Impact Assessment of ODIN

Interim Impact Assessment of the Open Discovery Innovation Network (ODIN)
Academic report from the Danish Centre for Studies in Research and Research Policy (CFA), Department of Political Science, Aarhus BSS, Aarhus University

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Contents

Executive summary **6**

1.0 Introduction **9**

2.0 Background **10**
2.1/ The emergence of Open Science Partnerships (OSPs) 10
2.2/ The challenges of "closed" collaboration models 10
2.3/ The potential of open partnerships 11

3.0 About ODIN **13**
3.1/ ODIN: key facts and stated aims 13
3.2/ Organization 13
3.3/ Key elements of ODIN 14

4.0 Aims, data and methods **18**
4.1/ Aims and guiding questions 18
4.2/ Impact assessment challenges 20
4.3/ Data and methods 20
4.4/ On citing interview respondents 22

5.0 Intervention logic **23**

6.0 Progress and impact **25**
6.1/ Progress in relation to pre-defined KPIs for ODIN 25
6.2/ Overview of realized and potential outputs and impacts of ODIN 26

7.0 The ODIN projects **29**
7.1/ Projects funded 29
7.2/ Changes from the first to the second call round 30
7.3/ Origin of the idea for the project 31
7.4/ Participants' impressions of the matchmaking 31

8.0 Participants' motivations **34**
8.1/ What motivates academic participants? 34
8.2/ What motivates large research-intensive firms? 35
8.3/ What motivates small and medium-sized firms? 39

9.0 Contributions and collaborations **41**
9.1/ Industry contributions 41
9.2/ Requirement of firms' active contributions 43
9.3/ Impression of the collaborations 44

10.0 Openness in ODIN **46**
10.1/ The open legal framework 46
10.2/ Industry perspectives on openness 47
10.3/ Academic perspectives on openness 50
10.4/ The nature of the collaborative research 52

11.0 Concluding reflections **58**
11.1/ How do ODIN projects differ from other university-industry collaborations? 58
11.2/ Concluding reflections from the interim impact assessment 59

Appendix I. Interview respondents **60**

References **62**

Executive summary

This report presents the findings of an interim impact assessment of the Open Discovery Innovation Network (ODIN), a three-year pilot initiative (2020-2023) at Aarhus University funded via a grant of DKK 54.5 million DKK from the Novo Nordisk Foundation.

The purpose of ODIN is to create a platform where academic and industrial partners can work together in creating new knowledge and research tools within drug discovery.

All results generated within ODIN-funded projects must be made openly available, without the possibility of claiming intellectual property rights (though IP rights can be claimed on subsequent work that builds on ODIN results). ODIN is the first larger-scale implementation of such an open platform for precompetitive public-private collaboration at a Danish university.

ODIN facilitates co-creation of novel research projects and provides funding for selected precompetitive collaborations between academic researchers at Aarhus University and private firms. In addition to developing an open legal framework to ensure compliance with ODIN's openness principles, ODIN has provided funding for a total of 11 collaborative research projects, selected via two call rounds completed in 2020 and 2021, respectively.

Given that the collaborative research projects are still early-stage, it is not yet possible to assess their outputs, much less the broader and long-term outcomes of ODIN. Instead, the interim impact assessment examines motivations and expected outcomes of participants in ODIN-funded projects. These provide some preliminary insights into the possible outcomes of ODIN-funded projects, which can be assessed in subsequent impact assessments.

Moreover, the primary focus of this interim impact assessment is to assess the preliminary progress and possible impacts of the ODIN program as a platform for open university-industry collaboration.

Key results and conclusions from the interim impact assessment are presented in the following.

Already at the time of the interim impact assessment, ODIN has met and in fact exceeded most of its predefined KPIs. Among other things:

- ODIN has developed a novel **open legal framework**, which has been accepted and signed by all participating companies. This legal framework has moreover been adopted by two new Open Science collaborative platforms, one in Canada and a new platform under development in Denmark.
- ODIN has **engaged** more than 100 academic group leaders and more than 40 companies in its network of potential collaborators (substantially over the original targets of, respectively, 30 group leaders and 14 companies).
- ODIN has completed two call for project proposals, based on which a total of **11 collaborative projects** have been selected and funded.

Additional findings from the impact assessment include:

- ODIN's **ideation and matchmaking efforts** were hampered during the first call round by the unexpected first COVID-lockdown and during the second round by another lockdown. Still, five of the 11 projects funded by ODIN did not rely on prior personal contacts but on ideas and collaborative consortia generated within ODIN, underlining the potential of the ODIN program to stimulate novel research collaborations inspired by industry needs and challenges.

- The non-negotiable open legal framework in ODIN is attributed with **reducing experienced barriers** to entering into partnerships and to ongoing knowledge exchanges within projects.

- Processes for the **co-creation of project ideas** in ODIN appear to increase alignment of scientific and industry aims, and to strengthen the practical relevance of joint research. Projects are informed and inspired by needs and unsolved challenges in industry (i.e. "use-inspired research"), which is described by industry participants as a key motivation to contribute to ODIN projects.

- ODIN's requirements of **active involvement of industry partners** in both the design and the execution of projects contributes to collaboration that draws on academic and industrial partners' complementary skills and resources. Moreover, firms make substantial in-kind contributions in the form of intellectual contributions, materials and access to analysis and instruments.

- Industry participants are able to pursue more **high-risk, high-gain projects** in ODIN than they would normally be able to pursue. Many industry participants emphasize that the external funding provided to the academic participants is crucial to allow the firms to participate in these projects, given that the in-house resources in the companies are dedicated to R&D activities with a lower degree of risk.

- For academic researchers, the open, precompetitive nature of ODIN stimulates **more generic and open-ended** research than typical university-industry collaborations which tend to focus on more specific, close-ended research aims. This is expected to accelerate the progress within the scientific areas addressed in ODIN projects as well as to build a foundation of knowledge, data and tools with relevance for a broad range of potential applications..

- The **open principles** behind ODIN are expected by both academic and industry participants in ODIN-funded projects to result in new opportunities for subsequent research and development that may be pursued by participating academics and firms or by any other interested parties.

In summary, ODIN represents a novel and promising approach to promoting university-industry collaboration. As stated, the early stage of the program means that it is not yet possible to assess the outputs or outcomes of ODIN-funded projects. Yet the interim assessment indicates that the ODIN program itself appears successful as a platform for engaging both academic researchers and private firms in collaborative, open research. Academic participants highlight the ability of the program to stimulate open-ended, novel research inspired by industry needs and challenges, while industry participants expect that ODIN-funded projects will lead to significant, novel innovative steps in drug discovery and development.

Moreover, interviews with both university representatives and private sector participants suggest that the development and implementation of the ODIN program has stimulated growing interest in and acceptance of open collaborative practices and knowledge exchange between academic and industry, as a supplement to conventional, "closed" collaborative practices and approaches to technology transfer from universities. Finally, it is worth noting that, as of the time of completion of this report, there has been no detectable decrease in the number of invention disclosures to the Aarhus University TTO.

About the interim impact assessment

The interim impact assessment was undertaken as part of a broader impact assessment of ODIN (2020-2023), which is carried out independently and objectively by a research team at the Danish Centre for Studies in Research and Research Policy (CFA) at Aarhus University.

The aim of this interim impact assessment is to provide preliminary insights into the progress and impact of ODIN. Given that the collaborative research projects funded by ODIN are still early-stage, it is not yet possible to assess their outputs, much less the broader and long-term outcomes of ODIN. The focus in this interim impact assessment has therefore been on:

- Describing the nature and aims of the ODIN program and the intervention logic by which it is expected to meet its aims
- Assessing the progress so far in the overall design and implementation of the ODIN program
- Investigating the motivations of academic and industry participants to engage in ODIN-funded projects, as well as their preliminary reflections on the projects in which they participate.

The interim assessment draws on the following data sources: interviews with academic and industry participants in all 11 ODIN-funded projects, background interviews with representatives from the ODIN organization (incl. the Secretariat, the Steering Group, and the Project Review Committee), and document studies. Data was collected during the period spring 2020 – spring 2022, and the interim impact assessment was concluded in the summer of 2022.

1.0 Introduction

This report presents the findings of an interim impact assessment of the Open Discovery Innovation Network (ODIN), a three-year pilot initiative (2020-2023) at Aarhus University funded via a grant of DKK 54.5 million from the Novo Nordisk Foundation.

ODIN facilitates co-creation of novel research projects and provides funding for the academic component of joint projects with industrial partners, while the latter and other partners (e.g. regional hospitals) fund their own participation through in-kind contributions.

The purpose of ODIN is to create an Open Innovation in Science (Beck et al. 2020, 2021) platform where academic and industrial parties can work together in creating new knowledge and research tools within drug discovery. All results generated within ODIN-funded projects must be made openly available, without the possibility of claiming intellectual property rights (though IP rights can be claimed on subsequent work that builds on ODIN results).

In addition to developing an open legal framework to ensure compliance with ODIN's openness principles, ODIN has provided funding for a total of 11 collaborative research projects, selected via two call rounds (completed in 2020 and 2021). These projects represent the lion's share of activities undertaken within ODIN and therefore the focal point for this assessment.

The aim of this interim impact assessment is to provide preliminary insights into the progress and impact of ODIN. Given that the collaborative research projects are still early-stage, it is not yet possible to assess their outputs, much less the broader and long-term outcomes of ODIN. Expected effects on e.g. innovation in industry will not materialize until the latter phases of the projects at the earliest, and will only fully materialize in subsequent follow-on activities undertaken by participating firms and/or in new, downstream collaborative projects.

The focus in this interim impact assessment has therefore been on: (i) describing the nature and aims of the ODIN program and the intervention logic by which it is expected to meet its aims, and (ii) assessing the progress so far in the overall design and implementation of the ODIN program.

Four questions have guided the interim impact assessment:

- What are the defining features of ODIN, e.g. as compared to conventional frameworks for university-industry collaboration?
- What characterizes the open legal framework developed in ODIN? To what extent (if any) and how does the legal framework and openness principles in ODIN influence the process by which collaborations are entered into and the design of collaborative projects?
- What motivates industry participants and academics researchers to participate in ODIN projects? And what are their preliminary reflections on ODIN and their projects?

The findings of the interim assessment thus provide a first window onto the progress and potential impact of ODIN. The interim impact assessment was undertaken as part of a broader impact assessment, which is carried out independently and objectively by a research team at the Danish Centre for Studies in Research and Research Policy (CFA) at Aarhus University. For the impact assessment (including both this interim assessment and a final impact assessment scheduled for publication in late 2023), CFA has received 750.000 DKK financed via the original ODIN grant to Aarhus University from the Nordisk Nordisk Foundation.

2.0 Background

This chapter briefly reviews prior work on challenges associated with current, conventional approaches to supporting university-industry collaboration and to accelerating and increasing the uptake and utilization of scientific research results. It also addresses possible reasons for the emergence of open collaborative platforms like ODIN.

2.1/ The emergence of Open Science Partnerships (OSPs)

ODIN describes itself as an "Open Innovation in Science" platform. For the purposes of this report, we employ a similar term, Open Science Partnerships or OSPs (Ali-Khan, Jean, and Gold 2018; Ali-Khan et al. 2018; Gold 2021; Gold et al. 2019).

A handful of OSPs have emerged around the world. They are precompetitive public-private research partnerships but stand out from most such partnerships by adhering to principles of open science (Stevens et al. 2016). This includes putting all research outputs into the public domain and precluding participants from seeking Intellectual Property (IP) rights protection on any of these outputs. ODIN is an example of such an Open Science partnership.

The openness principles at the heart of OSPs mark a clear departure from the standard operating procedure in most university-industry collaborations, which are often preceded by lengthy negotiations over the distribution of ownership to any IP that may emerge as a result of the collaboration.

OSPs are often touted as an alternative or at least a supplement to conventional, IP-based collaboration models aimed at achieving what current mainstream approaches to university-industry collaboration are often criticized for failing to do, namely accelerate and strengthen the use of scientific research outputs in industry and society.

2.2/ The challenges of "closed" collaboration models

Over the past fifty years, policymakers around the world have sought to increase the measurable returns on public investments in science (Pavitt 1991, 2001). Among other things, many countries have introduced or reinforced legislation on university patenting, allowing universities to claim IP ownership over research outputs produced by their staff (Geuna and Rossi 2011).

Legislation on university patenting is usually presented as a means of strengthening the use of academic research results in industry. Sometimes it also comes with an expectation that university-owned IP will generate substantial income for a university, even though very few universities in the world make a profit on their patents (Mowery et al. 2001; OECD 2013; Valdivia 2013).

Some countries, like Sweden and Canada, retain the so-called "professor's privilege", where inventors rather than their institutions have ownership over the results of their research. Yet even in these countries, IP rights to research outputs are often determined by agreements between universities and external research funders and collaborators (Geuna and Rossi 2011). In addition, a tendency for universities to emulate the patenting practices of the most prestigious

universities, combined with the development of a community of technology transfer professionals, have led to a harmonization of practices surrounding the distribution of IP rights to research outputs (ibid.).

Hence, in most countries and universities, public-private research collaborations are predated by legal negotiations over, among other things, the distribution of rights to any IP that might emerge from collaboration. However, several challenges with such "closed" collaboration models have been identified.

First, negotiations over ownership to potential IP increase the time and costs needed to enter into collaborative agreements. Key questions include how to assign rights to IP and how to remunerate universities for their contribution to research outputs, which may or may not eventually contribute to the development of new commercial products or services. Such negotiations serve to increase the barriers to university-industry collaboration (Bruneel et al. 2010).

Second, most outputs from university research are embryonic in nature (Jensen and Thursby 2001), making it very difficult to set a price on the value of research outputs. It can easily take years or even decades before their possible applications and actual impact on industry or society are realized (Rosenberg and Nelson 1994; Salter and Martin 2001). Outputs from university research therefore rarely hold intrinsic economic value before they have been incorporated into further research and development (R&D) activities in the private or public sector (David et al. 1992).

Third, scholars have raised concerns that patenting of academic research outputs may limit their diffusion and use by other scientific researchers but also as R&D inputs by companies (e.g. Mowery et al. 2001; Nelson 2006), effectively leading to a privatization of the "scientific commons" (Heller & Eisenberg 1998; Murray & Stern 2007).

These challenges should be seen in the light of the increasing costs and complexity of R&D in industry, as well as decreasing R&D productivity in research-intensive sectors like pharmaceuticals (Gold 2021), calling for effective approaches to stimulating productive university-industry interactions and accelerating the uptake of research.

At the same time, there are growing concerns about the way in which public science is organized, undertaken and made available. These include an erosion of trust in science and frustrations over practices that reward publication rather than the intrinsic quality of research (see e.g. Gold et al. 2019). There is also growing discontent over the limits to the accessibility of published research findings and IP-protected research outputs, leading to an increased focus on the value of public access to findings from publicly funded research (Link & Wagner 2021).

2.3/ The potential of open partnerships

In response to the challenges and concerns described above, a number of Open Science Partnerships (OSPs) have emerged around the world. This includes ODIN but also the pioneering Structural Genomics Consortium (SGC), which was established almost twenty years ago, as well as more recent initiatives such as the Early Drug Discovery Unit (EDDU) at McGill University, the Innovative Medicines Initiative (IMI)-funded EUbOPEN Consortium, the Open Plastic research program at Queen's University, and OpenPlant, a collaborative research initiative between the University of Cambridge, The John Innes Centre and the Earlham Institute.

Gold (2021, p. 2) defined Open Science Partnerships (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." Thus, OSPs can be seen as a subset of precompetitive research collaborations (Stevens et al. 2016) that provide universal access to knowledge and/or IP produced by placing it in the public domain and sometimes foregoing IP entirely.

Despite the growing number of OSPs, these partnerships have been the subject of little systematic research, with the exception of two studies of the Structural Genomics Consortium, one undertaken in connection with an evaluation of the SGC by RAND (Morgan Jones et al. 2014; Morgan Jones and Chataway 2021) and an independent academic study (Perkmann and Schildt 2015). In addition, a handful of articles have highlighted possible benefits of OSPs and some of the mechanisms by which these positive effects may be realized.

First, OSPs may be effective in aligning academic and industry goals and mitigating typical barriers to collaboration. Standard legal frameworks that participants must accept to join an OSP allow academic researchers and firms to quickly and easily enter into collaborations (Morgan Jones and Chataway 2021). In addition, Perkmann and Schildt (2015) argued that OSPs like the Structural Genomics Consortium are effective because they serve as "boundary organizations" that reconcile the goals of firms, academics and funders while mitigating challenges for firms in working in open collaborations. They accomplish this by giving firms a "safe space" in which to disclose R&D challenges, while giving academics an opportunity to engage in scientifically attractive but industry-informed research (ibid.).

Second, the open approach in OSPs has been argued to promote greater uptake of research and support innovation in industry. OSPs create a forum in which firms' needs and challenges can inspire and inform basic research (Perkmann and Schildt 2015; Morgan Jones and Chataway 2021). Simultaneously, firms' know-how help increase the quality and efficiency of scientific outputs as well as their relevance and usability for industry (Ali-Khan et al. 2018; Morgan Jones and Chataway 2021). OSPs can reduce duplication of efforts in academic and especially in industrial R&D, by allowing firms to share unsuccessful lines of inquiry (Ali-Khan et al. 2018). Through open sharing of knowledge, data and other research outputs – and precluding actors from restricting access or use of thereof – they contribute to a knowledge infrastructure that others can draw freely on (Morgan Jones and Chataway 2021) and thus to wider dissemination and use of science in industry and society (Gold 2021). Meanwhile, participating academics and industry partners hold a competitive advantage in the further use of research outputs through the tacit knowledge they build through their collaborative research (ibid.).

OSPs represent a clear step away from the closed, IP-focused collaboration models traditionally pursued in many industries (Dolgin 2014; Stevens et al. 2016; Morgan Jones and Chataway 2021). As such, they may offer a promising supplement to conventional, closed approaches to bolstering the production, dissemination and use of scientific research, but there is still limited insight into their outputs and effects.

3.0 About ODIN

This chapter describes the aims, organization and main activities of ODIN.

3.1/ ODIN: key facts and stated aims

ODIN was established in January 2020 at Aarhus University with a three-year grant of DKK 54.5 million from the Novo Nordisk Foundation, and is set to terminate in October 2023. It is a pilot project that seeks to accelerate drug discovery through an open science approach with a focus on precompetitive research. The goal is to break down barriers between industry and academia in the creation of novel research projects, with a scientific focus area on biomarkers and target validation.

The purpose of ODIN is to offer a platform where academic and industrial parties can work together in creating new knowledge and research tools within drug discovery. More specifically, ODIN facilitates co-creation by academic researchers and private firms of novel research projects. ODIN also provides funding for selected collaborative projects.

The stated aims of ODIN are to speed up drug discovery through the development of open knowledge and data and thereby pave the way for a faster translation of research into new and improved treatments of disease. These aims are to be reached through active two-way collaboration between academia and industry within an open science framework.

All results generated within ODIN-funded projects must be made openly available, without the possibility of claiming intellectual property rights (though IP rights can be claimed on subsequent work that builds on results from ODIN-funded projects).

ODIN aims to create an open environment where all research results are made public, which allows for a broader audience to access, use or re-purpose outputs from ODIN-funded research, and to e.g. develop products that can be commercially protected, and thereby accelerate discovery through collective problem solving.

3.2/ Organization

ODIN is managed by a steering group, a project review committee and a secretariat, which is responsible for the coordination and facilitation of ongoing activities..

The *Steering Group* consists of three deans from the represented faculties at AU, three representatives from companies appointed by Aarhus University, one representative of an industry organization and a non-voting observer from the Novo Nordisk Foundation. The Steering Group sets the overall strategic direction for ODIN, approves or rejects projects, and assesses progress reports.

The *Project Review Committee (PRC)* consists of permanent employees of the involved parties, and all are appointed by the steering group. The PRC assesses project proposals and makes recommendations to the Steering Group regarding which projects to fund.

3.3/ Key elements of ODIN

ODIN includes the following key elements, which are presented in more detail in the ensuing sections:

- Engaging academic researchers at Aarhus University and private companies in the pharmaceutical sector and connecting them to *a digital platform* for the development of collaborative, precompetitive research projects
- Providing *ideation and matchmaking* services aimed at supporting the development of proposals for collaborative projects
- Providing *funding for collaborative projects*,, selected via open, competitive calls for collaborative projects
- Establishing an *open legal framework* for collaboration that all participants on the ODIN digital platform as well as participants in ODIN-funded projects must adhere to

3.3.1/ The digital platform

ODIN has engaged academic researchers at three faculties at Aarhus University (the Faculties of Natural, Technical and Health Sciences) and private firms from the pharmaceutical sector as members on a digital platform, where members can access detailed information about ODIN and ODIN calls, present themselves and their interests in areas for research collaboration, post ideas for collaborative projects, and reach out to other members.

There is no membership fee, and any interested company can join. The platform is also open to researchers and clinicians employed at the Faculties of Natural, Technical and Health Sciences at Aarhus University.

3.3.2/ Ideation and matchmaking services

Emphasis in ODIN is on promoting bottom-up collaboration shaped directly by companies' research needs and priorities. ODIN provides support for the development of collaborative projects in several ways:

- Members can post ideas for collaborative projects or describe current challenges in industry on the digital platform and source inputs and partners from the ODIN community
- On the digital platform, members are also able to look for partners and provide inputs to others
- Both academic and industry members have provided "pitches" of ideas for collaborative projects in virtual events for platform members organized by the ODIN Secretariat
- The ODIN Secretariat can proactively or on request from members provide assistance in making connections among members, e.g. directing industry partners to relevant potential collaborators and vice versa. Among other things, the secretariat relies on networks of industry "ambassadors" to quickly distribute incoming project ideas to the right recipients within the often very large companies.

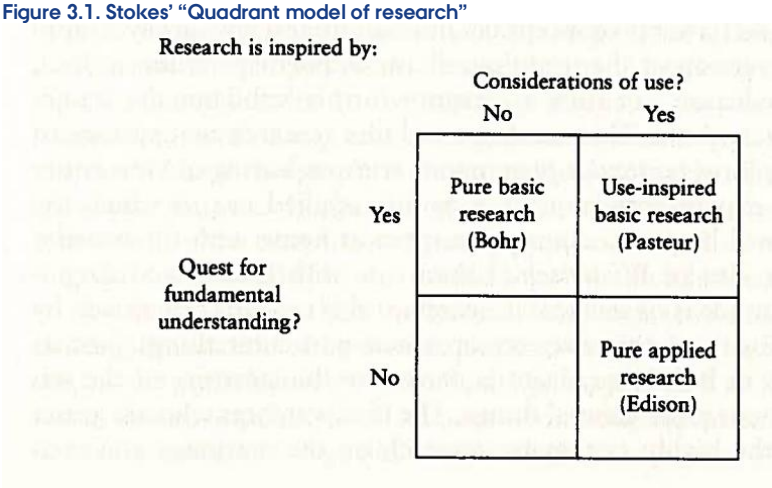
The stated aim of these activities was to promote a bottom-up (co-creation) approach to the development of collaborative projects, driven by needs in industry, also known as "use-inspired" research (see box 3.1 for more information).

Although ODIN projects must address research needs that are highly relevant to the individual companies involved, the projects must not limit their value creation by focusing narrowly on one company's specific needs or on niche applications. Most interaction among members of ODIN has taken place through the digital platform, virtual meetings, and other digital forms of communication. This is due to the fact that the launch of the ODIN platform was followed by the COVID pandemic and lengthy lockdowns.

Box 3.1. Use-inspired research

The notion of use-inspired research was introduced by Stokes (1997). He coined the term "use-inspired basic research" to describe research which is basic in nature but simultaneously motivated by potential uses of the research. This term was developed in criticism of the idea that basic research is motivated by curiosity alone. He visualized his argument in a matrix figure (figure 3.1) and used the term "Pasteur's quadrant" to describe use-inspired research that is motivated both by a quest for fundamental understanding *and* by considerations of use, with reference to the work of Louis Pasteur. Research motivated primarily by a quest for fundamental understanding was described as "Bohr's quadrant", with reference to Niels Bohr, and research motivated primarily by considerations of use as "Edison's quadrant", with reference to Thomas Edison.

Figure 3.1. Stokes' "Quadrant model of research"



Source: Stokes (1997, p. 73)

Use-inspired basic research has been shown to be more common in institutions focusing on applied research – e.g. universities of applied science and hospitals – than in universities (Kolarz et al. 2017). Identifying it can be difficult.

However, the Swiss research funding body SNSF (2022) has proposed the following criteria to indicate that a research project might be use-inspired:

- "Aim: the project aims to produce scientific insights and solve practical problems;
- Cognitive/Conceptual: although the project is primarily concerned with basic science, it might help to resolve practical problems or issues;
- Source of the research question: the question was defined by scientists in collaboration with a user/practitioner community;
- Implementation in the near future: the project has the potential to be implemented in the near future […];
- Types of output: the project will produce academic and non-academic publications;
- Target audience: the results will be made accessible to a lay public outside academia;
- People involved: the research team is composed of scientists and practitioners;

If several of the above-mentioned criteria are met, the project is likely to be use-inspired." (Ibid.)

3.3.3/ Project funding

The bulk of the funding awarded to ODIN by the Novo Nordisk Foundation was distributed as funding for distinct research projects to be completed within the lifetime of the ODIN pilot project. Projects had to address at least one of two preselected topics: biomarkers and target validation.

All projects within the ODIN framework must be co-created with industry and hold relevance for pharma companies with the potential to lead to new pharmaceuticals downstream. Projects must involve academic participants from at least two faculties at Aarhus University as well as at least one industry participant. They must be headed by a tenured group leader or tenure track researcher at Aarhus University. In addition, two-way interaction between academic and industry participants is required in both the idea/proposal development phase and in the actual projects selected and funded by ODIN.

ODIN provides funding for the academic component of joint projects with industrial partners, while the latter and other partners (e.g. regional hospitals) fund their own participation.

Participating companies are not required to provide in-cash funding for the projects in which they participate. However, they are expected to contribute with in-kind resources, including their own time, reagents, analysis on specialized equipment, access to compound libraries etc.

Projects were selected on a competitive basis, and calls for application were open to members of the ODIN platform.

ODIN employs an independent international expert review panel, but decisions regarding allocation of funding are taken by the Project Review Committee. The reviews from the expert panel are prioritized in case of a deadlock in the Project Review Committee.

Proposals received were assessed according to several criteria, including: whether the proposed project was relevant for ODIN's thematic focus areas biomarkers and target validation; whether it addressed unmet needs in both academia and industry; whether it had the potential to lead to subsequent research and/or innovation projects; whether the proposal clearly demonstrated interest and engagement from participating pharmaceutical firms; the scientific quality of the proposed research; the extent to which the project was suitable for and likely to benefit from an open approach; whether the budget was deemed sufficiently cost effective and proportionate to the proposed aim, activities and expected output.

3.3.4/ The open legal framework

All research data and results produced under ODIN must be shared with the public without any restrictions on their further use.

To ensure compliance with the openness principles in ODIN, a legal framework was developed, consisting of the following main elements:

- *All research within ODIN occurs at the pre-competitive stages of drug discovery* (TRL 0-3) – that is entirely without intellectual property (IP).
- *Research data and results must be openly and freely shared with the public.* Industry parties in an ODIN project get to assess outputs before they are shared to prevent accidental publication of confidential information (they have a maximum of 45 days in which to do this) – but they cannot prevent publication of foreground knowledge from the projects.
- *Participants also share (proprietary) materials and technologies within the projects* – but these are not shared with the public, and contributors remain ownership over the assets.

Participants are required to make use of scientific publications, conferences, existing repositories and the like to share their research outputs in accordance with FAIR principles and GDPR. Data are shared e.g. via Zenodo or specialized open databases, through scientific publications, and through events.

Participants, as well as any other interested parties, are free to access, use or re-purpose outputs from ODIN-funded research, and to develop products that can be commercially protected. As such, although no-one can patent the direct open results of ODIN, anyone can use the results for commercial purposes downstream – and even patent the specific application of the results.

Participants in projects funded by ODIN must sign a legal collaboration agreement. The agreement regulates issues related to e.g. governance, handling of IP, confidentiality and publication in an open set-up. The agreement has been designed in a collaboration between the Technology Transfer Office at Aarhus University and nine pharmaceutical companies who served as founding members in ODIN.

The legal framework includes both a framework agreement between Aarhus University and participating companies as well as a project agreement template for use in all ODIN-funded research projects. This agreement is non-negotiable, which means that the terms and conditions are the same across all ODIN projects – and projects can be initiated without lengthy negotiation session. For more details on the ODIN legal framework, see section 10.1.

4.0 Aims, data and methods

This chapter introduces the aims, approach, data and methods of the impact assessment.

4.1/ Aims and guiding questions

The aims of the impact assessment are to document and assess the *progress* and *impact* of the Open Drug Discovery Network (ODIN) pilot project.

The impact assessment is intended, first, to provide documentation for progress and impact in ODIN to funders, participants, stakeholders and other interested parties. Second, it is intended to help inform decisions about ongoing adjustments of ODIN and about possible extensions to or potential scaling up of the activities in ODIN beyond the pilot phase.

Finally, ODIN takes a novel approach to collaboration between academic researchers and industry; it is one of just a handful of Open Science platforms for precompetitive research collaboration worldwide. Participants in ODIN-funded projects must forego the option of patenting results and commit to open sharing of knowledge, technologies, methodologies, data and software produced in the projects. For many, this is a welcome approach that has grown out of concerns regarding the negative consequences of the increased focus on patenting of early-stage research results and dissatisfaction with IP-based frameworks for university-industry collaboration that have diffused across the world since the 1980s (see e.g. Norn 2016, Gold 2021). As such, results and lessons learned from ODIN are of great interest to e.g. policymakers, university and industry management, scholars of university-industry collaboration, and research funders. The impact assessment is therefore also aimed at providing insights into the lessons to be learned from ODIN, and how such lessons may inform other initiatives to bolster the effectiveness of university-industry collaboration, the uptake of science in industry, and ultimately the return on societal investments .

The results of the impact assessment are reported in this *interim report* and in a *final report* (expected to be published in late 2023).

Focus in the impact assessment is thus not on documenting concrete outputs from ODIN – this is the responsibility of the ODIN Secretariat – but rather to shed light on what defines ODIN, on its outcomes, and on lessons to be learned from ODIN. The preliminary set of questions guiding the overall impact assessment as well as the interim and final assessments are listed in table 4.1. These questions were identified and formulated by CFA. No a priori questions were formulated by ODIN or the Novo Nordisk Foundation for the impact assessment.

Table 4.1. Impact assessment questions

Questions guiding the overall impact assessment
What are the defining features of ODIN, e.g. as compared to conventional frameworks for university-industry collaboration – and what are the implications of these features for the impact of ODIN?
To what extent do ODIN-funded projects yield (un)intended outputs and outcomes, and to which extent are these outputs and outcomes attributable to the defining features of ODIN?
To what extent (if any) and how does the ODIN open legal framework and openness principles in ODIN influence the process by which collaborations are entered into, the design of collaborative projects, outcomes of these projects, sharing within/from projects etc.?
Questions guiding the interim impact assessment
What are the defining features of ODIN, e.g. as compared to conventional frameworks for university-industry collaboration?
What motivates industry participants and academics researchers to participate in ODIN projects? And what are their preliminary reflections on ODIN and their projects?
What characterizes the open legal framework developed in ODIN?
To what extent (if any) and how does the legal framework and openness principles in ODIN influence the process by which collaborations are entered into and the design of collaborative projects?
Questions guiding the final impact assessment
To what extent and how do ODIN-funded projects differ from other collaborative projects that the participants have been/are involved in?
What changes have participants in ODIN-funded projects noted in their project – and why did these changes occur?
What are the preliminary outputs and benefits of ODIN-funded projects, as reported by project participants? To what extent and why can these outputs and outcomes be attributed to the defining traits of ODIN and/or to realized inputs/interventions of the ODIN pilot project? And how do preliminary outputs and outcomes compare to the intended outcomes of the ODIN pilot project and of the individual ODIN-funded projects?
Have participants (academic or industry) initiated other projects or activities as a result of their involvement in ODIN / ODIN-funded projects? If so, which types of projects/activities, and how were they related to ODIN?
What are the (positive and/or negative) implications of the ODIN open legal framework as perceived by project participants? To what extent (if any) and how does it influence the process by which collaborations are entered into, the design/outcomes of collaborative projects, sharing within/from projects etc.?

4.2/ Impact assessment challenges

All evaluations of collaborative research programs face certain challenges, which must be addressed in the design of the impact assessment. Oft encountered challenges in assessing the impact of such initiatives include, according to Martin (2007):

- *Causality issues*, i.e. that it can be difficult to attribute outcomes to the specific activities or events that caused them
- *Attribution issues,* i.e. that it can be difficult to distinguish between the contribution to an outcome from a specific set of research activities versus other inputs that have or may have contributed to the outcome, and
- *Evaluation timescale issues,* namely that premature impact assessment cannot capture the full impact of the activities, as wider, longer-term outcomes, however important, cannot yet be reliably assessed.

In addition, even the best indicators used in impact assessment only capture an imperfect or partial picture of impact (Spaapen and van Drooge 2011; Perkmann et al. 2020). Finally, different stakeholders have different perceptions of what constitutes valuable socio-economic impacts of research (Spaapen and van Drooge 2011).

Moreover, ODIN pursues a novel, open IP-based approach to collaborations, and is among but a handful of similar Open Science Partnership initiatives worldwide. Such initiatives have so far been the subject of little systematic study or assessment. This means that there are limited, directly relevant findings to draw on in the design and execution of the ODIN impact assessment.

4.3/ Data and methods

The impact assessment has been designed to as to take into account difficulties related to causality and attribution issues, as well as the novelty of the ODIN approach and the relatively small number of projects funded by ODIN (11), by adopting a *qualitative research design*.

Qualitative data from ODIN-funded projects provide rich and nuanced data on motivations and contributions of project participants, as well as on the activities, outputs and outcomes of projects. This allows for the impact assessment to identify and explore a broad range of potential impact indicators, as well as taking into account issues concerning the timing of the impact assessment. Such timing issues are particularly salient in the assessment of an initiative aimed at early-stage research that can accelerate and advance drug discovery – a translation process that can take many years and even decades. As such, the assessment of the ODIN project can only aim to identify early signs of downstream value creation rather than an assessment of the actual, full set of outcomes of the ODIN project. A more reliable assessment of these broader impacts of ODIN would require later follow-up studies of the activities funded by ODIN.

As stated earlier, the impact assessment consists of two main parts: an interim assessment (in 2022) and a final assessment (in 2023). The data collection behind these two assessment reports rests on the methods and data sources outlined in table 4.2.

Full lists of interview respondents are included in Appendix I.

Table 4.2. Overview of methods and data

Methods	Description of the data collected as of March 2022	Source of data
Document studies	Written materials describing aims, activities etc. of ODIN Original applications for the projects funded by ODIN (provided by the ODIN secretariat)	Provided by the ODIN Secretariat (ongoing) Additional documents were downloaded from the ODIN website and digital platform
	Data on funded projects and project outputs as well as data on overall achievements in ODIN (including data on KPIs established by ODIN in dialogue with the Novo Nordisk Foundation)	Provided by the ODIN Secretariat (ongoing)
	Comparative study of the ODIN legal framework with the standard "fast track" contract used for collaborative projects with industry involvement at Aarhus University (focus: rights; transfer of rights; publication terms)	Documents provided by the ODIN Secretariat and downloaded from an internal Aarhus University website
Background interviews	With the ODIN secretariat (initial background interview and ongoing dialogue) Members of the ODIN Project Review Committee (5) and the ODIN Steering Group (1) A management-level representative of the Aarhus University Technology Transfer Office that supported ODIN in developing the ODIN legal framework (1)	Primary data collected by the CFA research team via semi-structured interviews Respondents were identified in dialogue with the ODIN Secretariat Interviews were transcribed
Interviews with ODIN-funded projects – principal investigators (PIs) and industry participants	All 13 PIs (two of the 11 projects had two PIs) were contacted and interviewed (though the resources available for the assessment did not allow for interviews with additional academic participants); in total, 13 out of 13 PIs were interviewed All industry participants were contacted; five industry participants declined to participate or did not respond to requests for an interview. In total, 13 out of 18 instances of industry participation in ODIN-funded projects were interviewed	Primary data collected by the CFA research team via semi-structured interviews Industry respondents were selected by CFA Interviews were transcribed and analyzed (coded) using the qualitative data analysis software NVivo

The data described in table 4.2 formed the basis for this interim report. A second round of interviews is planned for 2023, towards the end of the ODIN project, and will contribute with additional empirical data for use in the final impact assessment.

It should be noted that we did not have access to applications that were not funded by ODIN, nor to the applicants behind these applications. Thus, the insight of the CFA team into academic researchers and company participants involved in ODIN is based solely on the perspective of those who were involved in successful project applications, whose perspectives on ODIN are likely to differ, at least to some extent, from the perspectives of those who were not.

The impact assessment design and execution were guided by an *intervention logic*, which set out how ODIN was intended to work, and to what effect, at the outset of the project. Please refer to chapter 5 for more information on this intervention logic.

In addition, the impact assessment is informed by insights from two related, ongoing studies:

- *A self-funded comparative study of Open Science public-private research partnerships* in biomedical research (by the CFA research team in collaboration with Marie Louise Conradsen, Head of Open Science at Aarhus University, and Laia Pujol Priego, Assistant Professor at Esade, Ramon Llull University)
- *A study of ideation and matchmaking processes in ODIN* (by an international research team headed by Marion Pötz, Scientific Director of the LBG Open Innovation in Science centre, Vienna, and Associate Professor, Copenhagen Business School, and Laia Pujol Priego – in collaboration with the CFA research team).

4.4/ On citing interview respondents

This report includes selected quotes from the interviews undertaken. The following approach is used to refer to respondents:

- (Academic participant, PI*x*) refers to a principal investigator in an ODIN-funded project. PIs were assigned, and are identified by, a number (PI1 to PI13).
- (Industry participant, I*x*) refers to an industry participant in an ODIN-funded project. They were assigned, and are identified by, a number (I1 to I15). Where relevant, the interview references specify whether the respondent is employed in an SME or a large pharmaceutical firm.
- (PRC/SG representative from academia/industry, B*x*) refers to a background interview with a representative from the ODIN Project Review Committee (PRC) or Steering Group (SG). It is specified whether the respondent represents industry or the university (B1-B6).

Occasionally, respondents had multiple roles, e.g. both as an academic or industry partner in a project and in the Steering Group. In this case, to preserve the anonymity of the cited respondents, a quote refers only to the role of the respondent, which was most relevant for the part of the interview that the quote was drawn from.

5.0 Intervention logic

This chapter presents an intervention logic for ODIN, that is a description of the motivations for and desired effects of the ODIN pilot project, and of the means by which the project is intended to create the effects.

To understand the impacts of ODIN, we must first understand its original intentions and intended impacts. To this end, figure 5.1 illustrates the intervention logic behind the ODIN program, as interpreted by CFA.

The intervention logic treats ODIN as an *intervention* made to achieve certain aims. It sets out how the ODIN initiative was intended to work, and to what effect, at the outset of the initiative. It includes the original *motivation* for ODIN as well as the intended *long-term impacts* of ODIN.

The intervention logic also describes how the overall motivation to establish ODIN has been translated into more specific *aims* and *activities*, as well as the possible *short-term outputs*[1] and *mid-term outputs and intermediate effects* from these activities.

Moreover, the figure distinguishes between two sets of aims, activities and outcomes: those at the *program level* (the ODIN initiative itself, as driven by the ODIN Steering Group and Secretariat), and those at the *project level* (the ODIN-funded projects, as driven by the participants of the 11 projects that have been awarded funding from ODIN).

The intervention logic represents the CFA team's interpretation of the aims, activities, outputs and outcomes of ODIN. It is based on a study of documents pertaining to ODIN, including the original application to the Novo Nordisk Foundation and other documents describing ODIN aims and activities. It is also based on data collected from background interviews completed in connection with the interim impact assessment.

[1] While intervention logic models distinguish between *inputs* (e.g. additional resources attracted to a given intervention) and *outputs,* for the purposes of this study, we include relevant input indicators as short-term outputs (e.g. the contributions of private firms to the projects in which they participate), since attracting such additional inputs to activities within ODIN is part of the aim of the ODIN initiative.

Figure 5.1. The ODIN intervention logic

6.0 Progress and impact

This chapter presents an overview of available indicators and information about the progress and impact of ODIN at the time of the interim impact assessment (in March 2022).

6.1/ Progress in relation to pre-defined KPIs for ODIN

ODIN measures its own progress according to a number of predefined KPIs which have been agreed upon with the Novo Nordisk Foundation. These KPIs mostly concern activities necessary for ODIN to be able to attain its goals (e.g. developing the open legal framework, getting more academic researchers and companies involved in ODIN etc.)

Table 6.1 below presents the status on formal KPIs for ODIN as of March 2022. As apparent from the table, ODIN has exceeded most of its KPIs at the time of the interim impact assessment. One KPI ("number of new research avenues that emerge as a result of ODIN") concerns outcomes that cannot yet be assessed.

Though ODIN pursues a strict "no IP" policy, it is worth noting that data from the Technology Transfer Office, provided by the ODIN Secretariat, show no negative effect yet from ODIN on invention disclosures at Aarhus University; in fact, the number of disclosures is expected to increase in 2022 given the number of invention disclosures received in the first half of the year.

Table 6.1. Overview of KPIs in ODIN

KPI	Goal	Status
Organizational development		
Establishment of an open legal framework	Yes	Yes
Number of PIs involved	30	107
Number of PhD students + postdocs involved	30	29*
Number of industrial companies involved	15	44
Productive interactions		
Number of ODIN projects created and funded	5-7	11
Number of new research avenues that emerge as a result of ODIN	2-4	N/A
Number of lectures/pitches given by industry in ODIN	12-15	12

*29 are involved in funded projects. An as of yet unknown number of postdocs have contributed to rejected applications and ideation.

Source: Data provided by the ODIN Secretariat.

6.2/ Overview of realized and potential outputs and impacts of ODIN

The assessment of the preliminary progress and impact of ODIN presented in this interim impact assessment report should be seen as just that: preliminary.

All ODIN-funded projects are ongoing. Results from these projects cannot be expected until the end of the project period and months thereafter. Moreover, the full impacts of these results will not materialize until years after the end date of the project, given the basic, precompetitive nature of the research collaborations and the long R&D and innovation processes in the pharmaceutical sector. As such, it is not yet possible to assess the outputs of ODIN-funded projects, much less the broader impacts of ODIN itself.

This section however presents an overview of the *possible outputs and impacts* of ODIN as well as results that have already been achieved. The tables on the following pages distinguish between (i) outputs, (ii) immediate impacts, (iii) intermediate / mid-term impacts, and (iv) long-term impacts.

Table 6.2 presents possible outputs and impact indicators at the level of the overall ODIN project, while table 6.3 presents outputs and impact for individual projects funded via ODIN. Both draw on selected concepts from the intervention logic presented in chapter 5.

In addition, the tables include a column for predefined KPIs for ODIN. This includes the formal KPIs reported on in section 6.1, which are specified in the ODIN grant letter from the Novo Nordisk Foundation, but also a series of additional, so-called "ambition KPIs" described in the original application for ODIN to the Novo Nordisk Foundation. Both of these sets of KPIs are pursued by the ODIN Secretariat and are therefore included in the table.

As apparent from table 6.2, ODIN has met (and in many cases surpassed) its goals for activities and preliminary outputs at the time of the interim assessment. The outputs and initial impacts of the ODIN-funded projects (table 6.3) cannot be assessed until the end of the ODIN project period at the earliest.

Table 6.2. Overview of measurable output and effects in from the overall ODIN program

Aims	Activities	Predefined KPIs	Short-term outputs	Mid-term outputs and intermediate impacts
Establish the ODIN "concept" as a viable model for open university-industry collaboration	Develop procedures to carry out ODIN aims Develop an open legal framework	Open legal framework is developed	The ODIN concept is established and implemented (incl. procedures, written materials etc.) Open legal framework developed and signed by all participating firms	The legal framework has been approved by two other Danish universities, University of Copenhagen and the Technical University of Denmark, and applied in two new platforms: Open Plastic (established) and Plant2Food (under development)
Build a network of potential collaborators	Engage relevant academic researchers in the ODIN network	30 PIs and 30 PhD students/postdocs involved	107 academic researchers (group leader level or higher) have been associated with ODIN 70 unique * researchers (group leader level or higher) involved in 32 applications 50 unique researchers (of which 27 are group leader level or higher) involved in funded projects. 29 postdocs/PhDs involved in funded projects.	
	Engage relevant industry partners in the ODIN network	15 industrial companies involved	44 companies have been associated with ODIN (grown from 9 original partner firms) 11 active participating companies ** – and 37 individual industry participants – in funded projects	
Facilitate ideation and matchmaking	Develop digital platform Support matchmaking and ideation (through the digital platform and ad hoc matchmaking)	12-15 lectures ("pitches") by industry partners at ODIN/Aarhus University	Digital platform established 60 project ideas posted on the platform 31 pitches by companies (12) and researchers (19) 33 project applications received (32 of which met requirements and were eligible for review)	
Fund selected projects	Carry out competitive call rounds Assess and select proposals for funding	5-7 open research projects that would not have occurred without ODIN	11 projects selected via two competitive call rounds 5 of the 11 projects were directly shaped by ODIN: this included four projects where initiating researchers located industry partners through ODIN, and one project where an initiating private firm located academic partners through ODIN	

* Several researchers participate in more than one project – but are only counted once here. ** Of which 3 companies are each actively involved in respectively 3, 4 & 5 funded projects.

Source: Both data provided by the ODIN Secretariat and primary data collected by the research team at CFA.

Table 6.3. Overview of measurable output and effects in ODIN from ODIN-funded projects

Aims	Activities	Predefined KPIs	Short-term outputs	Mid-term outputs and intermediate impacts
Carry out novel open, collaborative research projects	11 collaborative research projects funded by ODIN	2-4 new research avenues emerge 5-15 multi-group publications with industry	Results, data, methods, technologies and other outputs from projects (including negative results, e.g. identifying paths that are not feasible or fruitful) Scientific publications, including co-publications with industry partners	New research avenues that emerge as a result of ODIN Follow-on academic research projects (and attraction of funding with which to pursue them)
Promote bidirectional knowledge exchanges and commercial applications of research outputs from ODIN-funded projects	Promote active involvement of industry partners and two-way collaboration Stimulate commercial use of research outputs	3-7 planned or realized downstream projects (e.g. closed IP collaborations or in-house R&D) 10-15 ODIN industry partners actively use ODIN outputs for innovation/optimization purposes 1-2 start-ups established or planned	Industry contributions to projects, including intellectual contributions (20 instances), material contributions e.g. compounds, tissue samples etc. (6 instances), performance of analyses or access to instruments, facilities or technologies (18 instances) and training, hosting or exchange of researchers (2 instances) Bidirectional knowledge exchanges within projects "Productive interactions" (i.e. stakeholders use or apply research results or information, experiences etc. gained via the interaction)	Downstream R&D projects driven by industry (in-house; collaborations with academia; collaborations with other firms) Spinouts based on outputs generated in ODIN Downstream IP citing research produced in ODIN projects
Boost openness in precompetitive research	Open sharing of project outputs in the public domain	N/a	Project outputs are accessible and used by third parties (that have not been involved in the project)	Reduced duplication of effort in science and industry R&D Accelerated progress in science and industry R&D
Support training (in academia) and R&D capacity building (among industry partners)	Training of young researchers Other training and staff exchanges	10 students, PhDs or postdocs recruited by industry	29 PhDs and postdocs involved in funded projects 37 industry researchers involved in funded projects Researcher exchanges Students or young researchers from ODIN projects recruited by industry	Training of young researchers incl. exposure to knowledge needs and R&D practices in firms Increased research insight and/or capacity among staff employed by industry partners (e.g. in new methods of technologies) Increased capabilities for collaborative research among project partners

7.0 The ODIN projects

This chapter briefly introduces the projects funded via ODIN as well as information about how the ideas and collaborative teams behind ODIN projects were funded.

7.1/ Projects funded

A total of 11 collaborative research projects have been funded by ODIN.

Five projects were granted funding in a first call for project proposals in 2020, and an additional six projects received funding in a second call in 2021.

All projects included academic participants from at least two faculties at Aarhus University, and at least one participating company. Most of the company participants are large pharmaceutical companies, though some of the projects also include small or medium sized companies offering specialized expertise and services, and one biotech firms.

Table 7.1. Overview of project applications and funded projects, in both call rounds

	Call round 1	Call round 2
Number of ideas posted	37	23
Number of applications received	19	13
Resubmitted applications	n/a	3
Nominated / funded projects	5	6
Max budget / duration per project	7.5 M DKK / 2.5 years	4.5 M / 2 years
Funding	21.8 M DKK (allocated)	23.9 M DKK (allocated)

Source: Data provided by the ODIN Secretariat.

7.2/ Changes from the first to the second call round

Based on interviews with members of the ODIN Project Review Committee (PRC), a number of changes from the first call for ODIN project proposals (completed in 2020) to the second call round (completed in 2021) can be observed.

The ideation and matchmaking activities in ODIN were hampered by the onset of the COVID pandemic and the first nationwide lockdowns in 2020. Originally, these activities were intended to occur via face-to-face interaction. The lockdown made it necessary to undertake these activities online, while shortening the time available for them due to the first lockdown. By the second call round, the ideation and matchmaking activities had been designed for a virtual format. PRC representatives felt this was reflected in the proposals: whereas proposals in the first round drew more on existing personal networks between academia and industry, a larger share of proposals received in round 2 has been established or at least partly shaped (in their idea or set of partners) by participation in pitches and matchmaking efforts. See also section 7.3 for more information on the origin of the ideas and teams behind ODIN projects.

PRC representatives interviewed all felt that applicants in the second call round demonstrated a better understanding of ODIN and ODIN aims. They also pointed to an improved fit of proposals with the ODIN themes (biomarkers and target validation), as well as a higher overall perceived quality of proposals in round 2 (which they attributed partly to more time for the development of proposals in the second round, as well as several resubmitted applications).

In the second round of proposals, industry representation in applications was perceived as stronger, in the form of clearer description of industry needs or interest in the project as well as higher levels of commitment to the projects from contributing companies. One PRC member attributed to improved facilitation/matchmaking in the second round, strengthened communication and understanding of ODIN aims, and more time for pitches and matchmaking efforts.

Some PRC members also felt that proposals in the second round were more thorough in their citation of prior art, which they had felt was overall insufficient in the first round of proposals. During the second round, in their own assessments, the PRC also placed more emphasis not only on the thematic focus, openness principles and requirements of active company engagement in proposals and projects, but also on the degree of novelty of the projects proposed.

Finally, several PRC members addressed the issue of gender diversity in the group of principal investigators (PIs) leading the academic component of the ODIN-funded projects. The first 5 ODIN projects were led by 5 male PIs and 1 female (one project has two co-PIs). The PRC members stressed that the pool of PI applicants in the first call round was heavily gender skewed, whereas the second call round included a substantially higher proportion of applications led by female PIs. The projects funded in this second round were led by 2 male PIs and 5 female (again, one project has two co-PIs).

7.3/ Origin of the idea for the project

This section examines (based on data collected from interviews with project participants): Where did the idea for the project come from, and how was the team assembled?

As mentioned in the previous section, ideation and matchmaking activities during the first call round were hampered by the COVID-pandemic and the unprecedented first lockdown in spring 2020. The second call round included more time for the development of proposals, and was designed to take place virtual through virtual pitches and matchmaking.

This is reflected in table 7.2, which highlights that most projects funded in round 1 were established through existing personal networks, where the majority of round 2 projects consisted of ideas and teams assembled through ODIN, during the ideation phase.

Table 7.2. Origin of ideas and collaborative teams in projects funded in the first and second call round

	Round 1 projects	Round 2 projects
PI had the idea. Reached out to industry partner(s) through personal network	4	2
PI had the idea. Identified industry partner(s) through ODIN (e.g. pitches or via the ODIN secretariat)	1	3
Idea came from a company; the team was assembled through ODIN	0	1
Total	**5**	**6**

7.4/ Participants' impressions of the matchmaking

As evident from the previous section, some project teams, particularly in the first call round, did not make use of ideation and matchmaking activities, given that they were based on preexisting ideas and existing personal ties between academic researchers and industry.

In contrast, in other projects ideation and matchmaking efforts played a key role, e.g. in the form of virtual pitches by academic researchers or interested companies, contacts established directly through the digital ODIN platform, or support from the ODIN Secretarial in identifying and connecting to potential partners. Generally speaking, the interviewed project participants who had made use of these possibilities had a very positive assessment of them. One researcher pointed out that ODIN's openness principles are reflected not only in the open sharing of research outputs from the projects but also in the ideation process:

> *"[The idea with] the ideation process – to really open up and discuss what are the needs, what do we have in academia, how can we utilize it, how can we come up with projects that are relevant, and to have this open discussion – is really new. […] In the ideation phase you can come and talk openly about your ideas, your project, your expertise – and anybody can chip in and discuss projects: […] do we have some feedback for you, are we interested, do we have some ideas. So there's an openness in how the projects are conceived and designed." (PRC/SG representative from academia, B5)*

Both academics and industry representatives pointed to the virtual pitches as a key mechanism for forging new ideas and collaborative ties, and to the potential to strengthen the competences of the ODIN platform members in making the most of these pitches. As one industry participant stated:

> *"I actually participated in these meetings in the beginning [...] to find partners even though we already had a project and partner. [...] For people that were interested [in locating partners], I found it quite interesting that, you know, there are these opportunities for you to actually build your own projects. And that ideas could actually spark from this. And it gives the opportunity to network also with people that you usually don't really have access to. [...] It seemed like there was a lot of opportunities to do stuff. I also learned about activities in other companies. [...] There were more opportunities than what we usually could obtain just by ourselves, just by talking with the individual people in the individual companies or universities that you know." (Industry participant, I13)*

Both academic researchers and especially industry representatives firms describe ODIN as an *eyeopener* with regards to the knowledge and competences available in, respectively, industry or at Aarhus University.

> *"For me, it's really been an eyeopener to see how many exciting possibilities there are at Aarhus University, and how much exciting research is going on there." (PRC/SG representative from industry, B4)*

Industry respondents stress the value of ODIN in expanding their academic networks. Several academic researchers also expressed that the ODIN set-up provides "points of entry" into industry in the form of relevant potential collaborators, which they had no prior knowledge of or access to. Several researchers highlighted the involvement of "industrial ambassadors" for ODIN (see Box 7.1 for more information), that is, industry managers that facilitated access to their companies, e.g. acting as gatekeepers to the firm, helping to identify relevant persons to contact within the firm's internal R&D organization. For instance, as one PI explains:

> *"Initially [...] I knew the stuff that I was doing was relevant for the pharmaceutical industry, but I didn't have any strong contacts with the industry [...]. I saw an opportunity [in ODIN] and I briefly described the ideas that I had and they suggest that I could present, pitch, my ideas at this matchmaking event, 'Pitch your idea' I think it it's called. And there was some interest from [company x] ..., and then [member of the ODIN Secretariat] helped us to establish a connection with [gatekeeper person] from [company x]. [...] I think I had a brief Zoom meeting with him and then [the academic team] ... drafted our ideas on a piece of paper that we sent to [gatekeeper] and he established some contacts internally to some colleagues ... Yeah, that's how it all started." (Academic participant, PI10)*

These "industrial ambassadors" are people who have been engaged by ODIN to support the matchmaking and ideation activities from within partner companies. The ODIN Secretariat meets regularly throughout the ideation phase with one to four representatives from partnering companies to present them with new ideas posted at the ODIN digital platform and discuss with them whether or not the company is interested in the idea. If interested, the ambassadors will distribute the idea to relevant colleague(s) within the company with the aim of shortening the time needed for matchmaking and increasing its efficiency. This is motivated by the recognition that university researchers often find it difficult to find the right point of entry into large pharma companies, and because companies do not consistently monitor ideas posted on the digital platform.

The typical profile of an industrial ambassador is an innovation director or a head of a relevant research department. According to the ODIN Secretariat, these ambassadors are considered

key opinion leaders within the company and have in-depth knowledge of company strategies and activities. As such, the industrial ambassadors can act as both gatekeepers and matchmaking facilitators – with the necessary mandate to make decisions and move projects forward within the company, even in other departments than their own.

Several respondents describe the attempts at matchmaking in ODIN as a key distinguishing feature of the initiative. For instance:

> *"I think the ODIN program has made a lot of effort to try to facilitate these bilateral interactions and to try to create some connectivity between Aarhus researchers and our own researchers. […] This is something, I think, that really sets it apart from IMI [i.e. Innovative Medicines Initiative, a public-private partnership] this proactivity, this thing about creating a framework for meeting and finding a 'fit' between your interests. You're just on your own when you're sitting in some EU program. Then you just hope that 'if we force some academics and some industry people to sit around the same table, something sensible will probably happen.' And that does sometimes happen. But in many cases, it doesn't. […] I also liked the idea that the pharma/industry side got the opportunity to pitch some ideas, like problems or challenges we would like help solving […]." (PRC/SG representative from industry, B4)*

Several PIs as well as industry representatives called for more academics to become involved in ODIN, should future calls emerge. For firms, this increases the pool of potential collaborators to draw on. For academic researchers, it has the same effect, given that projects ideally had to involve representatives from at least two faculties at Aarhus University, and that some of the matchmaking processes involved a search for relevant academic partners at the university.

8.0 Participants' motivations

This chapter focuses on how representatives from academia and from industry describe their motivations to participate in ODIN-funded projects.

8.1/ What motivates academic participants?

The two most often cited motivations for academic participants were, first, that ODIN was seen as a *possibility to pursue desired projects* and/or *realize desired collaborations* with industry. For instance, several PIs had developed an idea for some time but lacked the means and/or collaborators with which to pursue their idea. Other PIs had both an idea and a contact to a possible industry collaborator, but lacked the resources to establish a project. Second, ODIN provides *access to funding*. Attracting external funding is crucial for the academic participants to be able to pursue their research aims. ODIN offered a new, additional source of funding, which given its limited scope (its thematic scope as well as the fact that it was only open to proposals from scientists at Aarhus University) and novelty offered limited competition, compared with other potential sources of competitive research funding.

In addition, PIs described *ODIN grants as having a reasonable size and duration*, though some PIs (particularly in the second round of projects) assessed that it was unlikely that all their project activities and goals could be completed by the formal end of the ODIN project period.

Generally speaking, however, ODIN grants were described as substantial enough to allow for real advances and contributions to be made, but small enough that projects do not become overly complex and cumbersome to administrate or manage.

Some PIs described ODIN funding as *"seed money"*, as they expected the advances in their ODIN-funded project to establish a basis for further collaboration with industry and/or new applications for research funding.

PIs also emphasized that the application process from ODIN was neither too demanding nor detailed, meaning that the *barriers to application were seen as low*.

Many PIs also explicitly mentioned the open principles in ODIN as part of their motivation to apply for project funding from ODIN (see also section 10.3 for more details on how academic participants view openness principles in ODIN) and as a promising alternative to IP-based collaboration models. As one PI stated:

> *"What makes it [ODIN] so interesting is that it manages to bring together a commercial partner and a university partner without you having to compromise on your basic research DNA. For us, working in closed projects, with contracts and confidentiality agreements and IP rights and all that, is not always very rewarding. It places so many controls over what you do as a researcher that you lose a part of what drives you in your work: the academic freedom." (Academic participant,, PI5)*

Finally, some PIs explicitly mentioned being motivated by the *access to know-how, materials, models etc. in companies* that ODIN-funded projects can provide.

8.2/ What motivates large research-intensive firms?

The main motivation to engage in ODIN firms, according to large, research-intensive (pharmaceutical) companies, was that the ODIN model was seen as a means of *addressing shortcomings and challenges in industry R&D.* More specifically, industry respondents saw ODIN as an opportunity to *address complex unsolved challenges or creating new long-term innovative opportunities* that require basic scientific insight, new science-based tools and/or data. For instance, some firms indicated a desire to further basic understanding of disease mechanisms or possible biomarkers or targets.

> *"....our aim is to find biomarkers that correlate with disease progression. For example by looking into samples from these different populations of the disease that are available at Aarhus University and Aarhus University Hospital. So very early stages of disease, later stages of the disease, and also different variants of the disease that appear to exist." (Industry participant, I8)*

Some companies looked to explore how well their animal models translated to human disease and/or to explore other, alternative models for preclinical development.

> *"The key question for us is always: do our animal model translate to humans, and into a patient setting? We need to build extensive understanding about our models to ensure translatability. Now, with all the data coming out, we can get down to the gene level and understand [changes in patients' disease progression] at a much deeper level. With the data we expect to gain from the ODIN project, we aim to be able to select the right model that resembles the patient profile of interest best, so that when we go into clinic, we can better predict how our drugs will work. Our hope is that these data will really be used in our projects, but also by our peers. This not only helps the industry as a large to develop drugs in areas of unmet need but also academia. We want to know more about the mechanisms, the cause of the disease, and what is driving the disease. These foundational research questions are pivotal in order to really gain better understanding from the models." (Industry participant, I4)*

Others yet were interested in learning about the possibilities in, and helping to advance the development, of new platforms that would be useful to both their own company and for other users.

Moreover, industry respondents highlighted that matchmaking and project development in ODIN is *driven by industry needs* (i.e. use-inspired research, cf. Box 3.1), and projects are *informed by industry knowhow* of drug discovery and development (practices, standards, prior R&D, promising avenues etc.). This was seen as leading to needs-inspired basic research that increases the value of the projects for firms. For instance, several industry participants emphasized the contribution of ODIN-funded projects to building fundamental insight into understudied mechanisms that are hypothesized to play a role in the onset or progression of disease that the companies are trying to target pharmaceuticals at. As one respondent put it, "we lack biomarkers that will tell us whether our drugs are working or not before we can see it on the clinical symptoms", which is particularly challenging as the company develops medicine for diseases that progress slowly, where quick feedback on the efficacy of treatments can be crucial to the ability to adjust treatment (Industry participant, I8). Another respondent explained that current pharmaceuticals are partially successful in reducing the risk of developing a given disease – but only partially successful. Their company is therefore working to identify ways in which to reduce this residual risk. Their ODIN-funded project investigates on a particular mechanism which for a number of years has been hypothesized to play a role, but which has been severely understudied (Industry respondent, I1). Their project is therefore crucial in building fundamental insight into this mechanism, which may eventually make it possible to develop new drugs that reduce the residual risk of disease.

Other industry respondents highlighted the potential of their ODIN-funded project to improve the models by which they validate new targets, e.g. by developing more complex models and models that offer better translation to human subjects than e.g. animals models. Other respondents had helped shaped their ODIN-funded projects towards developing promising models by making them more efficient and introducing more standardization, reproducibility and control – all factors crucial for companies to be able to use such models as a viable alternative to animal models.

One example of user needs driving key decisions in the design of a research project comes from a project where the industry partner was instrumental in ensuring that the model under development in the project targeted not just a narrow part but all major parts of the part of the body that their pharmaceuticals are developed to affect. This significantly increases the potential value of the project's outcomes for the pharmaceutical sector. As the industry respondent explained,

> *"[Our aim is] To build a platform that hopefully makes it easy for other scientists, companies and groups to tap into and utilize the fairly new science [that the project focuses on] for as many distinct purposes as possible. So, the aim is to bring the [field] forward, to open it up to more participants by introducing standardization as well as control into the system, [and establish] a solid foundation [...] that hopefully anybody would find useful. So it's really good to have a human model that can get us away from testing on animals or at least allow us to heavily supplement the animal work [...] It should help us to reduce our animal footprint and ethical issues surrounding animal testing. And hopefully it will also give us very accurate data [...] and that will just give us an extra safety and confidence before we go to actual patients. Not to say that we are close to testing, but if it gets up and running [...] we would definitely use this platform." (Industry participant, I2)*

On a side note, the use-inspired nature of the projects was also emphasized by several PIs. As one PI stated,

> *"[...] for me, I think the important thing is that we are doing something which is relevant for several companies. And then, [...] normally, we do applied research and [...] all of that research could be useful for several people. But it's, in the end, it might not be, because I don't get to hear from the companies whatever it is that they really need, [...] because they don't want to tell me their secrets. So for me [a key difference in ODIN is] the chance talk to each other and not worry about it." (Academic participant, PI10)*

Industry respondents also all mentioned the contact to new potential academic collaborators as a key motivation, as it *expand the firm's academic network*. More specifically, participating firms can with relatively few resources broaden their external search for knowledge and partners by joining the ODIN network and platform. Moreover, *pitches and proactive matchmaking* were explicitly described as providing an opportunity to stay updated on state-of-the-art ideas and approaches in academia, or to connect with new academic partners.

The majority of industry respondents also described seeing ODIN as an *opportunity to engage in explorative and/or high-risk, high-reward R&D*. Even large research-intensive pharma companies have limited internal funding for academic collaborations, particularly for high-risk, high-reward projects and/or projects with a high degree of uncertainty and a long time horizon to potential commercial application (for more on high-risk, high-reward projects in ODIN, see section 10.4.3).

As such, industry participants did not expect concrete outcomes in the short term from ODIN projects, but saw them as *long-term investments in knowledge building and exploratory R&D*. As such, they naturally look for partners that complement and extend existing R&D aims and activities in their companies:

> *"We think many of the ODIN project ideas are interesting, but if we are to be an active partner in them, it should be very much in line with where we would anyway place our resources. Because I don't have extra resources just to explore things that would be scientifically interesting. It should sort of fit very tightly into what we do." (Industry participant, pharmaceutical firm, I8)*

Many of the industry respondents also specifically mentioned the open legal framework of ODIN as a motivation for participating in ODIN, as it was seen a *quicker and more effective way of entering into collaborations with academia.* By doing away with the need to negotiate over the distribution of IP rights and possibilities to delay publication of results, the process of entering into an agreement is speeded greatly up. Moreover, it helps avoid early-stage, broad patents, which are less effective and valuable than more specific patents. For instance, as one industry representative put it:

> *"If you look at this through [our company's] glasses, then it [i.e. ODIN] is actually really refreshing. Because [our company] has probably had a culture and tradition for going into these old school bilateral collaborations, where you had total control over IP from day zero. Because that was part of the contract you negotiated, and for that reason you sometimes found yourself in incredibly long and difficult negotiations […]. And the university TTOs were very difficult to dance with, because they wanted to sit on the IP rights, and the industry doesn't like that. So you have this dilemma where you have some scientists on both sides of the fence who really want to work together on something exciting […] and then everything ends up in a knot because you fight over all this legal stuff. […] Some of the newer managers coming into [company x], we're actually trying to change the internal culture, to say that we have to move away from patenting [early stage discoveries]. […]. Trying to do that, to patent breakthrough discoveries, is poison. […] Academic discoveries are not really well-suited for patenting; that's more for the things that you do as a private company, that you refine further downstream. […] This also has to with a development in patent law which implies that very broad patents are not worth much in a patent court. But if you have a patent on the molecule that is your blockbuster drug, well, then you've got things well covered.. That's why we, from the pharma side, would like to avoid taking out patents on golden discoveries that are too early, and too broad, because otherwise you're left with some weak patents whose terms are already quite advanced by the time you finally bring a drug to market. […] So, the short takeaway from a long answer is that we actually think it's pretty awesome to approach the legal stuff this way, and it has definitely made it much, much easier to collaborate. Not just to get the contracts in place, but the whole thing about having as a fundamental premise for the collaboration that there is no IP to fight over… well, it makes a lot of things a lot easier, and it creates a natural focus on really early-stage stuff." (PRC/SG representative from industry, B4)*

A few of the companies also mentioned *signaling* as a motivation to join ODIN, as it can be seen as a sign that the company is innovative and contributes to the freely available pool of knowledge and tools.

Some companies mentioned that ODIN *facilitates access to valuable clinical material*, which is difficult for companies to access directly, particular since the Generalised Data Protection Regulation (GDPR) came into force in 2018 or that it allows them to pursue resource demanding projects they would not otherwise have been able to purse.

> *"[In these ODIN projects] you see the synergies between industry and the university world [...]. And we're in this sort of borderline territory between the clinic and research – both basic and application oriented research – which the industry cannot handle itself like you can in an academic setting. But this whole aim of trying to search for new biomarkers or for that sake drug targets [...], that's exactly the kind of research we want more of. And then you can also say that we're in sort of a paradigm shift in this whole world around target discovery and target validation, where we're seeing increasing recognition that studying mice and rats as representatives of other mammals and humans in particular has yielded quite a lot of rather misleading results over time. [...] And now where some of these genetic tools and large-scale bioscreening are becoming feasibly, then going straight to human materials to search for drug targets and biomarkers becomes an actual possibility. [...] And that's something [our company] definitely wants to see a lot more of. But in the search for the right drug target and translational data, interaction with academic partners is crucial as they have access to these clinical materials that are in demand in industry. So I think ODIN has been a super strong platform to kind of establish that kind of interaction, and to do it specifically with a Danish focus." (PRC/SG representative from industry, B4)*

Finally, several companies mentioned the role of *third-party funding* from the Novo Nordisk Foundation in their motivation to enter into an open collaborative platform. For instance:

> *"We might have gone into something similar to this [collaborative project]. We have other comparable projects [...] where we enter into an external collaboration.]...] But we probably wouldn't do it with such a high degree of openness. Those other types of collaborations are generally less open. This is the first time we've entered into such an open collaboration. But it is of course externally funded." (Industry participant, I1)*

Ultimately – in the long term – the projects are expected to open *new potential avenues to drug discovery and development*. For instance, one respondent (Industry participant, I9) explained how they pursued their ODIN-funded collaboration to generate fundamental insight into a group of molecules that appeared promising in terms of being able to access targets in cells that are normally very difficult to access, but which they could not optimize because the molecules were poorly understood. Their expectation is that the new insight generated through the ODIN funded project will allow them to develop novel therapeutics that are not currently accessible.

Another example comes from a large pharmaceutical company, where the company participant in an ODIN-funded projects stated:

> *"What we're really hoping is that we can find a good handful of attractive targets [by identifying] mechanisms in these cells that have a very, very strong link to disease in humans. [Based on our approach in this project], we think we have a really big opportunity to find some good stuff to work with. And then the idea is, of course, that we as a big pharma company can go in and invest in different programs to develop specific molecules that can target these mechanisms. So that's definitely the purpose. We want to find some medicine that can help people." (Industry participant, I1)*

8.3/ What motivates small and medium-sized firms?

Though the companies involved in ODIN are mostly large pharmaceutical firms, ODIN-funded projects also include a few small or medium-sized firms (SMEs). These largely consist of providers of specialized service and analysis, often spun out from or with close ties to academia.

The specialized service providers interviewed mentioned three types of motivations for participating in ODIN projects. The first is the *visibility and access to potential collaborators and clients* it offers.

> *"I mean, you have your old networks, and that's fine, but sometimes they can feel like a limiting factor. But with ODIN, you can build on your network. If you have the ideas, if you have the concept, you can find new contacts." (Industry participant, SME, I3)*

On a related note, SME participants emphasize the *opportunity to showcase and develop their specialized skills and service offerings* in e.g. supporting and enabling academic researchers. Developing the knowledge base upon which they build their offerings, and extending it with new applications or showcases is often, they argue, a more important competitive parameter than securing IP, alongside insight into state-of-the-art research.

Finally, they emphasize the *opportunity to engage in R&D* that ODIN offers. Although they have to fund their own participation, the grant provided to academic scientists allows for the collaboration to established:

> *"We see it as an opportunity to do some R&D. As a small company, we would not have the resources to establish such large projects, but through ODIN we can be a part of it. Because we have the competences to do the part that we do, and to do it really well, but we can't deliver any of the stuff around it." (Industry participant, SME, I3)*

Two biotech firms also participate in ODIN-funded projects. One of these companies also pointed to the *opportunity to engage in basic research* as their key motivation for participating, namely that it offers an opportunity to get involved in basic research which is not specifically linked to company activities or with direct therapeutic interest, but which is focused on fundamental insights upon which company activities build:

> *"We made some observations about some of our molecules which were sort of completely unexpected. […] we started to raise, you know, more fundamental questions about how [our technology] worked […] and this obviously became broader than just what [our company] was interested in. And so we felt that it was a worthwhile exercise to think about doing this as a more basic research project in a way that wasn't specifically linked to [our company's] molecules." (Industry participant, SME, I9)*

The main motivations expressed by the three types of project participants interviewed is summarized in table 8.1.

Table 8.1. Motivations to participate in ODIN-funded projects, by partner type

Academic participants (PIs)	Industry participants – pharma	Industry participants – SMEs
A possibility to pursue desired projects and/or realize desired collaborations with industry Access to funding ("seed money") Access know-how, materials, models etc. in companies Low barriers to application/funding	Address shortcomings and challenges in industry R&D through use-inspired basic research Expand the firm's academic network Opportunity for explorative/high-risk, high-reward R&D Quick, effective entry into academic collaborations Signaling (vis-à-vis competitors) Access to clinical material Third-party funding increases willingness to invest in open collaborations Novel opportunities for drug discovery and development	Visibility and access to networks of collaborators and potential clients Opportunity to showcase and hone/develop specialized skills and service offerings Opportunity to engage in (collaborative) R&D

9.0 Contributions and collaborations

This chapter focuses on how the contributions that industry participants make to ODIN-funded project, as well as impressions of the ODIN collaboration so far, from both the academic and industry perspective.

9.1/ Industry contributions

For the thirteen companies participating in ODIN-funded projects, table 9.1 lists, first, the number of projects that they are involved in, and the number of people that they have assigned to work on these projects. Second, it lists the number of projects in which each company contributes with:

- **Intellectual support**. This may take the form of active participation in the design of the research, having dedicated tasks in specific work packages, engaging in discussions of the research in the project with the other project partners etc. This is the most common form of contribution, present in all projects. According to interview respondents, company partners' intellectual contributions rest on their specialized expertise within e.g. specific disease areas, experimental set-ups, automatization of processes, and more generally within drug discovery, development and safety.
- **Materials.** This refers to instances where company partners contribute to the collaboration with their own proprietary materials, such as chemical compounds, assays, antibodies, tissue or samples.
- **Infrastructure.** This final category covers instances where a company partner contributes by performing an analysis or providing access to instrumentation and technologies

.

Table 9.1. Planned industry contributions to ODIN-funded projects

Company	No. of ODDIN projects the company participates in	Involved no. of persons in all ODIN projects *	No. of projects where company contributes with:		
			Intellectual support	Materials	Infrastructure
Novo Nordisk	5	11	5	2	4
AstraZeneca	3	8	3	1	3
Nordic Bioscience	1	3	1	1	1
Omiics	3	3	3	0	3
Bioneer	1	2	1	0	1
Stipe Therapeutics	1	1	1	1	1
ApconiX	1	1	1	0	1
H. Lundbeck	1	2	1	1	0
BioXpedia	2	1	2	0	2
NanoString	1	2	1	0	1
LEO Pharma	1	3	1	0	1
Total	**20**	**37**	**20**	**6**	**18**

Source: The ODIN Secretariat.

* The number of persons involved is calculated as a total across all projects for each company. The calculation is based on applications and grant holder surveys and does not indicate how many hours the individual person contributes with.

Table 9.2 provides more detailed information on the number of people assigned to each of the 11 ODIN-funded projects, group by type of employee (.i.e. group leader, researcher, or technician). The table provides this information for both Aarhus University and for the total set of industry partners in each project.

All industry partners must assign at least one group leader-level person to the project. As evident from table 9.2, in many cases, additional researchers or technicians have also been assigned.

Table 9.2. Types of personnel assigned to the projects (at the outset of the projects)

Project	Aarhus University			Industry partners			No. of industry partners *
	Group leaders	Researchers	Technicians	Group leaders	Researchers	Technicians	
BALDER	2	0	0	1	0	0	1
BIOMETSCO	2	2	1	4	1	1	3
BioPsych	4	2	1	2	0	1	2
CELPPLUS	2	3	2	1	2	0	1
FRIGG	5	3	1	6	0	0	3
IMPAD	3	4	2	1	1	0	1
KidDO	4	5	4	2	2	0	1
MiCO	1	1	1	1	2	0	2
oLIVER	3	4	2	1	0	1	1
P2P	3	3	2	2	0	0	2
THOR	2	5	0	1	5	0	1
Total	**31**	**32**	**16**	**22**	**13**	**3**	**18**

Source: ODIN Secretariat, based on a survey among ODIN grant holders.
* 'No. of industry partners' includes only the total number of companies that are active partners in ODIN project and have thus assigned personnel to the named projects. Some projects also have 'interest companies' associated to them, but these companies do not play an active role during the course of the project and therefore have not been included here. ** The total number of companies includes companies that participate in more than one project. The number of unique companies that serve as active industry partners in one or more ODIN-funded projects is 11.

9.2/ Requirement of firms' active contributions

ODIN emphasizes that company partners are expected to contribute actively not just to the development of project ideas and aims, but also to their execution.

While some company respondents felt that their contributions to the ODIN-funded project they participated in was equal to the degree of commitment they would usually bring to their academic collaborations, others express that the requirements of what they need to deliver are higher than usual.

> *"I think there's a difference between if an industry partner goes in [...] and says 'this is a good idea, you know, we support the idea' - and we often do that in collaborations because there are many good ideas out there... But this is a different collaboration in the sense that the industry partners are part of driving it, and delivering into the project. Not only supporting the idea or the project on paper, but actually going in and actively engaging in the project and putting people's time in." (Industry participant, I4)*

> *"I think where it [i.e. ODIN] is different is... let's put it this way: A letter of support, it's not a high barrier internally, right [...]. We typically do that, and then of course it's nothing more than that we really find this technology interesting and support it. We also know that's not worth a lot, it doesn't come with a commitment, so it's easy to do. Then, I think, ODIN [...] tries to make sure that there are some real activities [...] and I think that's kind of a good way." (PRC/SG representative from industry, B3)*

Some industry respondents also emphasized that the expectations of active company participation in ODIN-funded projects had the positive byproduct that it requires in-house prioritization and commitment to the project. Such prioritization ensures top-level support for the project as well as the necessary resources to contribute to and learn from the project.

Indeed, respondents also explained that the in-kind contributions of firms to the ODIN projects they participate in help them in building the internal capacity necessary to absorb knowledge from ODIN and to be able to act on opportunities that arise from their participation in ODIN projects.

> *"It's important that we have to bring in kind resources to the projects – because if we don't contribute in an active way, we don't absorb knowledge in-house." (PRC/SG representative from industry, B1)*

Finally, industry respondents argued that the requirement of industry partners to specify their concrete contributions to projects in their ODIN application – along with the risk of projects being terminated and funding pulled if they don't deliver – opens up for additional opportunities for interaction and knowledge exchange – and for research synergies. Moreover, it makes it more likely, according to one respondent, that the project will remain a priority for the firm. Academic collaborations often suffer from changes in priorities in participating companies, which the expectation of continued active involvement helps safeguard against. Similar reflections were made by some of the academic participants. For instance:

> *"... It's simply written in capital letters that the company has to participate in full. And that we don't get money, if they don't stay in. I feel the company is more dedicated. Often when you have a project with a company, they can't quite find the time for it, or to assign people to participate. I can't speak for the other projects,, of course, [...] but this is really an area where I've felt a difference in ODIN." (Academic participant, PI1)*

9.3/ Impression of the collaborations

Given the level of ambition in ODIN with regards to the degree of collaboration between academic and industry partners, both academic and industry respondents were asked to describe their initial impressions of the collaborations in which they engage under ODIN.

Respondents explained that the expectation of two-way collaboration promotes actual contributions, which several respondents described as "real" collaborations or "researcher-to-researcher" collaborations, involving close interaction around joint aims and activities. Many of the industry respondents interviewed had a background in academia themselves.

> *"It [i.e. our collaboration] is a very dynamic, interactive process, because there is a lot of knowledge exchange between the people I have in my lab and the people [the academic PI] has in his. [...] And then [the academic partners] are responsible [for performing a given task] in their lab [...]. And we chose to complement what they're doing, so we're not testing the same things, but instead doing it a bit differently. When you're working with cell cultures, and think it provides a realistic picture of what you're interested in, you often don't find what you really should and could be capturing. So we try to optimize our chances by approaching it from different angles. [...]." (Industry participant, I1)*

Collaborations under ODIN were generally described as balanced, that is, neither dominated by an academic partner or dictated by a commissioning firm. Respondents also underlined the importance of reciprocity in that ODIN projects are largely designed so that both academics and industry need to deliver for projects to achieve their aims, which further strengthens incentives for collaboration.

> *"I have been involved in consortiums previously that involved several companies [...]. There were a lot of different work packages. Basically everyone did their own little thing, on their own. It seemed like it was just an array of small projects by each research lab. There was some collaboration between the groups of course, and there was some goal of having transferred knowledge between them. But definitely, with the ODIN project, this is a much closer collaboration between the four groups that are involved. I think this is more how I want a collaboration to be with industrial partners. That's also probably because, when I think back on what [some of these company partners] were doing, they had some IP-related parts that weren't disclosed. And some of the other research labs, like our research lab, didn't disclose their results until they were more advanced. But in this case, we are happy to keep it more open, because [...] it's not looking at specific disease parts or anything, so it is more beneficial if we develop the platform faster." (Academic participant, PI4)*

Many of the interactions described so far had been planned, but respondents also gave several examples of unplanned interactions that emerged as a by-product of the planned collaborations, for instance in the case of companies drawing on in-house expertise and colleagues to inform the design of the experimental set-up under development by their academic partners.

Finally, both academic and industry representatives stressed the benefits for collaboration of the limited size and scope of ODIN projects. The fact that ODIN projects are relatively small, according to respondents, helps keeps them focused but also agile, set limits to their complexity, while facilitating exploration and risk-taking.

> *"Having small projects, tailored projects, keeps it light. It keeps thing unburdened. Is there a correlation between larger projects and large impact? I don't necessarily think so. Bigger projects also mean more complexity, more coordination. [...] Then you lose all the good things about ODIN: that's it's quick and agile, and hurdles are low. Bigger projects are not necessarily better just because they're big." (PRC/SG representative from academia/industry, B1)*

10.0 Openness in ODIN

This chapter focuses on the openness principles in ODIN. More specifically, the chapter examines how these principles are enforced, what are participants' reflections on them, and how may they influence the nature of the research undertaken in ODIN-funded projects.

10.1/ The open legal framework

A key aim of ODIN is to facilitate downstream, proprietary innovation projects (where the distribution of rights to IP are negotiated on usual terms) by opening up precompetitive research. To help ensure this openness, i.e. that data and other research outputs are shared freely and widely, ODIN rests on an open legal framework.

The framework consists of:

- *A framework agreement* between Aarhus University and the nine founding partner firms in ODIN: Novo Nordisk, Lundbeck, Bioneer, BioXpedia, Omiics, Boehringer Ingelheim, AstraZeneca, Nordic Bioscience and Leo Pharma. This agreement describes ODIN, including its overall aims, main activities, and the roles of the Steering Group, Project Review Committee and Secretariat.
- *A project agreement* template, to be used by all projects that receive funding from ODIN.

A comparison with the standard Aarhus University "fast track" collaboration agreement highlights the particular features of the ODIN project agreement. The standard agreement provides parties with different options to seek out use rights and transfer of ownership of foreground knowledge. Third-party use can be restricted if the company partner wishes to seek exploitation of foreground knowledge e.g. by exercising a time-limited first option to negotiate a non-exclusive or exclusive, royalty-bearing right within its field of application. Also, Aarhus University retains the option to license or sell rights to third parties. Few options are restricted a priori.

By comparison, the ODIN project agreement attempts to close as many doors as possible that would allow parties to pursue the privatization or withholding of foreground knowledge. Any foreground knowledge generated under ODIN-funded projects must be made publicly available as soon as reasonably practicable. No one can claim exclusive rights to this knowledge, and it may not be protected by patents or the like. Anyone within or outside the project has an irrevocable right to use this knowledge free of charge for any and all purposes.

Both the standard agreement and the ODIN agreement stipulates in line with the University Act that university researchers have the rights to publish and disseminate scientific findings generated within the collaboration. The ODIN agreement goes a step further, stating that all foreground knowledge generated under the project must be published, to the benefit of the public. Moreover, while the standard agreement allows parties time to apply for IP prior to publication of findings, the ODIN agreement only allows parties time (45 days) to ensure that no confidential knowledge is disseminated in publications.

The ODIN agreement however allows for parties to pursue IP on findings of applied research based on results and data generated in the project: "Any results and data generated outside the Project but on the basis of such applied research that can be protected by intellectual property law, including by patent if applicable, and the owner shall be free to apply for

protection in accordance with applicable law." The purpose of this clause is to ensure that anyone who can use the outcomes from the ODIN projects can do so without having to engage in property right agreements with the original ODIN partners. It is however worth nothing that this clause opens up a possible grey area; it is conceivable that partners who may be able to exploit patentable foreground knowledge could argue that it is outside the scope of the ODIN project, as the purpose of the ODIN projects are precompetitive thus not covering patentable findings, or prove that some amount of applied research has been performed and that therefore the patentable data and results are in fact generated outside the project. In this case, the one of the parties is likely to be worse off than in the standard agreement.

The grey area in the ODIN agreement likely stems from the fact that the parties as well as the designers of the contract do not expect any inventions or patentable findings to stem from the ODIN projects. And that these will only come in a possible, later round of downstream research.

10.2/ Industry perspectives on openness

In the next part of the chapter, we turn our attention to industry and academic stakeholders' perspectives on the degrees of openness in ODIN.

According to industry representatives in the Project Review Committee and industry participants in ODIN-funded projects, the degree of openness in ODIN is substantially higher than in usual university-industry collaborations and higher than in most other precompetitive public-private collaborations their companies engage in. Nonetheless, none of the respondents saw the openness principles are problematic.

> *"Basically, when I discussed this internally, I mentioned that 'this is open, so there will be no IP for us.' It's just given. And when we know this, […] as soon you're willing to accept that, then you don't mind it at all. […] So yes, we accept that, and that may exclude certain things, but I would say it mostly excludes that we would bring or in any way connect this to our internal discovery programs. Or if we were to provide compounds, we would provide compounds that are either competor compounds that are published or things, that are kind a lower priority for us, because we cannot run a risk that we damage existing IP or potential IP […]." (PRC/SG representative from industry, B3)*

Several respondents explain that their company's ability to enter into an open collaborative framework was enabled by a gradual change in industry culture and practices regarding openness. The pharmaceutical industry has experienced the challenges of trying to develop commercial products from early-stage IP, there is a desire to avoid duplication of effort, and positive experiences with partially open precompetitive collaborations.

> *"I think that if you had asked me [to join ODIN] 5-10 years ago, then you would probably not have met the same mindset. But an internal revolution has happened [in our company], and it's reflected in [the ODIN initiative]. It's based on the idea that we have to think differently. We used to have this idea that if it wasn't made here, then it wasn't interesting. It's a bit black and white, no? But it's also because we've been extremely good at what we do […]. We just have to acknowledge that the world has changed, and we have to be more open." (Industry participant, I1)*

Indeed, several industry representatives described increased openness in precompetitive collaborations as a necessary change in R&D practices, given the need for new approaches that can address well-established challenges in pharmaceutical R&D, such as decreasing productivity, increasing complexity, rising R&D costs, and high attrition rates in drug discovery and development.

Industry representatives also express an expectation that collaboration and open sharing will contribute to knowledge and thus accelerate scientific progress, and thereby eventually the development of commercial applications.

> *"Usually in academia, [...] you get some money, do a lot of stuff, publish it, and then you relax for a moment. Because then others can see what you did. And no one can beat you to it. [In ODIN] we chose to do things differently, because if you do it the usual way, it simply takes too long. So by saying "we're open and sharing right away", then maybe in our process we can get some feedback from someone who's maybe doing something a bit similar. And they might say 'hey, did you try this' or 'we tried that too, and we can't get it to work either'. We need the sum of many bright minds for this to succeed. [...] For that we need an open platform, and there just hasn't been a platform for this before ODIN, at least not one that I am familiar with." (Industry participant, I1)*

> *"I think the industry has become much more realistic about this. Yes, there are always some things where it would be great if you just had them for yourself, if you had this advantage in having access to a unique platform. But there is such a high risk. Due to the risk balance, it makes a lot of sense to support this together [...]. Where yes, in the end, having the best next generation of something would be a huge competitive advantage, but it's simply such a high risk, and such a hard problem, that no single party will solve it on their own. So it makes sense that a lot of companies join together in research." (PRC/SG representative from industry, B3)*

Some respondents from industry also expressed that they felt their companies had an obligation to be open about outputs from their project, due to the basic nature of the research undertaken into e.g. disease biology, or the unique nature of the materials they had access to. For instance:

> *"There will be accumulated so much data that will be published. And then our data will form the platform for commercial ideas that would be followed up on afterwards. I think it's difficult to say that basic research is precompetitive. I think all kind of research is competitive, isn't it? Because you want to be first with the findings. But, in this situation, we also have an obligation against this [unique material] that we have been allowed to use for research. And so we have an obligation also to be very open around what we find." (Industry participant, I10)*

Moreover, given the precompetitive nature of the research undertaken within ODIN, company participants do not see expected outputs as being relevant for patenting:

> *"ODIN does put some limitations on us, because it's clear from the get go that its precompetitive: everything needs to be shared, and any IP related discussions will come later [...]. I recently had a discussion about this, and we said 'okay, this is not IP generating', but I think these platforms, we would never try to get IP on anyway, so that's fine.. But we can address something that [...] requires more work and also higher uncertainty [than we'd normally work on]. It's a more academic approach.. But if it really works out, we would absolutely appreciate having access to it, and wouldn't mind other people having access to it." (PRC/SG representative from industry, B3)*

> *"There were no reservations from our side [with regards to the degrees of openness in ODIN]. It's no problem for us in the sense that we as a company always aim to publish as much as possible [...]. That being said of course, we cannot go into to a collaboration in an open setting if it's on a specific target or on a project that is going to clinic, for example. Then the openness would not work because then we need to own the IP. But*

with the types of projects that came up here [on ODIN], where it's more around developing new methods, for example, or characterizing new models, etc. Then I think it's a win for both the academic partner and the industry partner." (Industry participant, I4)

Potential downsides of openness are tempered by the lead time advantages that participating companies expect to enjoy thanks to their tacit knowledge of the data/outputs and possible commercial applications.

"Seeking out exciting new knowledge where it is, and where it's generated, and to maybe be among the first to gain insight into it... well, that is how we can be competitive. And then our task downstream is to make sure that we can turn the things that could maybe become pharmaceuticals into proprietary products" (PRC/SG representative from industry, B4)

A similar point was illustrated by an academic researcher:

"Even though it [i.e. data] is lying out there, it can sometimes be difficult to handle. Because you don't have insight into how they were made. You're supposed to write this down, to document it, but it's still difficult... It's like if someone has a recipe for a really complicated cake. The person who really know how to make it, is the person who created it. It can be difficult for others to replicate or work on [...]." (Academic participant, PI1)

Project participants have time to build up internal know-how and competences needed to effectively pursue downstream applications, and have close existing ties to the academic scientists with whom they may engage in further open or proprietary collaborations. All of these factors are expected to give participating companies a "head start" and thus an advantage over third-party firms. Moreover, companies emphasize that their ability to influence ODIN projects' research aims and approaches towards areas of particular interest for their companies and to inform project aims and designs based on their insight into industry needs and practices is likely to increase the relevance of the research generated and reduce the time needed to develop downstream applications of the research.

Finally, some of the small and medium sized firms participating in ODIN projects argued that any disadvantages of the lack of opportunity to seek IP protection were outweighed by the competitive advantage they expected from access to state-of-the-art insight that could support their product and service offerings.

Respondents gave a few examples of other SMEs who had declined to participate in ODIN-funded projects *because* of the openness principles applied in ODIN. As one academic researcher explained:

"As I see it, the big companies know the rules of the game and they are not really worried about the openness [...] Small companies are different, more difficult to convince that openness is the best approach. [...] I was actually a bit surprised when we started ODIN that it was so relatively easy to get companies on board. It hasn't been a problem for the big companies. It's more the smaller companies that sometimes worry about it." (PRC/SG representative from academia, B6)

10.3/ Academic perspectives on openness

Academic participants expressed very positive views of the openness principles in ODIN. Some argued that prior experiences with trying to patent e.g. biomarkers or efforts to take out university patents on early-stage findings had met with limited or no success; they therefore saw ODIN as a welcome new approach.

> *"I mean, I think and actually hope that ODIN can push some boundaries, in that the university agrees to go into IP-free projects. […] Where I see the greatest potential in ODIN is that it's faster, and the research that gets done can get out there and benefit patients." (Academic participant, PI2)*

Some researchers stated that the degrees of openness in ODIN surrounding the sharing of research outputs were not unusual in their fields, although the expected speed of disclosure might be, given ODIN's requirement that outputs must be published as soon as reasonably practicable:

> *"Most researchers hold on to their data until they have published a peer reviewed article. At that point of course, there are rules about how, if you publish, the data often has to lie there somewhere, so that makes it open to everyone. The special thing about ODIN is that you have to place all your data out in the open before you publish anything on them […]. That's something ODIN will have to follow up on, because I could imagine that some researchers would like to hang on to their data until they have harvested all the information they can harvest themselves. […] But […] if we all do it, […] you'll have access to a lot more data […]. It's important that all researchers have to understand in the projects: that it benefits everyone at the end of the day." (PRC/SG representative from academia, B6)*

> *"People [in my field] do use open datasets, and people publish with open datasets. We take open data sets from […] online sources and compare them. But it's relatively rare that these open datasets are made available before for example a flagship publication that includes your open dataset. So, when we submit manuscripts, we often have datasets that are hidden from the general public, and you can only access them with a username and password during the review process. And, if our work is accepted [for publication], then these are removed. But in reality here [in ODIN], we're supposed to sort of open our data up to everyone as soon as it is generated." (Academic participant, PI3)*

Academic respondents generally saw openness surrounding findings and other research outputs as crucial to ensuring quality, replicability and efficiency in research, and as a means of accelerating the progress of science:

> *"As it is now, you generate these gigantic data sets, and then you typically follow up on a small part of the data. Because if you have to validate something in a mouse model for example, it's a huge undertaking and requires a lot of resources. […] So we're seeing more and more research where you […] go straight to a publicly available data set. And then after that, you find what's interesting and dive deeper. […] It's awesome that people are making their data accessible. And by and by, everyone starts to recognize open data as a resource and knows the data is our there. […] For instance, a reviewer might ask you to compare open data sets to your own data, and to check if you find the same thing in other data that you found in your own. So it can also be used as an extra validation." (Academic participant, PI2)*

> *"... it [expectations of open data sharing] gets more and more common. Like when you publish papers, you should upload your data. At the very least they ask you for your raw data. And I think it's really nice with some of the studies I'm doing. Because [...] the results can depend a lot on how you calculate them, actually, so I think it's important that you have this open research [...], and that you can see that raw data." (Academic participant, PI11)*

Other respondents highlighted the benefits of openness in finding new collaborators:

> *"We of course wanted to disclose our findings openly at some point. [...] Because we already know that we aren't worried about competition and things advancing in other labs. We just incorporate those things, and our project goes faster. We are happy to be open from the beginning. [...] The benefit is that we might also interact with other labs and start new collaborations or incorporate more people that might have some other ideas for enhancing the project in some way." (Academic participant, PI4)*

Some respondents also described open sharing of data as crucial to allow academics and industry to contribute productively to a massive growth in the amount of data available.

> *"Within the field of genetics, the studies are now so large that [data] are pouring out. It's like giant tsunamis of genetic variants and risk genes and the like. So there is a massive need to strengthen our understanding of the underlying mechanisms. We know a lot of the genes, but we don't understand the biology and mechanisms behind. I really see the need to take a step further here." (Academic participant, PI6)*

> *"I just want to say that this is not usual practice for us. Usual practice for us is finishing the work, drawing a conclusion, and then maybe sharing all the data or just publishing an article based on data. So this is going to be quite a change for us. However, the data we're generating are well-suited for the purpose. [...] And in these data, there is actually a lot of information, in fact way more information than we can find the time to dig out. That's why it makes good sense to get it out there, so others can look through it." (Academic participant, PI5)*

A few respondents described openness as a responsibility e.g. when working with unique data and materials, to provide the wider scientific community and society access to key data and insights.

However, several academic respondents were also uncertain about practical aspects related to openness. Openness can be practiced to many different degrees, with different implications for how accessible the data is to third parties. Data can be shared freely and widely but are difficult or impossible to use without information on how the data was compiled and what it represents. As one researcher stated,

> *"We're drowning in data. Understanding them is the real bottleneck. [...] So much data is being generated at the moment, but it's so hard to find them. They're in different formats and in all different types of places. I feel like we need new eyes on all data. For that to happen, they have to made accessible and curated, so you can understand what's going on. [...] At the moment, such data are accessible to bioinformaticians, but to them, one gene is the same as the next. [...] But in terms of how to get the data into the hands of those who actually understand a given disease and a given system, well, there we have a gap. So it makes a lot of sense to begin investing in ways in which we can gather and curate data." (Academic participant, PI6)*

Other academic researchers addressed the existence of a trade-off between how many resources they would use to make their data open vs. how accessible and useful these data would be to third parties. Other researchers debated possible benefits of open and immediate sharing of research data:

> *"There's two things. One is visibility. So, if I publish a dataset online, without any link or paper promoting it or so forth, then who is going to see that data? A manuscript is sort of the entryway to know where to find the data, and what's interesting about it. So if I publish all this open data [...], who will ever see it? So I think that is one issue that needs to be thought about a little bit: how to make people aware of the data without having a flagship publication or something. I think another issue is that, of course, scientific publications are biased towards your own interpretation of the data and therefore what you think is the most interesting and important. Other people may see something completely different. So I think having freely available data allows us to use it more. But yeah, my concern is how do people get to find this data." " (Academic participant, PI3)*

Finally, a few academic respondents expressed concern about how openness might affect the competition they face from other scientific groups. These were presented as superficial concerns, with possible negative effects of openness generally described as negligible. One PI however explicitly chose to build an ODIN proposal around a repurposing of existing technology due to concerns about bringing very novel technology into an open setting.

10.4/ The nature of the collaborative research

In the following, we turn our attention to how the openness principles in ODIN may affect the nature of the research undertaken in ODIN.

10.4.1/ Precompetitive research

ODIN has a stated focus on precompetitive research. The requirement that research outputs must be shared freely and widely leads, according to several respondents, to a natural focus on research themes that cannot be applied directly in the development of commercial products and which can benefit a broad range of industry and academic partners, such as:

- Novel, faster or more effective platform technologies for use in drug discovery
- Insight into basic disease progression, underlying mechanisms etc.
- Generating large amounts of data on potential biomarkers or targets based on novel research.

When asked to draw a line between precompetitive and competitive research, respondents generally draw this line when focus shifts from fundamental mechanisms or larger data sets to targeting specific mechanisms, cells, targets or other.

However, several respondents acknowledge that definitions of "precompetitive research" are fluid, and some went as far as to argue that ODIN is contributing to a widening of that definition:

> *"It [i.e. the definition of precompetitive research] is fluid. There is no one, single agreed upon definition. At the outset [of R&D projects], we don't know precisely which value creation we can imagine from the project, or what could or should be protected with IPR. [...] In ODIN, we're 'pushing the boundaries'." (PRC/SG representative from academia B1)*

Most industry respondents expressed an expectation that when the contours of possible downstream applications of research outputs from ODIN start to emerge, they expect to pursue such applications in "closed", or proprietary, projects. For instance:

> *"In the moment [...] where we can say, that 'here is really something super interesting, here we want to invest', that's the moment when the doors close. [...] This stage of the process is sensitive, because once we start developing our molecules, it is very important that we secure a patent that ensures that we can actually have a product with a good business case, once we reach the clinic. That's why the doors have to close at some point. Not really for our collaborators, but more to the outside world. Of course we'll keep exploring the biology, but it's obvious that for everything that happens around the chemistry, and the whole journey from a mechanism to a drug, we have to close the doors." (Industry participant I1)*

10.4.2/ Generic and explorative research

When asked to describe the aims and nature of their research in ODIN-funded projects, academic respondents all describe it – in different ways but consistently – as basic research, but with a strong orientation towards possible applications.

Many respondents also stated that the ODIN set-up, in line with its precompetitive focus, stimulates generic and explorative or open-ended projects over specific and "close-ended" projects. As a natural consequence of the precompetitive focus and the "no IP policy", projects are more generic (compared to industry-driven projects). Moreover, outcomes are not clearly or narrowly defined from the outset.

> *"If you look at [contract R&D and consulting for] private companies, you know, they pay for it, so they want something: they have a specific aim, either a platform, data, or new knowledge. You're very strictly bound to this, and it often also conflicts with publishing. So of course here it differs, because everything is open and everything has to be published, and [...] there's no IP protecting it. Even in basic research, I mean, you normally – especially if [you're applying to] research foundations – you have to have a specific question, a specific hypothesis that you go and test. I think these kinds of projects [i.e. in ODIN] can be a little bit more open... We do some screening, we don't know what it will give, but it surely will give something." (Academic participant, PI13)*

> *"Well, they [i.e. ODIN projects] don't look like those very focused projects that come from many of our larger foundations [...] where you typically have a very clear target. You could say that what's special about the ODIN projects is that they're pretty open in their aims, often rather descriptive [...]. Not just because they involve very large volumes of data, but because you, like, investigate broader patterns and relationships [i.e. in the data]. And so it's actually pretty unclear if something will come out of it. [...] Then there are certain other foundations, who would probably also give money to something that looks like it, but then there wouldn't be the same focus on industry involvement [...]. So I think the unique combination of having firms in the mix, at the same time as having very open and not very precise aims, is what sets ODIN apart." (Academic participant, PI1)*

> *"Actually, I think that the cool thing about our project is that it is, in a way, not hypothesis driven. […] Or, we based our project on our hypothesis [that a given mechanism could help explain disease onset and progression], but we are not looking to any specific cell type or protein, or any particular pathway. So we are completely open, and in that way we believe that we will bring an enormous amount of data that can be used at all different levels. They can be used for diagnosis, prognosis, for selection of patients with […] in the future. I think the openness of our questions will bring an enormous amount of possible projects in the future […], from clinical to basic research […]." (Academic participant, PI8)*

On a closely related note, several respondents emphasized the explorative nature of their projects:

> *"Well, to be honest […] my academic interactions usually […]have an eye for future commercial applicability […]. With ODIN, it's different, it's even more academic, and open, and focusing solely on helping to set this platform up so that anybody can tap into it. […] We're happy to be involved and excited to be part of a program that could create possibilities for the future and science more broadly. There's definitely less of a commercial objective compared to other academic collaborations that I would have. […] And it's a bit hard to see the exact commercial use for it. I mean, we've got ideas. But usually, when I collaborate with an academic team, it's a bit closer to our […] pipelines or other drug development activities. […] Whereas ODIN is more, 'let's see if we can get this platform up, we may find something we could tap into or we may not, and it could be beneficial or it may not'. But there's a lot of possibilities, and that's why I signed up." (Industry participant, I2)*

Some also argued that projects are more complex than would have been initiated in industry: Many projects are labor intensive and rely on e.g. knowledge, tools, models etc. built up over long time in either academia or industry, and it is according to respondents unlikely that any one organization could or would do pursue a similar project on their own.

> *"If you were a big company with many resources and access to thousands of patients, you could run this by yourself. But, not many companies are able to do that." (Industry participant, I8)*

> *"[The project] is really something that requires quite a lot of work. So I'm pretty sure we wouldn't have invested in all of this work ourselves. […] I don't think anyone would initiate such a project by themselves, because it's a very large project, but it's also something that […] I think will create a lot of value, for industry and for academia." (Industry participant, I4)*

Some respondents stated that it would have been difficult for them to get funding for their ODIN-funded research projects from industry or from competitive research funding sources, as projects that do not have specific, well-defined outcomes and/or for platform projects do generally not fare well in broader competitions for funding.

> *"This type of project where you only are generating data […], you don't have a defined outcome, that's very difficult to get funding for." (Academic participant, PI3)*

> *"I think it [ODIN] gave a unique opportunity to do something with […] target identification and target validation […] because if we wanted to go for [conventional research foundation funding], you might want to focus on specific biology and a specific target. And […] it's difficult to go for a specific target [in an collaborative, open setting], because the company will then lack the IP ownership." (Industry participant, I4)*

> *"[…] the majority of foundations or other funding sources, they like to have a very hypothesis driven question. You build it on preliminary data and then because you have this protein or this particular cell that is very important in this setting, you want to go deeper into what that is. That is mostly the type of funding that I have from other projects. But these completely open questions are difficult to approach with funding sources. So in that sense, […] it's very different because we are not […]driven by one particular group of cells or one protein, and that in a way it's a little bit risky. It's a little bit of fishing expedition if you want to say so. But I think the technical advantages that we have now on hand, and the combination of the groups that we are in this project, can bring a lot of power to the data that we may obtain." (Academic participant, PI8)*

Some respondents described how ODIN funding and openness principles in ODIN allowed them to opt for more sophisticated technologies and accelerate their development:

> *"Usually, when we develop new models, it would be in a more traditional project with funding related for example to a specific mechanism that you're looking at. Rather than developing a platform. I think it opened up more opportunities to look for collaborators especially in the industry, because […] I don't think it would have been possible to collaborate with [the company partner] if we said 'we're interested in this specific gene'. Usually, they have their own projects and things to do. […] With the open aspect, I think it was quite easy to talk to them about it [i.e. the project]. It's kind of a win-win for everybody. We get a new platform developed, and they can use the platform in their company, because it is not specifically related to any IP. I think that is fundamentally what the ODIN project is about. […] We already started [working on a similar project] in the lab prior to this ODIN project anyway, but it wasn't with […] these aspects we're planning to do in ODIN. There are many aspects we probably wouldn't do without funding through ODIN. […] Basically, it is difficult usually to get funding for platform technology, so this ODIN project's openness means we can dedicate specific research towards developing the platform, which we wouldn't do otherwise. I think we would have ended up at the same point […]. But it would probably take several more years to do that, and maybe not directly developed by us […]. So it wouldn't be us driving this new type of [platform] forward. […] With ODIN, there is a specific focus on accelerating that research." (Academic participant, PI4)*

Other PIs expressed an expectation that the fundamental, open-ended nature of their research would open up new research avenues that are either not known or not accessible today, e.g. adapting their research to address new disease areas:

> *"In the short term, within the project, we hope to discover potential novel targets for [a given disease]. That would be fantastic. We also want to be able to show that the methods and models we're proposing actually do help us [...] further understand the [disease] biology. [...] Some of the other things that I hope to be able to do with this [...] technology that we're developing, is to apply to other diseases [that] we believe it can be used with [...]." (Academic participant, PI10)*

> *"Because of our [research], we will have the opportunity to show that [our] models are useful to study this particular [disease mechanism]. [...] We can maybe also bring novel therapeutic targets. I think the openness of our [research] questions will bring an enormous amount of possible projects in the future at many levels, from clinical to basic research. So, in that sense, I expect our project and the data that our project produces to open hundreds of new projects. Hopefully." (Academic participant, PI8)*

Several respondents also argued that the external funding provided by ODIN via the Novo Nordisk Foundation is crucial to the ensure broad scope, flexibility and agility of the research undertaken in ODIN. As one PI stated,

> *"It matters a lot where the money comes from. [...] Because if the company has to pay, they usually don't want the openness, and they may feel that they are paying for a product. This leads to projects that can be quite rigid. [...] It typically ends up with some form of contract research, where you basically decided from the start what you're doing to do. And once you agree to that, then you have to carry out the project more or less the way you planned, even though maybe – if it had been a purely academic project – you would have stopped up and said 'this isn't really the best approach; let's start over and try something different or follow this path instead'." (Academic participant, PI5)*

10.4.3/ "High risk, high rewards" research

Finally, both academic and especially industry respondents interviewed often described the research in their project as "high risk, high reward" research. For instance:

> *"The thing about this project is that it's [...] high-risk, high-gain. If this were easy, someone would have already figured it out and developed medicine from it. But if you look at it, there isn't really much in the pipeline [of pharmaceutical companies]. There actually isn't really anything. And that's an indication that the science needs to catch up. Because we will see it [i.e. basic science to support and develop this approach]. [...] It's increasing at an exponential rate, if you look at publications, high-impact publications, within [this field]. [...] That's why we want to catch this wave now. [...] And that's why it's nice that [ODIN] is willing to invest in these projects, because I think it's highly unlikely, at least where our company is now, that we would invest 4-5 million in a high-risk, high-gain project." (Industry participant, I1)*

The open-ended and early-stage nature of research in ODIN means that ODIN projects generally have a high degree of uncertainty. ODIN is described as being designed to have a high tolerance for risk and failure. And company respondents acknowledge this risk, stating that while projects they participate in are given to advance science, it remains unclear whether they will be successful in spawning downstream applications.

As previously mentioned (see section 8.2), firms have limited in-house resources for R&D, and particularly for explorative, high-risk R&D. The funding provided by ODIN to academic partners was argued to lower internal barriers for participation in these projects.

> *"There are very few resources in firms to start things up outside the pipeline. Those kinds of projects tend to get cut away." (PRC/SG representative from industry, B1)*

> *"We can dedicate some resources to it [i.e. ODIN-type projects], but even though I would say the ODIN budgets – in an industry context – are relatively small, for the types of activities ODIN supports, it's very difficult in the industry to get an okay to do that. Because the immediate value, let's say with within 6 to 12 months is of course not evident, and the risk is also higher." (PRC/SG representative from industry, B3)*

Finally, not only industry respondents but also academic participants emphasize the high-risk, high-gain nature and the tolerance for failure that they ascribe to ODIN:

> *"If we get to the end, and generate all of these data, yet we don't find anything interesting… What does it mean? It doesn't mean anything. It's not gonna affect my next funding application. Where with normal funding mechanisms, if I don't make progress or things are not consistently published, that will have a great effect on my next grant application." (Academic participant, PI3)*

11.0 Concluding reflections

This final chapter presents some reflections on the impact assessment, the results and conclusions of which are summarized in the Executive Summary at the start of this report.

11.1/ How do ODIN projects differ from other university-industry collaborations?

University-industry interactions and collaborations can take many different forms and differ according to e.g. the field of research, the maturity of the research in focus, the sector, size and R&D intensity of the participating companies etc. It is therefore impossible to compare and contrast the collaborative arrangements in ODIN with the full set of university-industry collaborations.

To get a sense of how ODIN might differ (if at all) from other collaborative set-ups, however, both academic and industry respondents were asked to describe their experience so far of their collaboration(s) within ODIN with other prior university-industry collaborations they had engaged in. The results are summarized in table 11.1.

Table 11.1. Differences between ODIN and conventional university-industry collaboration, as assessed by academic and industry respondents, based on their prior collaborative experience

ODIN	Conventional university-industry collaboration
Quick and easy entry into collaboration	Potentially lengthy contractual negotiations
Outputs are shared freely and widely with no restrictions on their further use	Limits on sharing and use of outputs (selective disclosure, IPR options, "wriggle room" etc.)
Use-driven basic research (i.e. informed by industry needs and co-produced)	Not necessarily use-driven or basic research
Active matchmaking and facilitated ideation; facilitated access to academics and firms	Typically no matchmaking or facilitated ideation
Substantial collaboration and two-way exchanges in idea development and projects	Varying forms and degrees of collaboration, especially with regards to industry contributions
Funding seen as key to balanced collaboration and to openness (and thereby to favorable conditions for high-risk / open-ended research)	Source of funding has major influence on terms and conditions of the collaboration
Openness requirements stimulates generic research with multiple potential applications	Both competitive and private funding are associated with more specific research aims
Small projects – retains flexibility, promotes risk taking, keeps coordination costs low etc.	Varying size and scope of projects

These results should be seen as indicative only, give then self-reported nature of the assessment, which is limited by respondents' prior collaboration experience and their very preliminary insight into the ODIN-funded collaboration(s) in which they participate. Nonetheless, they offer a first glimpse into how ODIN may distinguish itself from other university-industry interactions.

11.2/ Concluding reflections from the interim impact assessment

As stated at the outset of this report, the interim impact assessment can provide only a very preliminary picture of the progress and potential impact of ODIN, given that the main component in ODIN – the 11 research collaborations – are all still early-stage.

Nonetheless, the interim impact assessment indicated that the progress made within the overall ODIN program has met and indeed exceeded pre-defined KPIs. Concepts and procedures have been established to carry out the aims of the ODIN pilot project, including an open legal framework, ideation and matchmaking activities, procedures for attracting and assessing project applications, guidelines for research projects etc.

Moreover, initial impressions from the 11 projects are positive and promising, emphasizing expected benefits from increased openness in university-industry collaborations and a close collaboration between academic and industry partners. Industry partners describe ODIN as a quick and effective means of identifying possible academic partners and entering into academic collaborations, as well as conducive to "high risk, high reward" projects and the pursuit of long-term investments in basic research with high expected relevance for downstream commercial applications. Academics, in turn, emphasize the benefits of openness for the advancement of science and applications thereof, as well as the ability to accessing funding – through ODIN – to pursue open-ended, exploratory research with a broad range of potential future scientific and commercial applications and generic elements (focusing on e.g. building tools, platforms and/or basic scientific insight rather than investigating specific mechanisms). Meanwhile, ODIN requirements of active industry contributions is described as promoting upfront commitment by industry partners while supporting ongoing build-up of internal competences and absorptive capacity to allow firms to later apply outputs to commercial ends.

Given the pilot nature of ODIN, its results are likely to hold importance for later decisions about whether or not to extend and/or scale up activities in ODIN, or to establish similar platforms in other fields of research. For the overall impact assessment of ODIN, and for such decisions, some key questions include whether the close two-way collaboration and active involvement of industry partners will be sustained throughout the project period; how the outcomes of the self-described "high risk" project will influence the overall assessment of the outputs from ODIN, given that failure is likely when risk levels are high; how many and which types of further research projects and downstream applications will emerge from the ODIN-funded projects. Finally, the open legal framework will stand its true test as outputs from ODIN-funded projects begin to emerge and, presumably, transition into proprietary (or new, open) projects.

Appendix I. Interview respondents

This appendix lists all interview respondents.

All PIs in the 11 ODIN-funded projects were contacted and interviewed . In total, 13 out of 13 PIs were interviewed (see Table I.1). All of them were from Aarhus University (AU).

All industry participants were contacted; five industry participants declined to participate or did not respond to requests for an interview. In total, 13 out of 18 instances of industry participation in ODIN-funded projects were interviewed (see Table I.2). Some projects also include so-called "interest companies" who do not play an active role in the projects; these interest companies were not contacted in connection with the first round of interviews.

The list of respondents included in background interviews can be seen in Table I.3.

Table I.1. Interview respondents, PIs (interviewed in 2021)

Call round	Project	PI	Interviewed (Y/N)
1	BIOMETSCO	Lasse Sommer Kristensen	Y
1	KidDO	Robert Fenton	Y
1	MiCO	Mark Denham	Y
1	oLIVER	Jørgen Kjems	Y
1	THOR	Jacob Fog Bentzon & Mette Nyegaard	Y
2	FRIGG	Rikke Nørgaard & Lene Nejsum	Y
2	BioPsych	Betina Elfving	Y
2	BALDER	Peter Sørensen	Y
2	P2P CPP	Hanne Poulsen	Y
2	IMPAD	Marina Romero-Ramos	Y
2	CELPPLUS	Duncan Sutherland	Y

Table I.2. Interview respondents, industry participants (interviewed 2021-2022)

Call round	Project	Industry participants	Interviewed (Y/N) and name of respondents
1	BIOMETSCO	BioXpedia nanoString AstraZeneca Omiics	N N N Y (Susanne Venø)
1	KidDO	AstraZeneca	Y (Pernille B. Lærkegaard Hansen)
1	MiCO	Novo Nordisk Omiics	Y (Jonathan Niclis) Y (Susanne Venø)
1	oLIVER	Novo Nordisk	N
1	THOR	Novo Nordisk	Y (Michael Nyberg)
2	FRIGG	Novo Nordisk AstraZeneca Nordic Bioscience	Y (Peter Helding Kvist & Agnès Bénardeau) Y (Pernille B. Lærkegaard Hansen & Timo Haschler) Y (Federica Genovese)
2	BioPsych	omiics Bioneer	Y (Morten Venø) Y (Boye Schnack Nielsen)
2	BALDER	Novo Nordisk	N
2	P2P CPP	STipe Therapeutics *	Y (Richard Bethell)
2	IMPAD	Lundbeck	Y (Karina Fog)
2	CELPPLUS	Leo Pharma	Y (Christine Brender Read & Andreas Herschenhan)

* This project included one more industry participant that was not deemed relevant to include in the interview round given their limited direct involvement in the project.

Table I.3. Interview respondents, background interviews (interviewed 2021)

Role	Name and affiliation *
ODIN Secretariat	Marie Louise Conradsen, Freja Bertelsen & Ditte Engholm, AU
ODIN Project Review Committee	Lene Nejsum, AU Jørgen Kjems, AU Pernille B. Lærkegaard Hansen, AstraZeneca Daniel Timmermann, Novo Nordisk Georg Duenstl, Leo Pharma
ODIN Steering Group	Niclas Nilsson, Leo Pharma
AU Technology Transfer Office	Anette Poulsen Miltoft, AU

* Affiliation at the time of the interview. Some respondents have since changed their affiliation.

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