



# Open data partnerships between firms and universities: The role of boundary organizations



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## ABSTRACT

Science-intensive firms are experimenting with ‘open data’ initiatives, involving collaboration with academic scientists whereby all results are published with no restriction. Firms seeking to benefit from open data face two key challenges: revealing R&D problems may leak valuable information to competitors, and academic scientists may lack motivation to address problems posed by firms. We explore how firms overcome these challenges through an inductive study of the Structural Genomics Consortium. We find that the operation of the consortium as a boundary organization provided two core mechanisms to address the above challenges. First, through mediated revealing, the boundary organization allowed firms to disclose R&D problems while minimizing adverse competitive consequences. Second, by enabling multiple goals the boundary organization increased the attractiveness of industry-informed agendas for academic scientists. We work our results into a grounded model of boundary organizations as a vehicle for open data initiatives. Our study contributes to research on public–private research partnerships, knowledge revealing and boundary organizations.

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‘All human genomic sequence information (. . .) should be freely available and in the public domain in order to encourage research and development and to maximise its benefit to society’ (Human Genome Project, 1996).

## 1. Introduction

The above quote expresses the ‘open data’ rule that constituted a cornerstone of the Human Genome Project. The disclosure regime of this large-scale research programme was built on the principle of free, unrestricted and timely access to research findings for all interested parties (Murray-Rust, 2008; Molloy, 2011). In the Human Genome Project, public science was pitched against for-profit entities with competing projects based on proprietary intellectual property (Williams, 2010). Yet increasingly firms themselves participate in and even instigate open data initiatives, either by releasing data to academic communities with no restriction or by supporting the generation of open data. Partnerships sponsored

by pharmaceutical companies, such as the SNP<sup>2</sup> consortium and the Genetic Association Information Network (GAIN) have made their data publicly available (Cook-Deegan, 2007; Pincock, 2007; Allarakhia and Walsh, 2011).

Partnerships with universities, aided by public or charity grants, are natural territory for open data practices, given the prominence that public knowledge creation has in the norms and traditions of academic science (Dasgupta and David, 1994). The propagators of open data in corporate R&D argue that by integrating their R&D programmes more closely with those of open academic communities, firms may reap significant benefits for both the quality and the volume of their innovation activity (Melese et al., 2009).

Nevertheless, participation in open data partnerships with universities is likely to complicate firms’ attempts to capture value from research. A first challenge is that firms may fear that proprietary information about their R&D agendas and technologies is publicly disclosed (Alexy et al., 2013), given that open data initiatives operate with minimum intellectual property protection and disclose all research results with no restriction. The second challenge, from a firm’s viewpoint, is to motivate outsiders to work on problems that are valuable to the firm, without being able to

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<sup>2</sup> SNPs are ‘single nucleotide polymorphisms’. They indicate possible mutations of a gene, and can be used as disease markers.

offer IP-related incentives (von Hippel and von Krogh, 2006; Levine and Prietula, 2014). In other words, in open data initiatives which, unlike traditional firm-sponsored contract research, are strongly aligned with academic conventions, firms may struggle to persuade scientists to work on firm-defined priorities rather than their own personal research agendas.

Extant research provides limited insight into how firms can address these challenges. The literature on research partnerships between firms and universities is largely focused on contexts with traditional, IP-centred appropriation mechanisms in place (Link and Scott, 2005; Bercovitz and Feldman, 2007) but says little about how open data partnerships ought to be structured and governed.<sup>3</sup> In this paper, we therefore address the following research question: what partnership characteristics enable firms to benefit from open data collaboration with academic researchers?

To explore how firms overcome the challenges of open data initiatives, we examined the structures and practices of an international life sciences partnership. We present an inductive study of the Structural Genomics Consortium (SGC) which led an open data programme involving firms and academic scientists. Supported by charity, government and industry funding, the SGC brought together pharmaceutical firms including GlaxoSmithKline, Novartis and Merck, with the Universities of Toronto and Oxford, and the Karolinska Institutet (Stockholm). The SGC's mandate was to determine the three-dimensional shape of proteins and release this knowledge into the public domain without restriction. This information is seen as vital to the discovery of new drugs to combat common human diseases, including cancer, diabetes and inflammation.

We draw on our empirical analysis to develop a grounded model of open data in university–industry partnerships. We propose that open data university–industry partnerships that are structured as boundary organizations (O'Mahony and Bechky, 2008) are particularly adept at generating productive outcomes while mitigating firms' challenges. Boundary organizations accomplish this via two core mechanisms: mediated revealing and the enabling of multiple goals. The former allows firms to reveal their research problems to external problem solvers in a way that reduces the threat of unintended knowledge disclosure and simultaneously allows them to shape the collective research agenda. In turn, by enabling multiple goals – in this case the concurrent pursuit of both industrial and academic goals – the boundary organization broadens the objectives and activities of the partnership so they align with the ambitions and professional practices of academic researchers which in turn helps to ensure their participation.

Our findings contribute to previous work by considering the implications of open data for both the rationales underpinning research partnerships between firms and universities and questions of organization design. In particular, we demonstrate the role that boundary organizations can play in orchestrating industry-informed, large scale scientific work that has the potential to advance and transform the knowledge commons from which science-based sectors draw.

## 2. Open data in university–industry partnerships

Open data partnerships provide universal and free access to research outputs including results, data and sometimes materials (Murray-Rust, 2008; Molloy, 2011). The open data approach is in contrast not only to commercial emphasis on intellectual property rights, but even to classic open science in which only the final

outputs are shared (Boudreau and Lakhani 2015; Franzoni and Sauerermann, 2013). Various scientific communities have recently adopted increasing openness, including the free sharing of data on which outputs are based (Reichman et al., 2011).

This development was partly spurred by the increasingly widespread use of computer code and large datasets which makes the large-scale sharing of data both feasible and economical (Boulton et al., 2011). The same technological affordance has facilitated 'crowd science' experiments where problem solving is pursued by a large number of dispersed contributors (Franzoni and Sauerermann, 2013). Particularly in the life sciences, a further driver of open data is the trend towards larger scale initiatives designed to address the complex, interconnected nature of biological systems which has tested the limits of the traditional small-scale approach in biology, centred around individual investigators (Swierstra et al., 2013). The Human Genome Project (HGP) absorbed \$3b of funding and used an open data approach to facilitate coordination across thousands of researchers around the world, and the subsequent exploitation of the generated knowledge (Wellcome Trust, 2003). Similarly, the Census of Marine Life project resulted in the Ocean Biogeographic Information System (OBIS) database, the world's largest open access repository of marine life data (Vermeulen et al., 2013).

The sharing of data in areas such as genetics, clinical trials and climate science is supported by various types of stakeholders, including research funding organizations, patient groups, interest groups and not least academic scientists themselves. They argue that open data enables scientific communities to validate and substantiate the results of previous research and thereby enhance its quality, particularly in areas where conflicts of interests are at play such as pharmaceutical research (Washburn, 2008).

Below, we first contrast the new open data approaches with traditional approaches in university–industry collaboration and then outline the specific challenges that open data collaborative initiatives create for for-profit firms.

### 2.1. Research partnerships between firms and universities

Research partnerships are innovation-based relationships focusing on joint research and development (R&D) activities (Hagedoorn et al., 2000). Firms engage in research partnerships because they allow investments in the creation of new knowledge to be shared across multiple participants. They also provide firms with access to complementary knowledge, broaden the scope of their R&D, and create new investment options in high-risk contexts (Hagedoorn et al., 2000; Perkmann et al., 2011). Especially in science-intensive sectors such as chemicals and pharmaceuticals, universities represent important partners and sources of innovation for firms (Mansfield, 1991; Cohen et al., 2002). Firms tend to view university research as complementary (rather than substitutive) to internal R&D (Rosenberg and Nelson, 1994; Hall et al., 2001). Access to key personnel represents an additional important motive for firms to work with academia, resulting both in "information gifts" from highly specialized academics as well as opportunities for hiring students and staff (Hagedoorn et al., 2000).

Partnerships are not without challenges. Chief amongst these is the concern that a firm may struggle in appropriating the knowledge outputs generated in the partnership (Teece, 1986). Compared to inter-firm partnerships, such concerns are even more pronounced in university–industry partnerships (Hagedoorn et al., 2000). There are two aspects to this problem. First, firms' efforts to appropriate knowledge arising from partnerships may be misaligned with open science practice. Academics may prefer generating publishable research output and contest the formal requirements involved in creating protected knowledge assets (Murray, 2010). At the very least, this may lead to an uneasy

<sup>3</sup> The phenomenon we refer to as 'open data' has also been labelled 'open source science' or 'open access research' (Munos, 2006; Edwards, 2008; Gowers and Nielsen, 2009; Hope, 2009; Melese et al., 2009).

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