aims.

The first dimension, *research aims of the partnership*, concerns the degree to which the OSP is aimed at advancing science within a specified, *focused* direction. Some OSPs pursue very specific aims, for instance the SGC's mission is to understand all proteins encoded by the human genome in order to accelerate the discovery of new medicines. Other OSPs are motivated not by a desire to achieve specific research objectives but rather to promote open



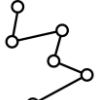

research within a given topic and thus pave the way for more *exploratory* research. For instance, the EDDU's mission is to undertake fundamental research that can lead to the development of new and improved treatments for neurological disorders. What their projects have in common is that they build on induced pluripotent stem cells, but the projects themselves can differ greatly in scope and aims. Similarly, ODIN was established to promote open university-industry collaboration within early-stage drug discovery research. ODIN has funded projects within two thematic areas, biomarkers and target validation, but these were selected not due to specific scientific aims but because they were deemed well-suited for open, precompetitive collaboration. Therefore, we argue that achieving specific, complex scientific aims calls for a different design of an OSP due to the need to ensure direction and to coordinate the efforts of participants.

The second dimension we propose, the *degree of industry orientation*, refers to the extent to which the partnership is explicitly expected to advance the uptake and use of science in industry. Some stated motivations of OSPs seem to give priority to scientific missions over industrial applications. An example of an OSP driven primarily by scientific aims (i.e. with *lower* industry orientation) is the SGC, which aims to advance and enhance the quality of scientific research that ultimately seeds the development of new drug discovery programs. Meanwhile, other OSPs emphasise the involvement of, and expected impact on, industry. An example of an OSP with *higher* industry orientation, driven both by scientific and industry aims is ODIN, which was established to increase and accelerate the use of science in industry. We argue that the degree to which an OSP is explicitly oriented to primarily advancing science as opposed to supporting industry uptake of science will affect key decisions in the OSP, e.g. about the mechanisms set in place for knowledge sharing in the public domain.

#### *Four archetypes of OSPs*

Based on these two dimensions we propose four archetypes for OSPs, as illustrated in Figure 1. These archetypes seek to capture ideal-type models for OSPs based on the aims that motivated them and are presented in more detail in the following.

Figure 1. Four archetypes of OSPs

		Degree of industry orientation	
		Lower	Higher
Research aims	Focused	<b>THE COLLABORATIVE MISSION</b> 	<b>THE COLLABORATIVE CLUB</b> 
	Exploratory	<b>THE COLLABORATIVE NODE</b> 	<b>THE COLLABORATIVE HUB</b> 

1. *The collaborative mission* refers to OSPs which are focused on specific research aims and have a lower degree of industry orientation. These could be large-scale partnerships involving

coordinated efforts pulling in a highly targeted direction. The core activities of the SGC to understand the functions of proteins encoded in the human genome would be an example of this.





2. *The collaborative node* is also primarily scientifically-driven, but rather than concentrating on certain research aims, seeks to engage in more exploratory projects that fit within the scope of the partnership, e.g. based on an existing scientific infrastructure, biobank, set of methods or the like. EDDU provides an example of collaboration built on its existing capabilities and infrastructure to work with induced pluripotent stem cells.

3. Among the OSP archetypes that are more explicitly oriented towards industry in addition to the pursuit of scientific aims, we find the *collaborative club*, which refers to industry-oriented but highly focused partnership on both specific goals and industry needs. Open Targets is an example of such a partnership that has developed a trusted and bounded collaboration amongst selected pharmaceutical companies and research labs to accelerate target identification and validation in key strategic areas of interest for the industry participants.

4. Finally, the *collaborative hub*, like the collaborative node, is more exploratory than focused on its research aims. OSPs of this type are likely to provide a platform for collaborative activities oriented at and closely engaged with industry. ODIN is an example of an OSP which stimulates needs-oriented basic research collaborations developed and executed in close collaboration with industry partners, resulting in a portfolio of heterogeneous activities developed on a bottom-up basis by project participants.

The four archetypes present distinct rationales which are reflected in certain key components of the OSPs. These differences affect how openness is implemented in practice and, subsequently, the corresponding outputs obtained from such collaborative endeavours. These main contrasting characteristics of the OSP archetypes are presented in Table 2.

Table 2. Characteristics of the four OSP archetypes

Archetype	The collaborative mission 	The collaborative node 	The collaborative club 	The collaborative hub 
Rationale	<p><i>Openness to achieve aims by adding knowledge:</i></p> <ul style="list-style-type: none"> <li>- Academic researchers lack scale and coordination</li> <li>- Firms underinvest in science from which it is difficult to</li> </ul>	<p><i>Openness to advance the applications of infrastructure:</i></p> <ul style="list-style-type: none"> <li>- Potential of infrastructure is unknown or underexplored</li> <li>- Seek to ensure economies of scale and scope</li> </ul>	<p><i>Openness to address demand-driven research needs:</i></p> <ul style="list-style-type: none"> <li>- Mitigate barriers related to IP negotiation</li> <li>- Facilitate further use of science</li> </ul>	<p><i>Openness to overcome coordination failures:</i></p> <ul style="list-style-type: none"> <li>- Difficult to align academic and industry interests</li> <li>- Transactional barriers</li> </ul>

	appropriate benefits			
Key component	<i>Large-scale set-up:</i> High-efficiency and high-throughput	<i>A high-quality infrastructure:</i> Substantial scientific and practical/industry relevance/applications	<i>Management of the collaboration:</i> Making sure the moving parts fit together	<i>Intermediation mechanisms:</i> Alignment of interests and within the partnership
Openness	<i>High degree but strict protocols for sharing of outputs:</i> Essential to achieve knowledge aims or to increase impact of infrastructure		<i>Can be mediated/negotiated:</i> – e.g. access to the partnership; sharing within the partnership; restrictions or discretion related to public sharing	
Main output	Generate large amounts of publicly available data to contribute to knowledge base	Extensions and applications of the infrastructure	Accelerate uptake of science	Increase alignment of research and industry needs

#### 4. Conclusion

The growing phenomenon of OSPs therefore calls for fine-grained approaches that are capable of exploring potential implications in the practice of research in domains where collaborative arrangements are usually shaped by IP and in the valorisation of this change in knowledge flows and technology transfer processes.

Towards that goal, our findings uncover that despite fundamental similarities, OSPs are not a homogeneous phenomenon. On the contrary, the OSPs examined show important organisational variety. We propose two dimensions that can help explain key differences across OSPs: their research aims and their degree of industry orientation. Based on these dimensions, we identify four archetypes and further characterise their different supporting rationales and the implementation mechanisms they employ to achieve their goals. Likewise, these partnerships also display differentiated openness patterns conducive to diverse research outputs.

It should be stressed that the archetypes represent ideal types, and not necessarily real-life OSPs. In practice, an OSP may include multiple programs and projects that fit into different ideal types. The purpose of the archetypes we propose is not to capture the full complexity of individual OSPs but to highlight crucial differences in their objectives, which affect the way in which OSPs are designed.

Finally, our proposed archetypes are intended to serve as a managerial inspiration for the design and development of future OSPs, particularly for practitioners and funders, by fostering informed decisions about critical OSP goals and how to organise the collaborative

sphere to achieve both scientific and industry ends. The article may additionally spark new insights and help to identify future research paths in the area of open innovation in science by taking a closer look at different models for OSPs and their functionality.

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## Open science practices

The document studies undertaken and the OSP descriptions developed in connection with the comparative study presented in this paper can be shared, though they have not yet been made openly available. The paper also draws on interview data, which due to GDPR issues is not shared openly, but which can be shared subsequent to removal of personal data.

Moreover, the study draws on close engagement of OSP practitioners from the OSPs included in our comparative study.

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**Competing interests**

The authors have no competing interests to declare.

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