

Outbound Open Innovation in the Public Sector: The Roles of Intermediaries

Göran Smith^{abc} and Asif Akram^a

^a Chalmers University of Technology, Division of Design & Human Factors, 412 96 Gothenburg, Sweden

^b K2 – The Swedish Knowledge Center for Public Transport, 223 81 Lund, Sweden

^c Västra Götalandsregionen, 411 06 Gothenburg, Sweden

Abstract

This paper examines how the public sector can use intermediaries to facilitate outbound open innovation (OI). Based on a qualitative analysis of three case studies in the public transport sector in Sweden, the paper describes how intermediaries can lower social and technical innovation barriers for both innovation seekers and external innovators. Drawing on this capability, four potential roles in outbound public sector OI are proposed: expanding the boundaries of innovation ecosystems; decreasing costs for distant search and data processing; fostering inter-organizational collaboration; and assisting innovation seekers in managing the innovation trajectory. The paper also discusses how these roles differ compared to those of intermediaries in private sector OI. In sum, the paper extends the knowledge of public sector OI practices, and increases the understanding of how intermediaries can be used to accelerate socially beneficial outbound OI.

Keywords: *Public Sector Open Innovation; Outbound Open Innovation; Open Innovation Intermediaries*

1. Introduction

The open innovation (OI) paradigm emerged when private firms started recognizing that useful knowledge is widely distributed, and that they thus “should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology” (Chesbrough 2006, p. 2). As a consequence these roots, most extant OI research has studied OI in the private sector (Feller et al. 2011; Mergel 2015). However, public actors have increasingly taken up OI practices in the latest decade. For instance, Fuglesang (2008) argued that a pattern of OI is becoming more pertinent to service development in the public sector. Similarly, Lee et al. (2012) found that the U.S., Australia and Singapore have developed national OI policies. Accordingly, Chesbrough et al. (2014) strongly encouraged scholars to further explore the potential of public sector OI.

To this day, the lion’s share of studies on public sector OI has focused on cases where a public actor unlocks its organizational borders to make greater use of external ideas and technologies (known as inbound OI) (cf. Kankanhalli et al. 2016). Moreover, much of this research stems from the e-government stream (cf. Yildiz 2007). Thus, scholars have so far mainly focused on OI cases where public actors strive to engage citizens in their innovation processes (e.g. Hilgers and Ihl 2010), with government transparency and citizen empowerment as central goals (cf. 'opening effects' in Schlagwein et al. in press). In contrast, there is a little knowledge about the cases where public actors increase their exploitation capacities by transferring internal innovations to external parties (known as outbound OI) or by creating enduring innovation alliances with complementary partners (known as coupled OI). Still, Lee et al. (2012) identified that there have been emerging attempts to exploit the value of government data through external innovators. Therefore, fueled by the emphasis on public-private collaboration within the new public governance movement (cf. Osborne 2006), we argue that there is a need for more research on outbound and coupled OI in the public sector.

Open innovation intermediaries (OIIs) – actors that intermediate between the seekers and providers of innovation in order to enhance the overall innovation capacity – have been identified as an important enabler of OI (e.g. Hossain 2012; Katzy et al. 2013). In private sector OI, OIIs have been found to contribute by connecting innovation seekers and external innovators and by providing collaborative functions as well as technological services (Lopez-Vega and Vanhaverbeke 2009) However, the roles of OIIs in public sector OI are still poorly understood (Bakici et al. 2013; Gascó-Hernandez et al. 2017).

Public actors within the Swedish public transport (PT) sector are increasingly considering how they can use intermediaries for facilitating external innovation that contributes to their goals for PT growth. At present, PT accounts for roughly 26% of the market share in Sweden (Lindblom et al. 2016). In order to reduce the negative externalities of the transport system, a majority of the key actors within the Swedish PT sector have agreed on a goal to double the market share by 2030 compared to 2006 levels (i.e. from 18% to 36%) (Grönlund 2017). However, despite the positive development so far, analyses have shown that current PT strategies and budgets might be insufficient to reach this goal (e.g. Legerius 2012). As a consequence, the PT sector is looking for new cost-efficient approaches to achieve growth. One approach being explored is to give external actors access to internal PT data so that they can develop digital services that in turn could increase the appeal of PT (outbound OI). To facilitate such practices, several new OIIs have been introduced in recent years. Accordingly, driven by both empirical relevance and research interest, we explore three case studies within the PT sector in Sweden to address the following research question: *How can OIIs facilitate public actors' outbound OI practices?*

The paper is organized as follows. In Section 2, we provide a brief summary of extant literature on barriers to OI in the public sector and on the roles of OIIs. Then, we outline the three cases studied and explain our research approach in Section 3, followed by a presentation of our findings in Section 4. In Section 5, we revisit extant literature on the roles of OIIs in order to discuss the contribution of our study as well as how the roles of OIIs in public sector OI differ compared to those of OIIs in private sector OI. We moreover suggest implications from our findings and propose potential future research topics. Lastly, Section 6 concludes.

2. Background

2.1 Barriers to Open Innovation in the Public Sector

Public actors face a different set of challenges in relation to innovation as compared to private actors (e.g. Windrum and Koch 2008). For instance, formal rules, multi-layered hierarchies, organizational silos, divided political leadership and lack of incentives make it difficult for public actors to collaborate across their organizational borders, and thus to participate in collaborative innovation (Sørensen and Torfing 2012). As a consequence, the barriers that hinder public actors from adopting OI practices are arguably also distinctively different from what private actors experience. Still, inter-sectorial OI collaboration seems to be difficult for all actors. Munksgaard et al. (2012) suggested that public and private actors experience difficulties in collaborating on innovation topics since their objectives and interests, time horizons, risk behaviors, incentives for participation and expected rewards as well as their innovation understandings are incompatible. Furthermore, it has been found that public actors' unwillingness to give up or share their authority hinders collaborative approaches (Bommert 2010).

Utilizing the widely adopted framework for analysis proposed by West et al. (2006), Mergel (2017) showed that barriers on several institutional levels hinder the implementation of OI practices in the public sector. In relation to outbound OI in the Swedish PT sector, Smith et al. (forthcoming) further developed Mergel's findings by detailing what barriers hindered a Swedish public transport authority (PTA) from adopting outbound practices: their perceived action space was limited by laws and regulations (external level); the traditional procurement processes that they typically use were unfitting for the collaborative OI approach (inter-organizational level); their organizational structure and culture did not foster innovation (organizational level); and they lacked the required competence and prioritization for utilizing outbound OI practices as a core innovation strategy (intra-organizational level).

Extant research on barriers to open data use moreover suggest that external innovators also experience barriers on several institutional levels when trying to participate in outbound public sector OI (e.g. Hjalmarsson et al. 2015; Janssen et al. 2012; Kaasenbrood et al. 2015; Maccani et al. 2015; Ubaldi 2013; Zuiderwijk et al. 2012). In a recent review, Beno et al. (2017) found that technical, permit- and information-related barriers were perceived as most hampering to open data use – for instance unreadable and incomplete data, lack of information about the quality of the data and restrictive licenses. In relation to outbound OI in the Swedish PT sector, Hjalmarsson et al. (2014) detailed 18 innovation barriers that participants in an innovation contest experienced. The most impeding barriers were, in this study, considered to be lack of time and money, lack of marketing competence and weak value offering of the developed concepts. In an exploration of the experiences of external innovators with more long-term use of open PT data in Sweden, Smith and Sandberg (forthcoming) identified several additional barriers, such as lack of transparency from innovation seekers, limited end-user market and non-existent standardization of data interfaces. They moreover added to the lists of barriers by showing that:

- (i) External innovators are hampered throughout their service lifecycles, that is when designing and developing services and service strategies as well as when operating and continually improving the services
- (ii) The perceived barriers are both social and technical in character
- (iii) The experiences of the barriers vary by the external innovators' motivation, objective, pre-conditions and innovation approach

In conclusion, the extant literature reflects that the public-private divide is a major barrier for public sector OI. The inherent differences between the natures of public actors and external innovators make it particularly challenging to establish inter-organizational trust and to develop well-suited management structures and innovation processes. Furthermore, the public actors' ability to collaborate across their organizational borders is hampered by additional innovation barriers such as legislation, organizational inertia and lack of incentives. Hence, the potential roles of intermediaries in public sector OI are probably different, compared to their roles when engaged in private sector OI.

2.2 The Roles of Intermediaries in Public Sector Open Innovation

Innovation practices are becoming increasingly open, distributed and collaborative (Chesbrough 2003). As a consequence, researchers have acknowledged the importance of, and investigated, the roles of intermediary actors in innovation processes (Howells 2006). Innovation intermediaries have been defined as actors "that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing the innovative capacity of regions, nations, or sectors" (Dalziel 2010, p. 2). As a subset of these actors acting as catalysts for OI processes, OIIs, has been described as actors "that [use] OI platforms to bridge the gap between organizers that seek solutions to an innovation problem and innovators that can provide a solution to an organizer's problem" (Hallerstede 2013, p. 35). The overall purpose of OIIs is to make innovation processes more efficient by lowering costs of all actors in the network, whether they use the intermediary's services or not (Secchi 2016). OIIs can come in many forms. For example, Lopez-Vega and Vanhaverbeke (2009) outlined four main types: consultants that provide innovation services to solve specific innovation problems; traders that, based on a platform of innovation solvers, facilitate the identification of potential scientific- and business-oriented solutions; incubators that provide infrastructures to facilitate internal knowledge exchange among firms searching to conduct science, technology or business activities; and mediators that provide infrastructures to facilitate the use of external ideas to conduct science, technology and business opportunities.

Howells (2006) detailed ten main functions for innovation intermediaries: foresight and diagnostics; scanning and information processing; knowledge processing generation and combination; gatekeeping and brokering; testing, validation and training; accreditation and standards; regulation and arbitration; intellectual property; commercialization; and assessment and evaluation. Departing from this work, Lopez-Vega and Vanhaverbeke (2009) suggested three overarching types of functions. First, innovation intermediaries can connect innovation problems and solutions by building bridges, establishing networks and representing a single and neutral point of contact. Second, innovation intermediaries can foster inter-organizational collaboration by offering collaboration and support functions that compensate for the capabilities that the other actors are missing. Third, innovation intermediaries can provide technological services such as intellectual property advice, provision of pilot facilities, technology assessment, standard setting and regulation. Still, there are arguably major differences between OIIs and innovation intermediaries working under a traditional innovation paradigm. For instance, OIIs are more dependent on informal relationships and high levels of inter-organizational trust (Porto Gomez et al. 2016). As a consequence, OIIs might have different roles compared to other innovation intermediaries. As such, Hossain (2012) emphasized that OIIs can contribute to companies by reducing costs for distant search, i.e. facilitating innovation seekers' exploration of alternatives on technological trajectories or markets that are far away from the field in which they operate (Afuah & Tucci 2012). Other scholars have stressed OIIs' process management capabilities (Katz et al. 2013) and ability to nurture sharing and absorption of knowledge (De Silva et al. in press; Elmquist et al. 2016; Kokshagina et al. 2017). In summary, as emphasized by Aqlaini et al. (2016), the roles of OIIs often go far beyond being a link between innovation seekers and solvers. They can rather be seen as an actor that provides a wide range of the capabilities that are needed to successfully carry out innovation processes (ibid).

Gasco-Hernandez et al. (2017) suggested that, in public sector settings, OIIs can be understood as actors that "intermediate between local/regional/national governments and other organizations and individuals with the purpose of enhancing public sector innovation capacity by means of applying OI methodologies: knowledge exchange, co-creation techniques and participatory methods" (p.143). However, the roles of OIIs in public sector OI have still received little attention. In a notable exception, Bakici et al. (2013) analyzed how local governments in Finland,

Germany, the Netherlands and Spain cooperate with OIIs. Among other things, they found that OIIs face unique objectives, methodologies and underlying problems in public settings due to the differences in the nature of innovation processes across public and private sectors. They also proposed that OIIs are necessary agents in public-driven innovation ecosystems who can maintain active networks and facilitate innovation participation, bridge the perceived distance between organizations and orchestrate collaboration. Other relevant studies have detailed how living labs (Gascó 2017) and online platforms (Mergel and Desouza 2013) may function as intermediary assets in public settings. Still, scholars argue that the documented knowledge is limited, and that the fundamental questions needing to be answered, when implementing OIIs in public sector OI, largely remain unanswered (Aquilani et al. 2016; Bakici et al. 2013; Gascó-Hernandez et al. 2017). Gasco-Hernandez (2017) concluded that “more research is needed to understand this emerging phenomenon that links public and private sector organizations around innovation to generate value for citizens” (p. 146). Accordingly, and reiterated here, the purpose of this paper is to increase the understanding of how OIIs can facilitate public actors’ outbound OI practices, using three empirical case studies in the Swedish PT sector.

3. Research Methodology

In order to analyze the roles of OIIs across various situations, a multiple case studies approach was adopted (Yin 2013), more specifically with three OII cases situated within the Swedish PT sector (see Table 1). These distinct cases exhibit two characteristics that make them relevant for this study: they include OIIs meant to boost innovation throughput; and they show features of outbound OI from the perspective of public PT actors. To form a rigorous documentation of and holistic understanding for the cases, data from each case was first collected using mixed set of methods (Venkatesh et al. 2013), including participatory observation, semi-structured interviews, online questionnaires, data logs and document studies. Second, the three data sets were analyzed individually to separately identify the functions of each of the OII. As the nature of this study is explorative, an inductive and qualitative approach was utilized for this analysis (Charmaz 2006). Third, a cross-comparison of the cases revealed the four roles that are depicted in Section 4. The following paragraphs briefly introduce the setting for each of the cases.

Case 1, Trafiklab, is a community-type marketplace that was launched in 2012 (trafiklab.se). The marketplace distributes open data from PT providers and other transport-related authorities, and is managed by their joint venture, Samtrafik. It aims to facilitate external development of digital travel services of potential benefit to PT users. The setup of Trafiklab includes: a technical platform that manages access to application programming interfaces (APIs) and back-ends other digital services; a website that forms the digital front-end of the marketplace; support services for both innovation seekers and external innovators; and physical and digital knowledge sharing activities, such as meet-ups and newsletters. The main data source in this case was semi-structured interviews with external innovators that used Trafiklab’s services (n=19). The interviews were guided by four topics: interviewee background information, motivations for developing services and for using Trafiklab, service development processes, and experiences of using Trafiklab and Trafiklab’s areas of improvement. During the interviews, the first author of this paper pursued the follow-up questions on interesting issues as guided by Schultze and Avital (2011).

Case 2, ElectricCity Innovation Challenge 2015 (EIC2015), was a one-month innovation contest that took place in the autumn of 2015 (challenge.goteborgelectricity.se). The innovation contest was co-hosted by 21 organizations within the PT industry and its central aim was to catalyze external innovation that could contribute to making contemporary electrified PT solutions more attractive for PT users. The contest was built around the ‘ElectricCity Demonstration Arena’ and the ‘ElectricCity Innovation Platform’. Three electric concept buses and seven pre-production models of plug-in hybrid buses form the core of the Demonstration Arena (2015 – 2018), which is meant to showcase how the efficiency, sustainability and attractiveness of tomorrow’s PT solutions can be increased. Public information about the Demonstration Arena and its components was during the contest provided through the Innovation Platform (platform.goteborgelectricity.se) via a digital library as well as a novel API that assembled real time information from its buses and bus stops (Smith, Burden, et al. 2016). Data was mainly collected using participatory observations before, during and after the contest. These observations were coupled with project meetings, discussions with funding agencies, contest events, interim reviews of the developed concepts, follow-up meetings with innovation seekers and external innovators, etc. In addition to the observations, three online questionnaires were distributed among the external innovators (n = 113) and one to innovation seekers (n = 23). Furthermore, data diversity was achieved by conducting semi-structured follow-up interviews with innovation seekers (n = 7).

Case 3, Mobilitetstorget (‘the Mobility Square’, a working title), differs from the first two cases in that it is a hypothetical OII. Mobilitetstorget is a digital marketplace that Samtrafikfen plans to develop in order to enable ‘Mobility as a Service’ (MaaS) in Sweden (samtrafikfen.se/projekt/swedish-mobility-program), i.e. services by which end-users can access a range of public and private transport services that together satisfy their major transportation needs (Hietanen 2014). MaaS has recently emerged as a hot topic in the transport sector since the concept is believed to hold potential to streamline public spending on transportation services while also contributing to social goals such as reducing congestion and cutting carbon dioxide emissions. However, MaaS requires that transport service offerings are combined into MaaS offerings. Hence, a major question among both scholars and practitioners involved in the development of MaaS is: who should become ‘MaaS Integrator’, i.e. handle the technical and commercial integration of transport service offerings (Smith, Sochor, and Karlsson 2017). Samtrafikfen plans to become a national MaaS Integrator in Sweden. As such, Mobilitetstorget is supposed to manage the distribution of data, tickets and contractual terms from transport service providers in Sweden to external bundlers and resellers (‘MaaS Operators’) in order to facilitate the external development and deployment of MaaS. Participatory observation of the development of MaaS in Sweden was conducted. For example, through participating in: Samtrafikfen’s pre-study projects; the development of a national roadmap for MaaS; and a parallel procurement process that preceded Samtrafikfen’s decision to develop Mobilitetstorget. In addition to the observations, data was also collected using semi-structured interviews with potential innovation seekers, external innovators and technology providers (n = 19) and through a review of MaaS-related policy documents and political decisions.

	Trafiklab	EIC2015	Mobilitetstorget
OII Type	Open data community	Innovation contest	MaaS Integrator
Purpose	Facilitate external development of digital travel services of benefit to PT users	Catalyze external innovation that can make tomorrow’s electric bus trips more attractive	Enable the development of viable and sustainable MaaS
Innovation seekers	Public PT actors	Public and private PT actors	Public and private transport service providers
External innovators	More than 3000 registered members – A mix of employees, entrepreneurs and hobbyists ¹	261 contest participants – University students, employees, entrepreneurs and hobbyists	Is planned to be open to all external innovators
Management	Samtrafikfen – A joint venture of 38 public and private PT actors	EIC2015 consortium – A temporary group with 21 partners	Samtrafikfen
Technical Platform	Trafiklab API platform	ElectriCity Innovation Platform	Yet to be developed
Interfaces	Website & meet-ups	Website & contest events	Yet to be developed
Goods	PT data – e.g. geographical position of bus stops, real-time positions of vehicles and traffic disturbances	Data from the buses & bus stops in the Demonstration Arena – e.g. current position of acceleration pedal and total mileage	Data, tickets and contractual terms for transport services
Contracts	SLAs with innovation seekers. Terms of use for external innovators for each API	No SLAs. Terms of use for external innovators for the API	Contracts and SLAs with both innovation seekers and external innovators
Primary Data Source	Semi-structured interviews with external innovators (n = 19, 2014)	Participatory observation before, during and after the contest (2014 – 2016)	Participatory observation of the development of MaaS in Sweden (2016 – 2017)
Secondary Data Sources	Semi-structure interviews with innovation seekers and OII personnel (n = 7); an online membership questionnaire (n = 84)	Four online questionnaires; three distributed among the external innovators, before, during and after the contest (n = 113) and one to innovation seekers (n = 23); interviews with innovation seekers (n = 7)	Semi-structured interviews with potential innovation seekers, external innovators and technology providers (n = 19); a review of related policy documents and political decisions.

Table 1. A summary of the characteristics of the three studied OIIs and the analyzed data.

¹ See Smith and Sandberg (forthcoming) for a clarification of this categorization of external innovators.

4. Results

4.1 Expanding the Boundaries of Innovation Ecosystems

In their internal strategy document from 2014, Samtrafikken listed two key goals for Trafiklab – to ‘involve more relevant innovation seekers’ and to ‘engage more active external innovators’. Accordingly, one of their key activities was to promote the possibilities associated with outbound OI within the PT sector in general, and to participate in Trafiklab-related activities in particular. Similarly, a key motivation behind EIC2015 was to increase public awareness, interest and involvement in the OI-inspired demonstration arena, ElectriCity, and Samtrafikken believes that Mobilitetstorget and its associated activities will help PT actors in opening up their offerings for external MaaS-related innovation. Hence, a major goal of all these OIIs seem to be to expand the (open) innovation ecosystems within which they operate, by increasing the awareness among both potential innovation seekers and external innovators. Moreover, in addition to increasing awareness, the three OIIs aim to expand their innovation ecosystems by lowering social and technical entry barriers experienced by potential innovation seekers and external innovators. For instance, both Trafiklab and EIC2015 provide API-descriptions, documentation and example code in order to make it easier to browse and understand the APIs.

Our data suggest that the studied OIIs are succeeding in expanding the boundaries of their innovation ecosystems. A total of 34 of the final 48 participating teams in EIC2015 (external innovators) affirmed that the contest had increased their interest in ElectriCity, and only 7 of the 23 surveyed consortium members (innovation seekers) had previous experience with outbound OI activities. Furthermore, in the case of Trafiklab, the interviewed external innovators expressed that, from their perspective, the PT actors’ participation in and cooperation with the open data community confirmed that the PT sector is increasingly recognizing that PT users can gain value from digital services developed through outbound OI practices. Furthermore, the external innovators also said that Trafiklab showcased the potential positive effects of disclosing data. More specifically, they believed that Trafiklab’s website and meet-ups, which both present successful services, acted as a feedback function that they believed made it easier for both incumbent and new innovation seekers to motivate their participation in outbound OI activities:

I think a meeting place, such as Trafiklab, is needed for [innovation seekers] to see what is actually happening. For instance, if representatives from Trafikverket [the Swedish Transport Administration] and SL [the PTA in the Stockholm region], who usually attend the meet-ups, see where this is going, it is also easier for them to motivate [participation in outbound OI activities] within their organizations. – IP3 Trafiklab (translated)

Beyond increasing awareness and lowering entry barriers, OIIs might also be able to expand the business scope for both innovation seekers and external innovators. For instance, Samtrafikken argues that Mobilitetstorget, by providing technical infrastructure and know-how, can lower the investments needed for both innovation seekers and external innovators as they will not have to develop the functions that Mobilitetstorget intend to provide. As a consequence, they argue that Mobilitetstorget might open up possibilities for e.g. smaller PTAs to join MaaS schemes even though they do not internally hold all the needed capabilities or manpower to prepare their organizations for such practices. In line with this, several interviewed representatives of potential innovation seekers argued that investing in a joint MaaS Integrator would lower the total public spending:

Find a system that works for everyone involved [PTAs]...[Currently], everyone is developing their own systems, which costs money that in the end is taken from the same budget. – IP17 Mobilitetstorget (translated)

4.2 Decreasing Costs for Distant Search and Data Processing

The Swedish PT sector consists of an ambiguous network of both private and public actors that operator on local, regional, national and international levels. Hence, it is far from easy for external innovators to first understand how the system is organized and second to get hold of all the data needed in order to develop a nationwide service. In the light of this complexity, one of the key benefits of Trafiklab is, according to the external innovators that currently use its services, that it provides a one-stop shop for PT data. Trafiklab is perceived to make it easier to find, access, evaluate and compare data from multiple sources, since APIs are gathered in one location, require only one registration and are presented in a similar manner. Furthermore, the EIC2015 participants reported that the contest gave them increased access to data from both public and private innovation seekers, and Samtrafikken’s outspoken aim that Mobilitetstorget should become a national integration platform for PT data is in part motivated by the hypothesis that this would make it easier for MaaS Operators to develop nationwide solutions. Beyond facilitating the realization of existing service ideas, the OIIs’ compilations of APIs seems to aid ideation:

You go there [to Trafiklab's website] and check what cool things [APIs] they have, and you wonder: Can you combine or use this in any fun way? And then you just get started. – IP11 Trafiklab (translated)

Technical standardization is another issue that the three studied OIIs address in order to increase external innovators' access to data. In recent years, Samtrafiken has put a lot of work into developing a national standard for PT data and tickets. Currently, they manage: specifications and documentation of a national standard; descriptions of technical infrastructure and API formats; metadata, such as key management and actors' IDs; and a support function for PT actors who plan to implement the standard in their systems (samtrafiken.se/projekt/biljett-betallosningar/). Arguably, this work makes it easier for external innovators to process and combine PT-related APIs (through both Trafiklab and Mobilitetstorget). Moreover, in addition to technical standardization, Samtrafiken also plans to harmonize contract management in relation to MaaS by providing general contracts for transport service providers (innovation seekers) as well as MaaS Operators (external innovators) in Mobilitetstorget. They reason that this might ease the contractual burden on both sides, and thus pave the way for MaaS that works in all parts of Sweden:

It would be great if PT had some kind of general APIs, open to everyone. And I can also imagine that Samtrafiken develops a PT platform [e.g. Mobilitetstorget] where they have agreements with the PTAs so that I [as a MaaS Operator] write a contract with Västtrafik [the PTA in West Sweden]. ...But my users also get access to a [PT] ticket when they are in Karlstad [another part of Sweden]. – IP10 Mobilitetstorget (translated)

In short, a harmonized and centralized access point seems to be able to both help OIIs decrease the costs for distant search for external innovators (i.e. for acquiring knowledge from sectors or trajectories outside their native environment) as well as make it easier for them to process the data, i.e. put the data to use.

4.3 Fostering Inter-Organizational Collaboration

The three studied OIIs seem to play an important role in establishing new connections between innovation seekers and external innovators. For instance, the EIC2015 consortium representatives reported that the contest offered an opportunity for innovation seekers to promote themselves and to establish new connections with both external innovators and other innovation seekers. On a similar note, the interviewed external innovators that used Trafiklab's services praised the meet-ups as key events for promoting their innovations and for coming into contact with the 'right' people at the innovation-seeking organizations. However, in addition to connecting innovation seekers and external innovators, OIIs also facilitate knowledge creation, sharing and absorption. For example, one of the main benefits that both innovation seekers and external innovators reported from their participation in EIC2015 was that the contest became a knowledge broker that bridged the gap between these same two groups. Moreover, the external innovators that used Trafiklab said that the community also provided an opportunity for sharing ideas and solutions with other external innovators:

The community is also important, but not in that one is interested in the people, but in what they do, what you do together. – IP10 Trafiklab (translated)

Another important aspect of the increased knowledge exchange between innovation seekers and external innovators, which was highlighted by the interviewees in the Trafiklab case, was the increased opportunity for external innovators to understand and influence the innovation seekers. They described two ways used to make their voices heard: reporting opinions to Trafiklab, who compiles them and takes on the task of conveying them to the innovation seekers; and going straight to the innovation seekers themselves:

Trafiklab has a [digital] portal, where I've asked some questions and provided some input a few times. Then, Trafiklab has had these meet-ups, where I [also] have presented these things [to innovation seekers]. – IP16 Trafiklab (translated)

4.4 Assisting Innovation Seekers in Managing the Innovation Trajectory

Samtrafiken's intention is that Mobilitetstorget should act as a 'neutral' layer between transport service providers (innovation seekers) and MaaS Operators (external innovators) within MaaS. Their logic is that transport service providers currently fear that opening up their tickets for external resale could lead to loss of control and eventually to them becoming dependent on the external innovators for selling their tickets. Accordingly, by providing the technical platform and the general contracts, Mobilitetstorget is intended to strengthen the transport service providers' position to govern the trajectory of MaaS, i.e. to ensure that the development of MaaS contributes to their goals:

I think that also in the long run this type of system [the value chain behind MaaS] would need to be under control of the public if political goals are first on the agenda, because otherwise these business rules will change at some point of time [away from policy goal fulfillment] to actually make the business [MaaS] more profitable, or profitable at all. – IP6 Mobilitetstorget

Despite utilizing ‘terms of use’ to limit what external innovators may use the APIs for, both Trafiklab and EIC2015 mainly manage their innovation trajectories through ‘soft’ measures. For instance, Trafiklab uses meet-ups to inspire external innovators to address problems relevant to the innovation seekers, while EIC2015 tried to accomplish the same using the contest events as well as the information disseminated at the contest website. In contrast, Mobilitetstorget could be described as an example of contract-based governance, as it plans to manage what external innovators may do via legally binding agreements. Moreover, positional power and trust seem to be more important (and contested) in the Mobilitetstorget case, in comparison with the two other cases. This is possibly due to the fact that Mobilitetstorget plans to intermeditate not only open data but also tickets and contractual terms. Moreover, it plans to ask for economic compensation from both innovation seekers and providers. As a consequence, Mobilitetstorget’s existence, and choice of business model and governance mechanisms, might have a larger impact on other actors’ business opportunities and business models.

5. Discussion

5.1 Synthesis of Identified Roles

The analysis of the three case studies suggests that the use of OIIs can be a useful measure in outbound public sector OI. The findings show that OIIs can lower technical innovation barriers by facilitating data transactions and supporting external innovators in finding, understanding and using the provided data. However, more importantly, the findings also illustrate that OIIs can help bridge the gap between public and private actors by addressing innovation barriers of more social character. For instance, some of the key benefits that external innovators experienced from the implementation of Trafiklab were improved access to knowledge and increased possibilities to influence the innovation seekers’ decisions (cf. Smith, Ofe, et al. 2016). Both Trafiklab and EIC2015 were also perceived to provide social structures for interaction (cf. Smith, Hjalmarsson, et al. 2016). Thus, they created shared pieces of identity and motivated external innovators to participate in the innovation ecosystems. In summary, our findings indicate that OIIs can facilitate public actors’ outbound OI practices through four interrelated roles:

- (i) Expanding the boundaries of innovation ecosystems
- (ii) Decreasing costs for distant search and data processing
- (iii) Fostering inter-organizational collaboration
- (iv) Assisting innovation seekers in managing the innovation trajectory

Hence, our analysis both enforces and complements extant research on the roles of OIIs (cf. Section 2.2). To connect innovation seekers with a diverse set of skillful external innovators has previously been outlined as one of the main functions of innovation intermediaries (e.g. Aquilani et al. 2016; Hossain 2012; Lopez-Vega and Vanhaverbeke 2009). We highlight a specific role of this function – to expand the innovation ecosystem by increasing awareness, lowering entry barriers and mobilizing potential participators. Accordingly, we strengthen earlier claims that OIIs can contribute to OI by bridging the gap between innovation seekers and external innovators as well as the gap between innovations’ areas of application and useful knowledge domains (e.g. Lopez-Vega et al. 2016). Further we describe OIIs’ potential role of decreasing external innovators’ costs for distant search and data processing. Consequently, we add to previous findings regarding OIIs’ role of enabling, guiding and streamlining distant search for innovation seekers (e.g. Jeppesen and Lakhani 2010; Kokshagina et al. 2017). Building further on the capability to connect organizations, our analysis also supports earlier notions of the role of fostering inter-organizational collaboration by brokering and cultivating knowledge (e.g. Bakici et al. 2017; De Silva et al. in press; Howells 2006). In particular, we underscore how OIIs can improve the opportunities for external innovators to understand and influence innovation seekers. Lastly, scholars have previously discussed how OIIs can be used for managing OI development paths (e.g. Agogué et al. 2013; Bakici et al. 2013; Felin and Zenger 2014). We add to these studies by illustrating that contracts as well as trust and power can be important governing mechanisms for public sector OI. Thus, our findings support earlier notions that trust is an important asset for managing development in knowledge-based economies (Adler 2001; Powell 2003; de Reuver and Bouwman 2012).

5.2 Relevance in Public Sector OI

The public sector comprises many actors that do not currently engage in collaborative innovation activities due to innovation barriers such as low innovation incentives, risk averse cultures and poor change management skills (Mulgan and Albury 2003; Sørensen and Torfing 2012). As a consequence, OIIs' role of increasing OI awareness among innovation seekers and lowering their entry barriers might be more fundamental in public sector OI, in comparison to private sector OI. In particular, OIIs might have the capability to address some of the legal and procedural barriers that public actors are experiencing in relation to outbound OI (Edler and Yeow 2016; Smith et al. forthcoming). Furthermore, OIIs' role of making it easier for external innovators to get a hold of and put innovation seekers' assets to use might have a greater impact on innovation outcomes when applied in the public sector, compared to in private settings. The public sector creates and collects vast amounts of data in many different domains, for which taxpayers have already paid (Janssen et al. 2012). Accordingly, the public sector likely has the assets needed in order to, on their own, create a large solution space for external innovators, i.e. the public sector has the ability to singlehandedly open up for a wide variety of possible innovations.

OIIs' role of brokering knowledge between innovation seekers and external innovators is arguably extra significant when public and private actors are supposed to collaborate, as the cognitive distances between them are larger (Munksgaard et al. 2012) and their perceptions of innovation barriers are incongruent (Smith et al. forthcoming). On a similar note, OII's role of assisting the management of the innovation trajectory can also be seen as especially relevant in public sector OI. As public actors' work is usually guided by policy goals rather than financial motives, public innovation seekers likely want to steer the OI trajectory towards objectives that business-driven external innovators may find more difficult to interpret and understand, compared to when innovation seekers and external innovators share similar motives (Munksgaard et al. 2012). In summary, all four identified roles seem to be particularly important in public sector OI, compared to private sector OI.

5.3 Implications and Future Research

The four identified roles support earlier notions that OIIs should be seen as active innovation partners rather than just middlemen (Aqualani et al. 2016; Elmquist et al. 2016; Hossain 2012). Moreover, the four roles also illustrate that OIIs can provide a heterogeneous set of services that facilitate outbound public sector OI in various ways (Bakici et al. 2013; Gascó-Hernandez et al. 2017). Therefore, we urge public actors to consider the utilization of OIIs when adopting OI practices.

However, a cross-comparison of the three analyzed case studies also indicates that the perceived value of OIIs as well as their effect on innovation throughput rests upon appropriately matching their characteristics with the needs of both the innovation seekers and the external innovators. For instance: Trafiklab's services were perceived differently across different types of external innovators (Smith and Sandberg forthcoming); the knowledge exchange was discontinued after the contest in the EIC2015 case, why the contest only had a temporary effect on the innovation ecosystem (Smith, Hjalmarsson, et al. 2016); and Mobilitetstorget is in general highly contested (discussed below) (Smith et al. forthcoming). So, in order to facilitate throughput in terms of innovation deployment, we propose that it is vital for public actors to thoroughly evaluate contextual factors of the innovation ecosystem as well as the needs of its participants prior to designing and implementing OIIs. Moreover, a service lifecycle perspective should be utilized in order to ensure that the entire innovation process is catered for, from ideation to implementation and operation.

Our three case studies are confined to a specific sector (public transport) and to a specific cultural context (Sweden). Therefore, additional case studies addressing the roles of OIIs in public sector OI are needed in order to generalize and broaden our findings. Moreover, extant definitions and descriptions of OIIs are quite vague (e.g. Abbate et al. 2015; Bakici et al. 2010; Hallerstedte 2013). As a consequence, OIIs with very different agendas, set-ups and service offerings currently fit under the umbrella term, which makes it difficult for both practitioners and scholars to compare their value propositions. Hence, we ask scholars to refine extant attempts to develop categorizations of OII types (Lopez-Vega and Vanhaverbeke 2009), and to explore the inner mechanisms of different OII types, i.e. to study the relation between OII characteristics and their perceived value. Furthermore, we concur with Ollila and Elmqvist (2011) on the need for additional research addressing the internal management of OIIs. But, additionally, we also see a need for studies that address multiple institutional levels, i.e. not only the perspectives of innovation seekers, OIIs and external innovators perspectives on the OIIs, but also the perspectives of end-users (citizens) and policy makers.

Although not emphasized in this paper, the three case studies show that the existence of OIIs in general, and MaaS Integrators in particular, are contested. Previous research has shown that MaaS can develop along different trajectories, and that views diverge upon whether or not MaaS Integrators are needed at all, and if so, what kind of actor should adopt that position (Smith, Sochor, and Karlsson 2017; Smith, Sochor, and Sarasini 2017). Those who object to the need for MaaS Integrators generally argue that if a new (additional) actor adopts the integrator role, this actor might become an inhibitory extra layer between transport service providers and MaaS Operators. According to the critics, there is therefore a risk that MaaS Integrators will divert the MaaS Operators' business potentials from sustainable to unsustainable, as the MaaS Integrators most probably will claim a share of the already small financial margins. It is also argued that external MaaS Integrators may be unnecessary, as MaaS Operators currently express a willingness to try to develop the integrator functionality themselves. Similarly, some interviewed external innovators in the Trafiklab case felt that data quality and access to raw data had been lessened due to the introduction of an intermediary technical platform. Drawing on these debates, we emphasize a need for further research on drawbacks, conflicts and shortcomings of OIIs in order to pinpoint issues needing to be addressed.

6. Conclusion

This paper illustrates that OIIs can facilitate public actors' outbound OI practices through four interrelated roles: expanding the boundaries of innovation ecosystems; decreasing costs for distant search and data processing; fostering inter-organizational collaboration; and assisting innovation seekers in managing the innovation trajectory. Although arguably also applicable in private sector OI, these roles seem to be particularly relevant in public sector OI due to the unique set of innovation barriers that hinder such practices. Still, further research is needed on how the proposed roles of OIIs vary across different types of OIIs and across different public sector OI ecosystems in order to gain a more holistic perspective on OIIs and a deeper understanding of their underlying mechanisms.

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