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Open Innovation: Revealing and Engagement in Open Data Organisations

Franz Huber, Francesco Rentocchini, Thomas Wainwright

University of Sussex

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Open Innovation: revealing and engagement in Open Data organisations

Franz Huber

Privatuniversitaet Schloss Seeburg, Salzburg, Austria

Francesco Rentocchini

Department of Economics, Management and Quantitative Methods, University of Milan, Italy

and

Southampton Business School, University of Southampton, UK

Thomas Wainwright

Royal Holloway, University of London, UK

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Abstract

Researchers have focussed increasing attention on the digital economy's role in driving innovation and product development. One emerging digital sector is Open Data, where organisations publish digital data, for free, that can be used by anyone to produce new products and services. Government and private sector organisations in the US, Europe, and emerging economies are publishing Open Data. We view the processes associated with Open Data as a form of Open Innovation and use the paper to contribute to filling some of the Open Innovation literature' gaps. While Open Data has been viewed as having considerable potential in enabling innovative digital products and services to be developed, we argue that the economic value from these products have not yet been fully realised. This is due to a limited research base on Open Data's use in practice, but also how Open Innovation operates within the sector. Barriers include hesitation in publishing Open Data as the benefits and risks from releasing data are unclear, while users can struggle to discover relevant Open Data and use it. Drawing upon 30 semi-structured interviews with UK based organisations, who publish and consume Open Data, our paper aims to look into their Open Innovation activities. We focus on outbound Open Innovation, the risks that organisations face, how they manage data asset revealing, and how 'gatekeepers' are used develop external engagement with users to facilitate successful new products development. We offer three main contributions to the Open Innovation literature. First, we provide insight into open service innovation in the context of Open Data and the digital economy, meeting calls for new insight into Open Innovation which occurs within the service sector. Second, we examine how organisations adopt selective revealing strategies. Finally, we contribute understandings into the role of gatekeepers who cross intra-organisational boundaries and facilitate engagement.

Keywords

open data; open innovation; digital economy; selective revealing; gatekeepers; engagement

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Open Innovation: revealing and engagement in Open Data organisations

1. Introduction

Policymakers and researchers have paid increasing attention to the potential role of the digital economy in boosting growth and driving innovation (Brynjolfsson, 2002). This has led to the development of new digital businesses which capture value through a number of new strategies, among which includes Open Innovation (Bharadwaj et al. 2013; West et al., 2014). One particular new area, supported by governments in the US, Europe, and increasingly emerging economies, relates to Open Data (Cabinet Office 2012; Open Data Institute 2015; Lee et al. 2014; Almirall 2015). Open Data refers to information that has been collected by an organisation which owns the IP rights, but which is then published online for other organisations to use freely (Open Data Institute 2015). What is especially notable is how Open Data has to be made available at no cost, and which can be used by any organisation – even competitors (Open Data Institute 2015). It can be argued that the publication and use of Open Data can be viewed as an extreme form of Chesbrough's (2003; 2006) Open Innovation. At the same time, we believe that Open Data provides a unique opportunity to fill some of the gaps recently outlined in the Open Innovation literature (West et al., 2014; Chesbrough et al., 2014).

The Open Data Movement has been supported by the introduction of new legislation by governments, which requires that their departments publish data which can be used by private sector SMEs and corporations to develop new innovative services (BIS 2014; Data.gov 2015). Advocates of the Open Data Movement claim it reduces costs,

as it is free, enabling organisations to retain more monetary value from new innovations. In addition, it provides access to previously unavailable data, enabling innovative digital services to be developed, which creates new social and economic value (Lee et al. 2014; BIS 2014; Data.gov 2015). The potential global economic impact has been estimated as being worth $3.5 trillion dollars annually (McKinsey 2013). However, despite government involvement and the anticipated economic impacts, the Open Data Movement is relatively new dating from 2012, and there is limited research and evidence of good practice from this sector and how Open Innovation operates within it. Our paper seeks to address this. In particular, there are considerable barriers to unleashing the potential of Open Data for the economy. Many public and private sector organisations are hesitant to publish Open Data as the benefits and risks from releasing data are unclear, and even if Open Data is available, its use by external organisations is limited (Almirall 2015). This may be due to difficulties in discovering relevant Open Data by users and then having the capabilities to use it. Our paper aims to look into these barriers and presents insights on how to overcome them.

Open Data can be examined through the Open Innovation paradigm as it is contingent on networks of collaborating public and private stakeholders who make their data available to actors outside of their own organisational boundaries (Chesbrough 2003; 2006; 2015). Drawing upon 30 semi-structured interviews with organisations in the UK who publish and consume Open Data, we provide new insight into their Open Innovation activities. By focussing on outbound Open Innovation, we examine the risks these organisations face, how they decide which data assets to reveal while preventing unintentional data leakage that undermines competitive advantages, and how information system ‘gatekeepers’ develop external engagement.

This paper provides several contributions to the current Open Innovation literature. First, it seeks to provide insight into open service innovation in the context of Open Data and the digital economy. The paper will move beyond earlier Open Innovation studies in high-tech manufacturing, meeting calls for new insight into Open Innovation which occurs within the service sector (Chesbrough, 2010; Chesbrough et al, 2014). Second, the paper will examine how organisations engaging with Open Innovation adopt selective data publication strategies. In doing so, we answer the recent call from Open Innovation scholars to investigate selective revealing strategies (Alexy et al., 2013; Salter et al., 2014). Finally, we seek to go beyond the focus on R&D of organisations in the Open Innovation literature (Chesbrough, 2003). Specifically, it will contribute understanding the role of information system gatekeepers who cross intra-organisational boundaries and facilitate engagement.

The remainder of this paper is structured as follows: section 2 will review the literature on Open Innovation and will provide insight into the relevance of Open Innovation to the Open Data sector. Section 3 describes the methodology. Section 4 examines the identification of risks and revealing strategies of organisations involved in Open Data publication. Section 5 investigates the practices of active engagement though information systems gatekeepers. Section 6 will conclude the paper.

2. Open Innovation

2.1 Open Innovation and the digital economy

Interest in Open Innovation (henceforth OI) by academics and practitioners has grown considerably since the early 2000s, with the launch of Chesbrough's (2003) seminal text. OI can be defined as the 'use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively' (Chesbrough 2006b:1).[1] One of Chesbrough's core arguments is that earlier R&D activities often occurred within organisations, where new knowledge and ideas were kept strictly in-house, even if no commercial use was found for the assets. Alternatively under OI, organisations accelerate their innovation processes by using knowledge and ideas from outside their organisational boundaries, but which can be leveraged with an organisation's internal assets and established position in markets (Chesbrough 2006). Researchers have argued that this accelerates and reduces the costs of innovation, making OI more efficient (Chesbrough and Crowther, 2006; Frenz & Letto-Gillies, 2009) and brings about positive effects in terms of innovation (Laursen and Salter, 2006), revenue growth (Chesbrough and Crowther, 2006) and financial performance (Rothaermel and Alexandre, 2009). As a complete review of the OI literature is beyond the scope of this paper (for excellent reviews, see Vanhaverbeke et al. (2014), West and Bogers (2014), West et al. (2014) and Randhawa et al. (2016)),

[1] The concept was later re-conceptualised to add the important contribution to the field of non-pecuniary motivations and alignment with the company business model. In its new formulation Open Innovation has been defined as 'a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model.' (Chesbrough and Bogers, 2014, p. 17)

we focus on three main gaps in the OI literature which relate more closely to the areas where research on Open Data can provide valuable contributions.

First, the initial focus of the OI literature has been on large (high-tech) manufacturing companies (Chesbrough, 2006; Laursen and Salter, 2006). Chesbrough himself later extended the analysis of OI to services, claiming that OI can be beneficial for the service industry, too (Chesbrough, 2011). Furthermore, OI practices and their effects can be different in service as opposed to manufacturing firms. For example, Mina et al. (2014) analysed OI activities in the UK service industry. They found that business services use more open innovation than manufacturers; they engage more in informal rather than formal OI practices and they rate scientific and technical knowledge components highly against market knowledge, compared to manufacturing companies. Despite being central to the current service-led economy, open service innovation has received scant attention (Randhawa et al., 2016). This is problematic given the increasing share in the contribution of value-added activities coming from the service sub-sector of the economy (Miles, 1993), but also due to the increasing 'servitization' of manufacturing activities (Kastalli and Van Looy, 2013). Similarly, most of the OI literature has historically focused on large companies, neglecting Small and Medium Enterprises (SMEs). Only recently, have researchers turned to analyse how OI practices differ between large companies and SMEs (for a review, see Vanhaverbeke (2012) and Van de Vrande and Brunswicker (2014)). For example, Van de Vrande et al. (2009) analyse survey data collected from 605 SMEs in the Netherlands and show that, compared to large companies, SMEs are more heavily involved in OI activities and they pursue OI primarily for market-related motives (such as satisfying customer needs or battling with competitors). Similarly, Spithoven et al. (2013) using the Belgian community innovation survey, find that OI practices in SMEs

differ from those in large companies. SMEs are found to be more effective in using different OI practices simultaneously and to capture value from intellectual property protection mechanisms. Although these two streams of the literature have seen an increasing interest from OI scholars, the focus on open service innovation activities and SMEs remains limited.

Second, existing work in the OI literature points to the existence of three different types of OI. The first, outside-in (inbound), is where internal innovation processes are opened to accept external inputs (Dahlander and Gann 2010). Under this mechanism, inbound knowledge and assets need to be integrated into existing processes and frameworks within the organisation (West and Bogers 2014). The second, inside-out (outbound), involves the opening of underutilised or unused assets to actors outside of the organisation's boundaries (Tranekjer and Knudsen 2012) through processes of revealing, sales and licensing (Dahlander and Gann 2010). The third, coupled OI, involves organisations that use both inbound and outbound flows within their business models through joint activities with other organizations (Gassmann and Enkel 2004; Bogers 2011; Boger et al, 2012). Recent contributions in the OI field highlight how there is a disproportionate number of studies which relate to inbound OI and (to a lesser extent) coupled OI, compared to outbound OI. For example, West and Bogers (2014, Figure 2) show that out of 165 scientific articles which they survey, only 14 of them refer solely to outbound OI. This is problematic, because within the outbound OI literature, a relevant research question has attracted increasing interest, namely how companies renounce elements of appropriability when dealing with OI. Recent contributions in the field have focused on understanding the reasons companies adopt selective revealing strategies. To our knowledge, the first paper to adopt the term 'selective revealing' is Henkel (2006), who examines selective revealing strategies in

a profit-oriented environment. Henkel and colleagues use the case of embedded component manufacturers that forsake their proprietary stance with the advent of the Linux operating system to show how and why companies in this market segment decided to adopt these strategies (Henkel, 2006; Henkel et al., 2014). The authors show that this was initially a customer demand pull effect, where customers explicitly demanded that component manufacturers adopt the newly established 'open' approach. This initial shock triggered positive feedback loops which eventually led to a further adoption of selective revealing (Henkel, 2006; Alexy et al., 2013). In a similar vein, Laursen and Salter (2014) study the complementarity between selective revealing and appropriability strategies. The authors show that higher appropriability strategies are positively related to external search breadth and innovation collaboration breadth, but mainly if they collaborate with competitors. Finally, Alexy et al (2013) provide a conceptual framework to better understand the conditions leading companies to reveal internal assets to external agents. The researchers discuss specific characteristics that are likely to drive the willingness of companies to selectively reveal: nature of the collaboration, type of external knowledge, need to influence the technology, internal and external drivers. Although the above-mentioned studies should be seen as a positive contribution that go some way to addressing the research gap, studies in this area remain limited.

Third, research on the impact of OI has historically focussed on the company R&D department/function. The role of OI for a firm can actually extend beyond the R&D function and integrate with other relevant company's functions (e.g. human resource management, support services, legal department) (Chiaroni at al. 2011). OI scholars have recently lamented the almost exclusive focus of the impact of OI on firm R&D department/functions and propose the study of OI strategies and integration with other

functions, such as IPR departments, support services, and IT, for example (Vanhaverbeke et al., 2014). Although, recent contributions in the field have covered the connection between human resource management and OI, a vast gap remains to be filled (Podmetina et al., 2013; Van Steerthem et al., 2013).

2.2 Open Data

Open Data (henceforth OD) originates from a recent movement where governments make their agencies release data for public use. These data are made available online and in machine-readable format so that citizens and businesses can access and use them to make innovative and value-added products or services (Chan, 2013; Janssen, 2011). Notable examples in the UK include the Land Registry, which publishes data associated with landownership; Ordinance Survey, who publish UK mapping and spatial data, the Department for Transport, who publish data on vehicles, road safety, and timetables, and the Greater London Datastore, who reveal civic data on the local economy, housing safety and environment. Later on, OD was extended beyond public administrations and has been embraced by several companies and SMEs who started to consume inbound OD and reveal outbound OD to the public (Lee et al. 2014). Figure 1illustrates how different organizations can become interconnected through OD. Ecology A represents a simple relationship where an organisation may use OD from one publisher as part of their innovation activities. Ecology B represents a more complex set of relationships, where an organisation such as an OD User/Publisher may use multiple OD sources from a mixture of different government agencies, corporations and SMEs in its innovation activities, before publishing its own OD, used by other organisations.

The OD Movement began to gain momentum after 2009, when US President Obama developed the Memorandum on Transparency and Open Government, which sought to open data to the public (Lee et al. 2014). This movement can be loosely connected to other 'open movements', including open knowledge, open government and open source software, and has begun to attract a series of leading stakeholders. Early interest in the OD Movement has arguably been strong, driven by the participation of public intellectuals credited with development of the Internet, such as Sir Tim Berners-Lee and Sir Nigel Shadbolt.

Despite the strong interest in OD by policy-makers and practitioners, the current academic literature on OD is limited and sporadic, given that the OD Movement is relatively new. Earlier research emerged from the discipline of web science which scrutinises the technical processes and opportunities for connecting data sets, particularly through debates examining the semantic web, ontologies and linked data, with regard to practical applications and the organisation of web infrastructure (Jain et al. 2010; Missier et al. 2010; Oren et al. 2008). In contrast, research from the overlapping spheres of policy studies and information management have examined the role that OD has in national information polices, particularly with regard as a facilitator for transparency, democracy and civic engagement (Janssen et al. 2012; Bates 2012; 2013). In the data rich fields of natural science and pharmacology, debates have sought to identify and determine how OD could be used as a new source of data, alongside 'Big Data' to support scientific studies and to share information amongst researchers (Vision 2010; Reichmann et al. 2011; Molloy 2011). What is particularly notable, is the limited research in management, innovation and information studies on this topic.

This may explain why researchers have argued that there has been a disconnection between the vision and reality of OD utilisation, where the latter has not been as successful as it could be (Lee et al. 2014). For example, Almirall (2015) argues that the best case for OD in the US is data.gov, with 400,000 datasets, published by 200 government agencies, but that only 150 apps have emerged from data on the portal, and only 24% of those have more than 10,000 downloads, at a decreasing rate. While there have been problems in OD involving data standardisation, licensing and quality (Almirall 2015; Lee et al. 2014), it can be argued that technologists have not given sufficient attention to the processes of business and innovation, understanding what data to reveal and open, and how to develop relationships between publishers and users to ensure that OD can be understood and absorbed into organisations that are external to the publisher. Growing interest by practitioners and researchers are seeking to examine the business use of OD, through the Open Data Institute's Start-up programme[2], European Open Data Incubator[3], and the Open Data 500[4] survey, for example, but critical insight into OD practices remain limited.

2.3 Open Data through the lens of Open Innovation

In contrast to the OD Movement, organisations have begun to absorb and publish OD to create new products and services, making OD usage an innovation strategy. OD can be examined through the lens of OI, as the data needed by innovative firms to create new services is often collected, collated and held by other distributed actors within the wider economy and society (cf. Chesbrough 2004). Subsequently, data that

[2] http://theodi.org/start-ups
[3] https://opendataincubator.eu/
[4] http://www.opendata500.com/

is not used, or is underused, once opened and revealed can be used by external corporations, SMEs or even other government agencies to develop new innovative apps and services. Previously, government and private data has been underutilised and hidden, following a closed model of innovation, where external businesses often had to purchase proprietary data from other organisations or collect it themselves, hindering innovation as data was unavailable for purchase, or was too expensive to make a new service or app viable. We believe that OD constitutes an interesting area of study for OI scholars for a number of reasons which closely refer to the key avenues of research highlighted by the current OI literature and discussed in Section 2.1 of the present manuscript.

First, the OD business segment is an interesting area of application for OI as it is mainly characterised by SMEs providing business services to other private and public organisations. OD firms adopting OI strategies are characterised by a rich interactive process which, by definition, involves consumers to a high degree. This is in the spirit of the initial development of open service innovation (Chesbrough, 2011). OD publishers can potentially work closely with inbound consumers to improve data quality, as their value proposition focuses on utility rather than the sale of data itself, as well as integration with customers in a process of data co-creation. Moreover, OD is a nascent industry segment and, as such, is characterised by the proliferation of new ventures of small initial size (Klepper, 1996). At this initial stage of development, OI strategies are closely linked to the company business model and the role played by the founder/entrepreneur (Vanhaverbeke et al., 2014). For example, Colin et al. (2014) show that the relationship between OI strategies and innovation performance is positively moderated by the strategic orientation of the company. Notably, this effect is particularly strong for entrepreneurial orientation. The case of OD resonates well

with a high level of entrepreneurial orientation, where companies are highly proactive towards market opportunities, open to new ideas and are tolerant of risk (Gassman, 2006; Keh et al., 2007). Furthermore, these companies are characterised by an 'open' organisational culture similar to that of open source software communities and tend to hire highly educated employees, all factors which relate well to the implementation of OI practices (West and Gallagher, 2006; Harrison and Koski, 2010). Subsequently, our first contribution to the OI literature comes from the analysis of OD as a case to understand boundary conditions for SMEs adopting Open service innovation strategies (Tucci et al., 2016). Obstacles and failures in the adoption of OI strategies are more likely to happen in a nascent industry segment such as OD. Studying how OD companies identify and manage OD publication risks can prove to be a valuable contribution to the existing OI literature, particularly with respect to open service innovation strategies in SMEs.

A second area where the study of OD can be fruitful for the OI community relates to selective revealing. Although OD businesses can in principle run the full set of OI activities (outbound, inbound and coupled), our focus here is on the outbound OI process. Previous studies in the OI literature have proposed some advantages and disadvantages of selective revealing strategies. On one side, advantages relate to a combination of market-related (increased reputation, advertising, increased customisability) and technology-related (access to new markets, reduced production costs, standardisation) factors. On the other, disadvantages refer mainly to the risk of imitation, decreased reliability, security issues and higher maintenance costs (Henkel, 2006; Henkel et al., 2014). Despite these initial contributions, understanding processes of selective revealing and how organisations decide what assets to open to avoid undermining an organisation's competitive advantage is far from being fully

understood. OD can be a fruitful domain of application to this purpose. OD publishers are keen for their revealed assets to be used, but one difficulty in using OD is understanding the attributes behind the data's initial collection (Lee et al. 2014), and how it can be repurposed. OD companies try to induce collaborative behaviours particularly when there is high uncertainty about which partners can improve their data assets and costs of coordination are high (due to the level of interoperability, selective access to data, etc.). This higher need for both content and structural compatibility is likely to lead to an increasing reliance on selective revealing strategies (Alexy et al., 2014). Finally, as mentioned in Section 2.2, OD is a 'new' movement in several countries (Janssen, 2011; Gunapati and Reddick, 2012) and bears the expectation of being able to influence the evolution of future technological trajectories, which is another pre-condition for the adoption of selective revealing strategies (Alexy et al., 2014).

A third area where OD may contribute to fill the gaps in the current OI literature is its ability to combine different functions within a firm. Although there are few cases of analysis of the role of OI beyond R&D (see Section 2.1), they mainly refer to inbound OI and human resource management practices. To our knowledge, there is currently a lack of coverage of IT-OI links with respect to outbound OI practices. Nevertheless, the importance of IT-enabled crowdsourcing in SMEs compared to large companies has been highlighted in the current OI literature (Van De Vrende and Brunswicker, 2014). Similarly, Gianiodis et al. (2014) highlight the importance of the external acquisition of IT systems in leveraging service innovation for the banking sector. The OD case, with a combination of IT-related capabilities and open innovation strategies, can provide further insights into this new topic.

3. Methodology

This paper draws upon research from a wider project on OD and the digital economy in the UK. We accept that the OD Movement has become increasingly international, but in order to understand this emergent sector, the UK was chosen as a unique context to gain greater insight and to control for national institutional variations in this understudied field. The UK is an ideal context to study OD as it is home to many key protagonists for the OD Movement, for example: Sir Tim Berners-Lee and Sir Nigel Shadbolt who have accelerated interest in the phenomenon. It was also one of the first countries to introduce legislation requiring government departments to publish OD in 2012 (BIS 2014). London in particular has been a key site for the organisation of the OD Movement, being the site of the Open Data Institute which lobbies for the release of open data, provides start-up support, technical advice and training in OD, while shaping the debates and creating an international network to promote the OD movement elsewhere (Open Data Institute 2015). In addition, UK cities such as London and Manchester host an emerging digital tech sector, with technical and entrepreneurial expertise that can utilise OD, making the UK and important study site (Open Data Institute 2015). As such, we focus exclusively on UK organisations involved in OD consumption and publication.

Primarily, we used semi-structured interviews to collect data for the project. We recognise that there are challenges in developing robust generalisations from qualitative studies. However, we argue that this study does not seek to be representative, but rather to uncover insight into the processes of selective revealing and mechanisms of collaboration through Open Innovation, rather than examine the scale of activities, which a quantitative study may seek to achieve. The research data

consists of 30 semi-structured interviews conducted by all three authors in the UK, between 2014—2015 (See Table 1). Each interview lasted between 45 minutes and two hours, was recorded and transcribed to accurately capture the conversations. Where possible, face to face interviews were conducted at the offices of the interviewee to assist in the contextualisation of the information provided, although some digital businesses insisted on Skype interviews, due to their flexible working routines (See Table 1). Respondent data has been anonymised to protect the identities of the interviewees and their organisations and to manage commercial sensitivities. In addition, we also analysed organisational websites, API blogs, company reports and documents supplied by interviewees to inform our analysis.

[Table 1 around here]

As OD organisations constitute a new subsector of the digital economy, there are no established, defined populations of actors that publish and consume OD. We used a series of official and unofficial sources in our sampling approach to identify relevant participants. First, we turned to official sources to identify organisations involved in OD from the Open Data Institute, from their membership list, and cases from data.gov. However, these organisations were sometimes interested in the OD Movement, as opposed to being active publishers and consumers of OD. Second, we turned to unofficial sources, using searches for companies that claim to utilise OD, in addition to snowballing through the developer community. Organisations that actively published or consumed OD were approached and invited to participate in the project. Overall, we approached 37 OD organisations, 30 of which responded, and we could

not identify clear patterns for non-response. Table 1 shows the characteristics of the organisations interviewed. The interviewees were selected to gain insight into to a series of different organisations, including public sector OD publishers and consumers, private sector OD publishers and consumers, including SMEs and larger corporations (See Table 1). This enabled us to gain insight into the different processes involved in publishing and consuming OD through OI processes, based on variations in the type of organisation. Interviewees included chief information officers, heads of data and statistics, owner-managers, and product/innovation managers.

We utilise an interpretive qualitative approach (Gephart 2004) to provide a detailed examination on how OI occurs between actors that publish and consume OD. In order to manage consistency across the three interviewers, a semi-structured interview guide was used to ensure that similar issues and topics were discussed, to facilitate analytical comparisons in the analysis, while providing flexibility in the interviews to capture issues the research participates deemed relevant, which is important given the limited research in the OD sector (cf. Biniari 2012). In particular, the guide themes examined the function or purpose of the organisation and their motivations for using or consuming OD. The guide also sought to investigate the potential risks involved, the processes and strategies involved in the decision to publish data, and the negotiation of selective revealing. In addition, the questions aimed to elicit data on the collaboration and engagement strategies used to enhance the efficacy of successful outbound OI. The transcripts were thematically open-coded (Meyers 2008) after the creation of key themes emerging from the interviews and OI literatures. Critical verification techniques (Morse et al., 2008) were applied to optimise validity, and a second coder double-checked and amended the interpretation of the coded themes. We aimed to address potential uncertainties in terms of biased memorising or strategic

impression management by using credibility probes during the interviews and critical interpretation of the transcriptions (Rubin and Rubin, 2011.

4. Open Data: revealing assets and preventing leakage

4.1 Identifying and managing Open Data publication risks

Protagonists of OD have argued that its use can be particularly valuable to organisations when consumed as it reduces data costs, or unleashes previously unavailable data that enables the creation of entirely new products and services (Cabinet Office 2012; Open Data Institute 2015). Outbound and inbound innovators can also gain recognition/reputation in external user communities, which can generate alternative revenue streams through selling products and premium services. Similarly, OD can be combined with closed data to create new proprietary assets (c.f Lindman and Lyman (014), or data generated by OD users can be captured to collate new closed data. Research participants indicated that there were multiple motivations behind publishing OD, although this varied by organisation type. On the one hand, public sector organisations in the UK are now required by law to publish OD as part of a wider transparency agenda (BIS 2014), making publication a mandatory activity. On the other hand, the publication of OD in private sector organisations is completed for philanthropic reasons, or to create new innovations and opportunities through collaboration beyond their boundaries.

In all organisations, outbound OD required a business case, which specifies what data should be published, and how it could open economic or social value to the organisation, without undermining competitive advantage. Even for public sector

organisations, OD publication may undermine income generated from sales to private sector firms, which supplements their government funding, or which may place citizens at risk. This makes successful selective OD revealing important. The interviewee below highlights concerns about how unsuccessful OD risk management can jeopardise competitive advantage, and explains how their OD had been used maliciously by competitors, which led them to be more analytical when deciding what OD to reveal in the future:

> "[Initially] externalising our data was a big "no no", why give it away… and also they didn't want to sell it, they were scared about what would happen if other people had it…it was the same with actual stock…We are a plc, so we would never give away anything that compromises our share price. Robots and search engines could scrape websites and hold stock, so that no one could buy from it…So you never show how many units [are available to buy]. Some websites do, they show "Only 8 left". I think when you get to a certain level, perhaps you could say "Only 8 of these left" because you don't mind if they sell through. But if you've got 800 items or something, maybe no one's going to buy it because they are going to wait for a sale. So your actual stock volumes…I just know that it's something that we hold precious" (Case 2)

SMEs in particular were concerned that their products and business models could be imitated by competitors, undermining their competitive advantage, if they did not manage the risks in OD publication (Henkel et al. 2014; Alexy et al. 2013). However, they often maintained how they had an ethical obligation to publish OD, if they consumed it from other sources. This can be problematic, as it is difficult to establish

what data should not be opened to the public. One recognised solution to mitigate this risk was to innovate and stay ahead of competitors, and to use trademarks, as IPR cannot be used as a safeguard mechanism in OD publication:

> "Well we have to innovate constantly. Like with any technology, patents I think are a very, very unnecessary strategy… it's not good, so anything apart from trademarks, it's good to have a trademark, but anything else, you shouldn't rely on corporate rights, you have to innovate. If you work in technology, you have to innovate all the time. So if someone comes up with something close to, I need to find a new interaction, a new way of doing things, or presenting information so that the users will say "Aaah, actually this is better…That continuous innovation, I think is the only solution for sustainable competitive advantage." (Case 9)

4.2 Open Data publication strategies and governance

OD requires organisations to publish data with availability for all, but this does not mean that an organisation must publish *all* its data (Open Data Institute 2014). Instead, organisations undertake a process of selective revealing to determine what should be published (cf. Maarse and Bogers 2012; Tranekjer and Knudsen 2012; Dahlander and Gann 2010). Experienced OD publishers take a systematic review and audit of what data is held within the organisation. Groups and individuals provide governance for particular data sets by auditing the data and seeking to identify risks which may weaken their competitive advantage (cf. Chiaroni et al., 2011). This may take place as a quick informal evaluation, or a more formal process involving legal advisors, and

members of senior management, to establish potential risks and if data can be published for external use:

> "Last year we established a data inventory, and that data inventory was published on .gov.uk. And against each of the published dataset, we have stated either when it's going to be published, or actually the reasons why we do not plan to publish it. Those reasons were put forward by the individual teams who were responsible for the data, and it was refused by the Head of [Data] as they were also checking them… I doubt anybody read every single brief, but they had a professional for the statistics, read and approved every single dataset, if we were saying that we could publish it, it was read and approved… I know we went through the exercise last year; we are going through an exercise now to review it, but that should be what happens with open data, why they are not publishing… We were reviewing that data inventory this year, and I may be able to challenge a couple of people on when they are away that they could be a little bit more open" (Case 5)

> "And there are certain restrictions in terms of what data we feel comfortable sharing with them, and we don't want that broadly disseminating…we can say "Yes, you can distribute this one." "No, you can't distribute that one." But you know, the bigger question which you alluded to is really trying to understand the knock on effects of releasing a particular bit of information and what the use cases around that might be, and whether or not that would jeopardise our business;

> and that would just be handled on a case by case basis really." (Case 6)

An alternative audit tool was identified in the research, in the guise of a risk-based tier model, where data that had been through an inventory process would be ranked according to the perceived risk (see Figure 2). This assisted in identifying prospective OD for release, which was seen to have a low risk, followed by OD that could be made available, but where it would be useful to know who is accessing it, requiring registration. In addition, 'Grey Data' is identified which could be made available, but only open to selected trusted and registered parties. The tier model would also locate data that would remain closed, given the risks of undermining the organisation's competitive advantage:

> "The API business model was, it was free, it had three tiers; 3 was open source available data about our products you can scrape anyway. The middle tier was a little bit more engaging with us in terms of you could add [products to] your basket." (Case 2)

Early OD publishers initially released data without considering if it would be useful for tech developers (cf. Chesbrough 2006; West and Bogers 2014). This made scoping and identifying potential OD problematic for consumers, as although protagonists celebrated a proliferation of OD, it was often irrelevant for tech developers, particularly start-ups that have limited resources to identify relevant OD. Only recently have some organisations become more proactive in publishing OD that is perceived to be useful to external organisations:

> "I think we tend now to start coming from the other end, so we start thinking about the clients' use case, and then kind of work back and

> try to understand what the prerequisites are in order to facilitate that use case… we have identified nearly 500 datasets that we could potentially envision a use case for, and we just don't have the time and resources." (Case 6)
>
> "One is clearly understanding the value that it will be for people; there's not much point pushing lots of data out that perhaps will be of peripheral interest…We've also had to consider data which is the easiest perhaps to publish, because some of our systems are quite antiquated in getting data out in the right form and is not as easy as it should be. So it's ease of doing it; there's what we foresee as being the demand for the data. I guess they're the main two things to be honest; it's what people want and how easy it is for us to give it to them" (Case 11)

This is an important shift, as switching from a supply-led, to a demand-led publication approach has been useful in helping OD publishers to further refine their publication strategies (cf. Tranekjer and Knudsen 2012; Dahlander and Gann 2010). OD does not always generate revenue for publishers, providing them with limited resources to publish all potential OD, requiring them to undertake rationing. In this instance, undermining competitive advantage is not a key concern, but being able to sustainably publish OD of high quality, requires selective processes to maximise the use of available resources. This process also reduces the range of potential OD sets, which can make it easier for OD consumers to scope and identify relevant OD sources (Chesbrough 2006). As such, it has become increasingly important for OD publishers to engage and develop networks with potential users of their OD, to identify what data is useful, but to also enhance the likelihood of successful product development through

collaboration (Prahalad and Ramaswamy 2013; West and Gallagher 2006; Schiele 2010).

5. From Passive Publication to Active Gatekeeper Engagement

Earlier OI research examined the transfer or use of IP as inbound innovation into an external organisation (Chesbrough and Di Minin 2014). However, OI researchers have recently argued that additional study is needed to understand how relationships and collaborations are managed across organisational boundaries to create joint activities that capture and create value (West and Bogers 2014; Piller and West 2014; Arora and Gambardella 2010; Ceccagnoli et al 2010). Furthermore, the OI focus on manufacturing has often investigated the role of R&D functions in managing the flow of assets across organisational boundaries at the expense of other organizational functions (Vanhaverbeke et al. 2014; Podmetina et al. 2013; Van Steerthem et al. 2013). As highlighted earlier, initial attempts at OD publication followed the processes of OI in technology and manufacturing sectors, where underutilized IP assets were made available to external innovators. This is a passive approach which creates two difficulties in our study context. First, in the OD community, data that is made available is not always useful to actors outside the boundary of OD publishers. Second, decontextualized OD without supporting knowledge on how and why it was collected, makes it difficult to use the data and to develop the necessary absorptive capacity (Cohen and Levinthal, 1990; Robertson et al, 2012).

Chiaroni et al. (2011) have highlighted the role of gatekeepers, or champions, who manage the relationships across organisational boundaries. While Chiaroni et al.

(2011) also note how specialist innovation teams can manage relationships between various internal and external organisational units, in the case of OD, single gatekeepers are used as OD publication is resource constrained. For larger organisations it is an experimental activity, or does not generate substantial income. For SMEs, their size and resource constraints do not permit a formal innovation team. Our empirical research shows that OD publisher gatekeepers facilitate a co-collaborative function that enhances the use of their OD. The findings suggest that successful gatekeepers have information systems capabilities and managerial knowledge, enabling them to provide support on how the OD can be used by consumed by external organisations. Subsequently, experienced publishers have required organisations to register their details in exchange for access to their OD, to collect metadata on the inbound innovators' consumption patterns to assist gatekeepers in developing collaborative relationships. Case 6 illustrates the passive approach used by publishers, while Case 8 illustrates more emergent, active approaches:

> "You know, these are the building blocks of other – analysis tools or more sophisticated data sets, but I think making that jump really depends on understanding the use case, the end use case. And a lot of open data is, in my experience, tends to become almost like, you know, they sort of just chuck it up there and you see what happens" (Case 6)

> "The data store, there will be a verification code needed for that. We are not looking to track individuals, but understand in terms of "Is there appetite?" and "What is it that is actually consumed?" So I think we'd like to be as well informed as we can, as to what we're publishing is

> useful and what's not getting any activity whatever. So if we get indications of activity around the theme area, then that will encourage us to do more in that area or to do more in a related area. Ok, it's more about the access statistics as it were, what areas are popular and which are not. I think if there was a possibility that people might volunteer to opt in, then that would be very useful to us. I guess we don't want to impose or to create a greater suspicion where people perceive that we are trying to spy on them, but it would be very useful to know what type of data is most valuable. Things like frequency of updates as well; that would be very useful to us. Technically we should be able provide that as an option. And you are right, some people will say "I'm happy to provide you with additional information" (Case 8)

Gatekeepers provide contextual information on OD and help develop new internal capabilities with consumers (cf. Chaiaroni et al. 2011; Spithoven et al. 2020). This can involve providing advice through blogs and forums where developer communities can discuss the use of OD, where the developer community creates new knowledge, to develop absorptive capacity:

> “To externalise the data requires support. So there are so many questions that come from having external data. And people who access it are quite happy to use blogs and forums to ask questions, but they expect quick responses, ’cos they are waiting on that responses before they can continue their development. And they expect you to give them source code; so you have to say, “Here’s an example of how to pull out this”, and you need to develop it” (Case 2)

Despite the prevalence of digital communications, deeper engagement activities and collaborative opportunities are also created through face-to-face events between OD gatekeepers and consumers, which is useful for more complex discussions, particularly with government departments and larger private sector organisations. This can involve private meetings or public events to scope and identify potential joint projects (cf. Chesbrough 2006):

> "I have met some of them face to face. [Government department 1]; they were also very likeable people and it's a pleasure to interact with them. About [Private business 1] as well. I haven't interacted much with other organisations. Let's say [Private business 2], [Government department 1], [Private business 1], mainly. Phone calls and face to face we will organise something, like I go to or when we do an event with an organisation, one of the organisations even have other guests." (Case 9)

> "And that's where there's, I guess, informal and experimental activities, so not really part of a requirement to do, but actually the talking with business owners for instance about what they might find useful, were we to be able to make it open data, and feeding that into what's becoming more of a production line for open data; and then trying to tie that across all of the different public sector partners. Which quite a lot of informal and experimentation, where it's built on networking and conversations and joining online communities for instance, where businesses gather anyway to talk about whatever the issues are, and

> sometimes open data may have a part to play in that. It's very hit and miss really" (Case 8)

Engagement with OD publishers can take many different forms, including 'hackathon' events where developers, particularly from SMEs, are invited to a sponsored event to create prototype apps and to experiment with the publisher's OD, and to develop networks and new knowledge for the developer community (Huizingh 2011; West and Gallaher 2006). To maximise the potential opportunities of using OD, publishers are not waiting for potential OD consumers to discover their assets, but are seeking to create an environment where they are seeking actively seeking likely inbound innovators. In addition to developing enhanced engagement, it is possible to reduce operational risks for OD consumers, by providing a sustainable supply of OD and notifying them of changes to that IP stream, to create a more robust OD ecosystem:

> "We are trying to engage with them on a number of fronts. We've had a data challenge, where it's a competition effectively, using innovative ways of using our open data actually, we are also speaking wherever we can…we are hosting, for example, with an SME, which is all about exciting and innovative ways using our data….what we foresee is that by building up a user community, it can effectively build that relationship with them, in doing that, give them almost an agreement, so that we can commit to continuing the supply for however long. We can commit to quality levels; we can also tell them if we are going to disrupt the service for any reason at any particular time; or change it. If the data content or format is going to change, then we also understand that businesses would like to know that in advance. So at the moment we don't have to broadcast messages on the website, and

clearly those things hopefully help them to get confidence that they can build businesses on the back of our data supply" (Case 11)

Study participants highlighted how developers have a technical, programming background, who have the skills to integrate OD into new apps and code, but who struggle to understand the commercial or social context of OD. This limited their ability to ask questions of the OD and to understand how can be optimised in the design of their products, to offer an attractive proposition for end users. This demonstrates how the simple publication of OD and its consumption is not sufficient to create successful OI, but how further education and knowledge creation was required from information system gatekeepers to develop absorptive capacities:

"Some developers didn't have that capability to understand how it needs to be seen as an experience and how it needs to represent us in a fair way. Because we are engaging with developers that didn't come from a branding, they weren't marketing developers, they're techies… So that was a missing link in terms of some of the partners that we engage with that didn't have that commercial acumen about them." (Case 2)

"You do need that data scientist; you do need the people to pick up the trends and drive the correlations to create the models, but you also need someone that's on the ground that can say, "Well actually if I knew this, I can then take advantage of it."… what it showed me is that unless you've got the smart engineer that asks the smart questions of dumb data, and you get someone that responds to the smart answer that the question has provided, you are stuffed. So you need that mix

> of data scientist, expert, practitioner, which may be the same thing. So then you can then say "This is what I want."… We've reached the point where look, if it's digitised and you want something, you can do it. Just stop proving the technology, let's start doing something with this information… It has to be demand driven" (Case 10)

Gatekeeper engagement activities to develop the absorptive capabilities of OD consumers also created new collaborative relationships and open business models (Gassmann and Enkel 2004; Bogers 2011; Boger et al. 2012). For example, Case Two and 16 sought to monetise these relationships and grow their businesses through coupled OI. Independent developers used Case Two and 16's OD to create new apps, which could be used to extend the publishers' business into wider markets. One app was offered for sale to Case 2, while other independent developers created apps connected to external OD streams to reach a broader customer base, and operate as marketing affiliates, locating and directing customers and web traffic to the OD publisher in exchange for a commission:

> "Two streams, yeah. So one is, I pay for their development time, and then I own that App, which is what I did with one of them. I said "Here's my budget; you come up with the idea and then ok fine, we'll take it through. We work through what's going to be called the MVP, the minimum viable product. So with this budget what can we get to proof of concept stage? And that was one of the ones we did. And the other one, they came to me quite saying "We don't want you to pay us for this, we want to do it, but we want to then become an affiliate."…. It's up to one person, the API Manager, to manage it carefully...so I was able to say "Right, well we are just going to give you X standard

commission, X what not and we do a check on your App; you have to submit it for review every six months" (Case 2)

"So it's completely free for you to use the API, and the way we make money is -. So we give you our content, which is like property listings, so this house is for sale, and when someone clicks on that, they get sent to the original source content, and we earn a small, like a few pence for that…People build mobile Apps of our data and all this kind of thing… if someone can generate a significant amount of traffic for us, we'll gladly pay them for that… I mean that's the nature of innovation, right? You have to get it out there and there are going to be 100 failures, and one success." (Case 16)

Subsequently, the coordination of engagement by information systems gatekeepers and OD consumers can produce more successful applications through coupled OI, capturing value from IP assets that are freely available (West and Bogers 2014). The engagement enables the development of enhanced selective revealing, network creation and the enhancement of absorptive capacity. This moves beyond the social transparency values created by the OD movement, and contributes to the creation of new apps, products and services, and innovation within the digital economy.

6. Conclusion

6.1 Empirical contributions

This paper has provided new insight into OD through the lens of OI. The OD Movement is relatively new at the time of writing, but despite substantial interest in the publication

and consumption of OD there are considerable barriers that have limited its potential (Almirall 2015), particularly given the limited research base on OD and good practice in sharing data. Although previous research has provided insight into the technical design of OD infrastructure, or its use in enhancing democracy and transparency (Bates 2012; Jain et al. 2010; Missier et al. 2010), there has been limited study into how OD can be successfully shared across organisational boundaries to develop new innovation, products and services. In this paper, we have provided new insight into how the risks associated with OD can be managed. In particular, we have suggested how data can be successfully published through outbound OI. We have noted how selective revealing strategies are central to reducing risk and have uncovered some of the internal processes used by OD publishers to successfully determine potential risks, but also how to use limited resources best through data rationing, by understanding what data would be most useful to inbound innovators. In addition to this, we have sought to uncover how the relationships are managed in the circulation of OD across organisational boundaries (cf. Chesbrough 2006). Specifically, we drew upon the role of gatekeepers within OD publishers in assisting OD consumers in contextualising the data, while also developing their internal capabilities and assisting them to consider how OD can be used to develop new commercial innovations. We determined how gatekeepers transfer internal publisher knowledge and disseminate that to OD users alongside OD assets. This knowledge is exchanged through a series of interactions through email and telephone, but increasingly through ‘hackathon’ events and face to face meetings as knowledge is co-created. This is particularly central in determining how monetary value can also be extracted from these co-collaborations, by extend the commercial reach of OD innovators through coupled OI.

6.2 Theoretical contributions

Our empirical findings make three core contributions to the OI literature. First, we move beyond research that examines OI in manufacturing, to investigate the service sector, in the context of digital businesses, to provide insight into the informal processes in which contextual and technical knowledge and assists across boundaries, an area that has so far received limited attention (Randhawa et al. 2016). We also explore OI practices in the context of SMEs that have so far been understudied in OI (Vanhaverbeke 2012). Not only do SMEs benefit from accessing OD, which is free or provides access to previously unavailable data, but they have also become involved in developing new innovations through OI collaborations. Second, the OI literature has often overlooked outbound OI in favour of inbound OI studies (West and Bogers 2014). In our paper, we sought to address this imbalance by examining outbound OI through the publication of data assets. In doing so, we add new understanding into the processes of selective revealing, regarding how OD is audited and how risk is managed through deciding what data will not undermine an organisation's competitive advantage. Our final contribution was to move away from studies that focus on the R&D functions of organisations in OI (Chiaroni et al. 2011; Vanhaverbeke et al. 2014), Instead, we focussed on gatekeepers on OD publishers, who manage the flow of OD assets, contextual information and commercial advice, that assists inbound innovators in extracting value from OD and enhancing their absorptive capacity, to maximise the success of new innovative products and services. Rather than working in a formal R&D function, these gatekeepers, with a combination of information systems and commercial knowledge, were able to assist innovators outside of the organisation's boundaries.

6.3 Policy and practitioner implications

To manage risk in the selective revealing process of OD, our results suggest that publishers should develop OD boards, or working committees, to annually assess what OD is being, or could be, shared with consumers, based on their risk and business model. A more holistic and critical examination of risks will identify OD that should not be revealed, while placing pressure on uncovering data that can be potentially released for the developer community. This needs to be continually reassessed based on the data available, but also changes in the organisations activities and wider operating environment. Regarding engagement, our findings suggest that OD publishers, but government departments in particular, need to focus on OD sustainability, by publishing OD that consumers are more likely to use, so that it can be released over the long term in an appropriate format, with gatekeeper support of a high-quality. As OD may not generate income, its publication needs to be rationed, so only high-quality, relevant OD is published. This can be achieved by developing informed internal gatekeepers who engage with the user community to help identify what is potentially the most useful OD. Developing engagement through gatekeepers will also enable publishers to notify users of changes to data publication and when OD updates will be available, or in extreme cases notify the community if an OD set will be shut down. As the role of gate keeping in this context is demanding and requires a mix of technical and managerial skills, selecting and developing qualified people requires special attention. Publishers also need to develop portals to indicate the OD community of potential collaboration opportunities to share the benefits of value generation, to ensure that publishers as well as issuers can benefit from OD, providing sustainability for the value chain.

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Table 1: Research Participants

Case	Organisation Type	Sector[5]	Interviewee	Publish OD (outbound OI)	Consume OD (inbound OI)	Face to Face/Skype/Telephone interview
1	Corporation	Engineering	Product/innovation manager	No	Yes	Face to face
2	Corporation	Retail	Product/innovation manager	Yes	Yes	Face to face
3	Public agency	N/A	Head of Data	Yes	No	Face to face
4	SME	Business services	Owner-manager	No	Yes	Telephone
5	Foundation	Business services	Head of Data	No	Yes	Skype
6	Public agency	N/A	Head of Data	Yes	No	Telephone
7	SME	Business services	Director	Yes	Yes	Skype
8	SME	Business services	Director	Yes	Yes	Face to face
9	SME	Business services	Director	Yes	Yes	Skype
10	Public agency	N/A	Product/innovation manager	Yes	No	Face to face
11	SME	Consultancy	Owner-manager	No	Yes	Skype
12	SME	Consultancy	Owner-manager	Yes	Yes	Face to face
13	Public agency	N/A	Head of Data	Yes	No	Skype
14	SME	Software development and services	Owner-manager	No	Yes	Skype

[5] Sector information is not provided for government departments as this would identify the organisations and potentially the interviewees, violating participant anonymity.

15	SME	Retail	Product/innovation manager	No	Yes	Telephone
16	SME	Real estate	Owner-manager	Yes	Yes	Face to face
17	SME	Leisure	Owner-manager	Yes	Yes	Face to face
18	Public agency	N/A	Product/innovation manager	Yes	Yes	Face to face
19	SME	Software development	Director	Yes	Yes	Skype
20	SME	Business services	Product/innovation manager	Yes	Yes	Telephone
21	SME	Software development	Software developer	No	Yes	Face to Face
22	SME	Business Services	Director	Yes	Yes	Skype
23	SME	Consultancy	Owner-manager	Yes	Yes	Skype
24	SME	Software development	Owner-manager	Yes	Yes	Skype
25	SME	Business Services	Director	Yes	Yes	Telephone
26	Corporation	Retail	Product/innovation manager	No	Yes	Face to face
27	SME	Consumer	Product/innovation manager	No	Yes	Face to face
28	Corporation	Consultancy	Director	No	Yes	Face to face
29	SME	Consultancy	Director	Yes	Yes	Skype
30	SME	Consultancy	Owner-manager	Yes	Yes	Face to face

Figure 1: OD publisher and user ecologies

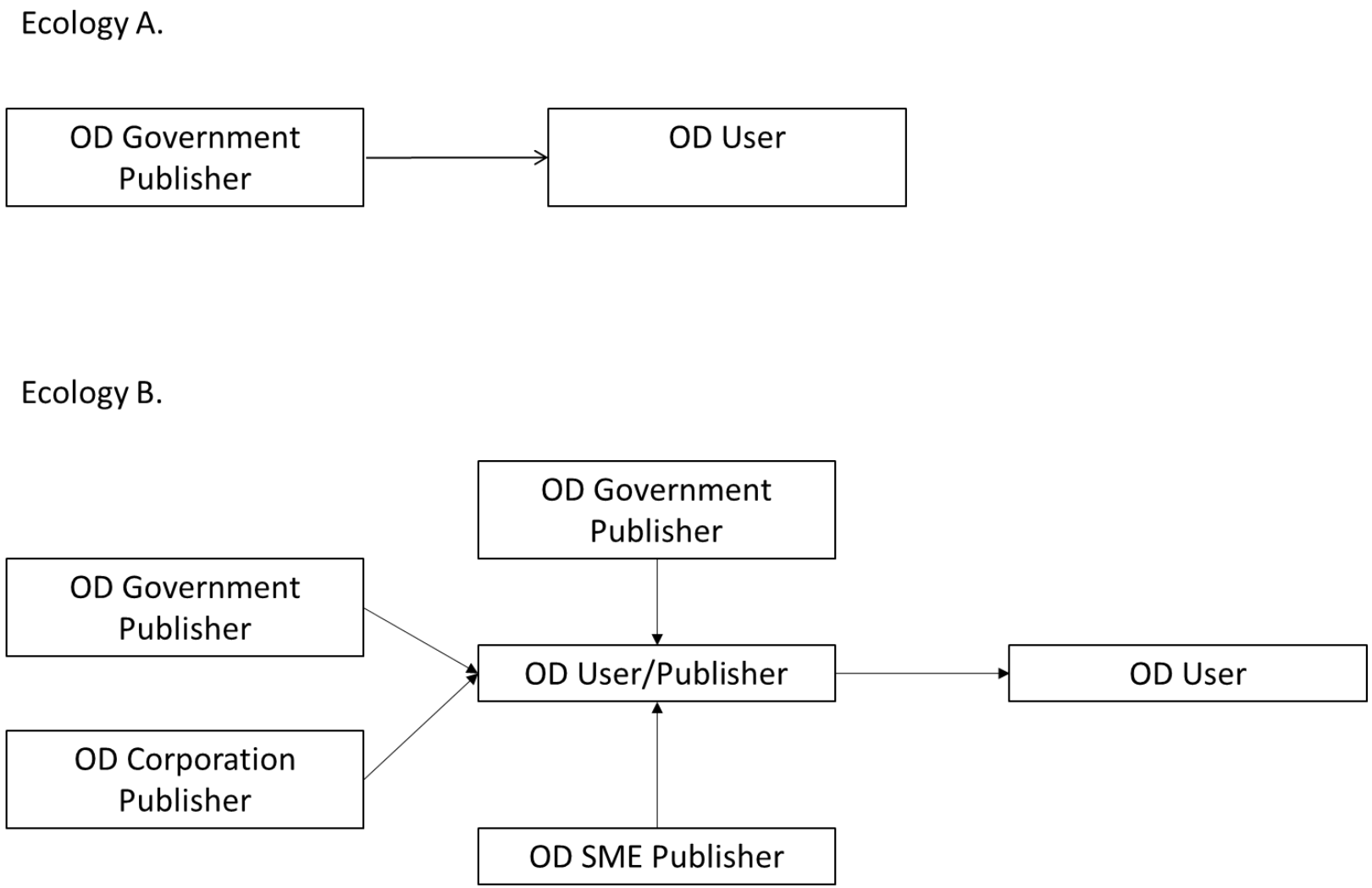
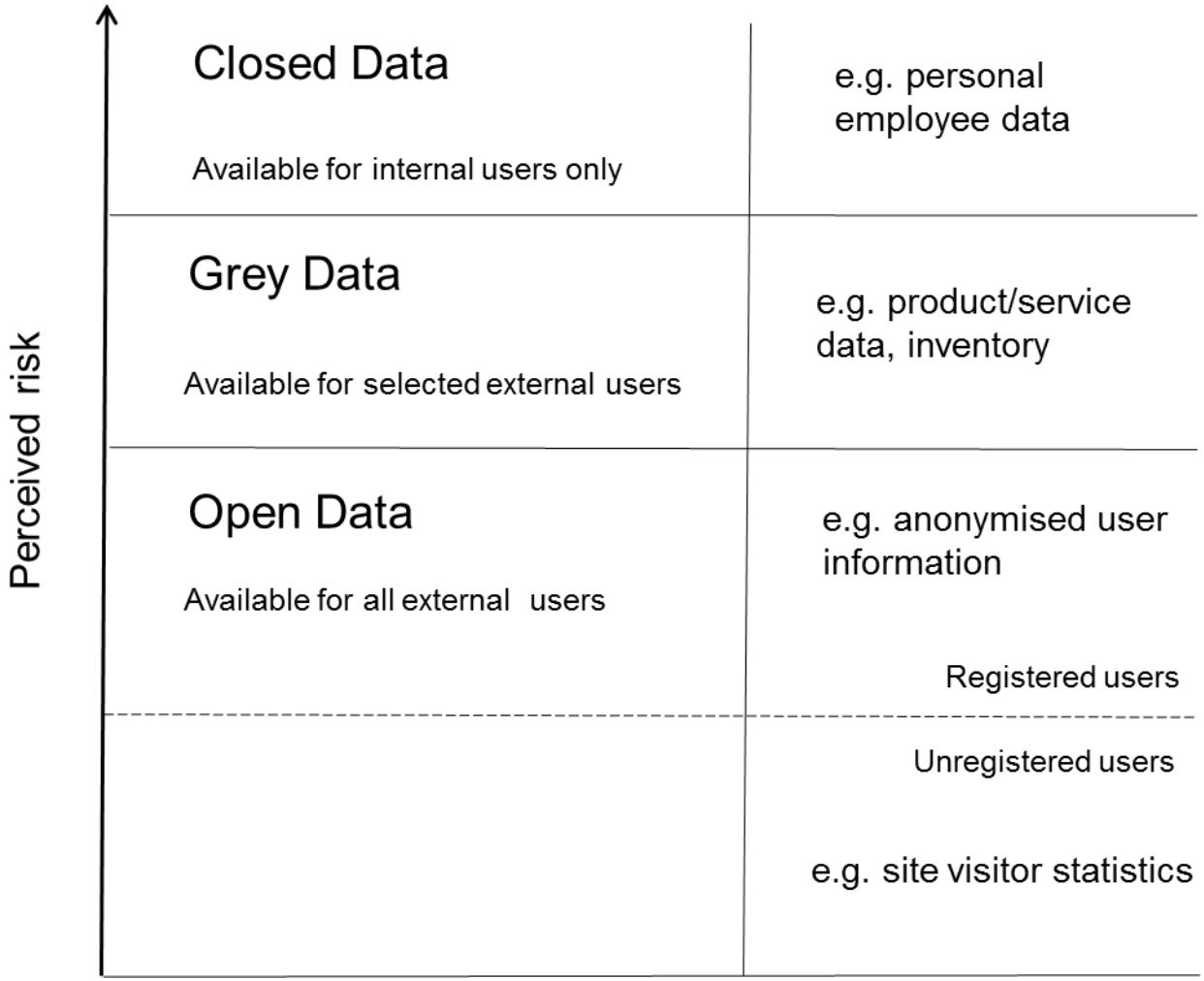


Figure 2: Risk-based tier model (commercial OD publisher)



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SPRU – Science Policy Research Unit
University of Sussex
Falmer, Brighton, BN1 9SL,United Kingdom
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