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Working Paper

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Working Papers in Economics and Finance, No. 2015-01

Provided in Cooperation with:

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Suggested Citation: Kristensen, Iryna (2015) : Assessing the role of PPPs in addressing proximity and systemic challenges in regional innovation policy, Working Papers in Economics and Finance, No. 2015-01, University of Salzburg, Department of Social Sciences and Economics, Salzburg

This Version is available at:

<https://hdl.handle.net/10419/122166>

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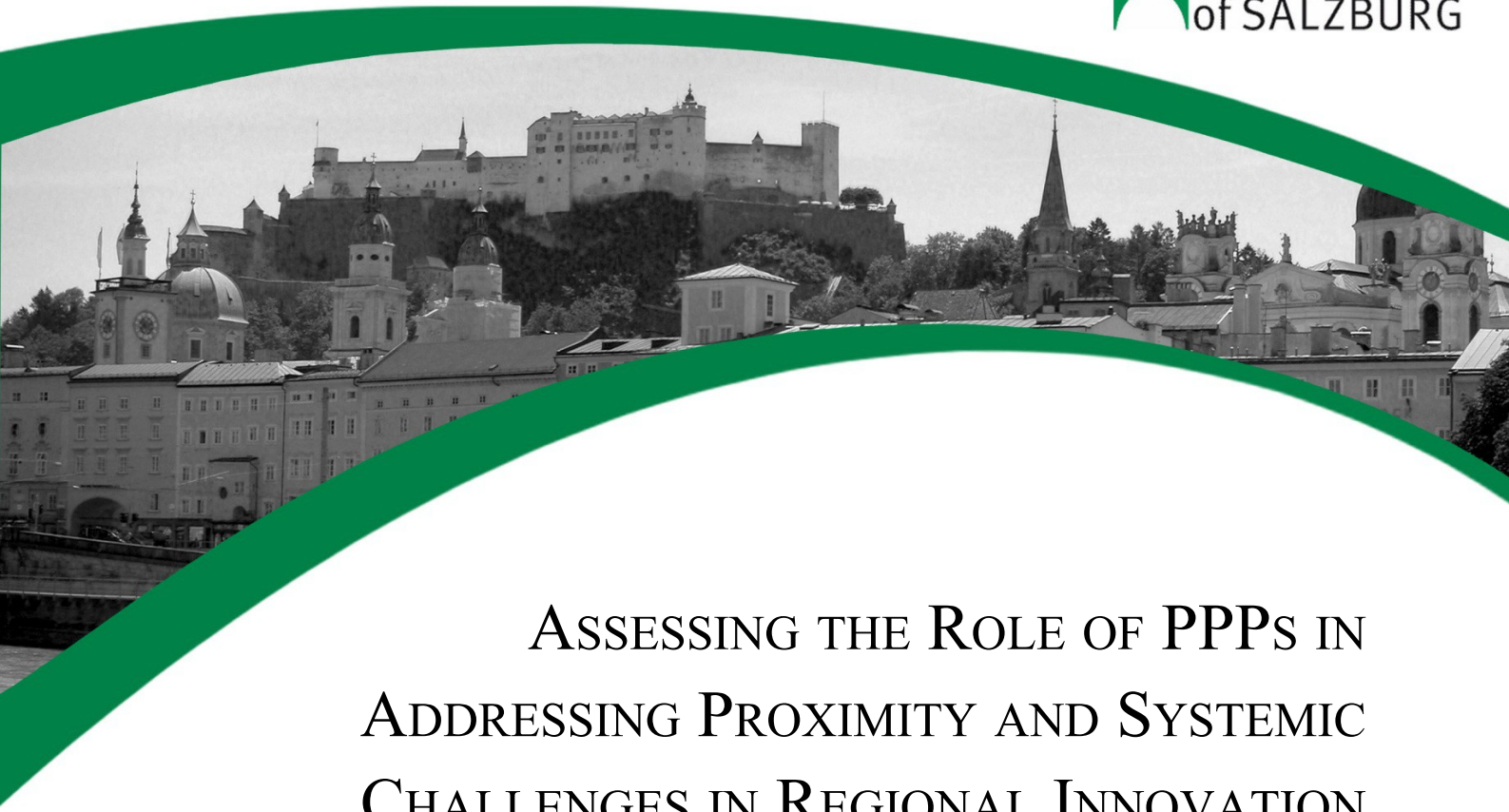
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ASSESSING THE ROLE OF PPPs IN
ADDRESSING PROXIMITY AND SYSTEMIC
CHALLENGES IN REGIONAL INNOVATION
POLICY

IRYNA KRISTENSEN

WORKING PAPER No. 2015-01

WORKING PAPERS IN
ECONOMICS AND FINANCE

Assessing the Role of PPPs in Addressing Proximity and Systemic Challenges in Regional Innovation Policy

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January 2015

Abstract

Public-Private Partnerships (PPPs) are argued to be able to add greater value to innovation processes by fortifying the quality of innovation systems by linking regional public and private actors together and exploiting a wide range of sources of innovation. The effectiveness of interface management and resource allocation as well as the dynamics of multifaceted interactions, however, will strongly depend on the degree of proximity between innovation agents. While it is difficult to determine the optimal degree of proximity for multi-sector cooperation in addressing systemic challenges, there is little doubt that certain level of cognitive, organizational, institutional, social and geographical closeness is conducive to interaction and learning. This paper applies a partnership-based approach to investigate the interrelation between dimensions of proximity and systemic failures and observes potential regional and sectoral variations with respect to proximity dimensions and their implication for regional innovation system efficiency. A matrix linking five dimensions of proximity with four categories of systemic problems serves as a basis for analysis. Six PPPs from two regions in Sweden (i.e. Sydsverige and Övre Norrland) are selected for empirical study.

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* Support by the Humer Foundation is gratefully acknowledged.

1. Introduction

Public-private partnerships (PPPs) have grown in importance with the rapid advancement of innovation processes and business demands calling for alternative solutions to address the gaps of an innovation system impeding the direction and effectiveness of innovation process (OECD 2004; Smits & Kuhlmann 2004; Wieczorek & Hekkert 2012; Kristensen, McQuaid & Scherrer 2015). A recent upsurge of interest in inter-organizational modes of cooperation can be explained by the existence of resource interdependence and complementarities among innovation agents (Nooteboom et al 2007). In this framework, the coordination of agents involved in the innovation process and proximity linkages among them play an imperative part as different proximity dimensions are likely to effectuate PPPs' potential to address systemic functions by stimulating knowledge exchange and creating dynamic interactions. The purpose of this chapter is to examine the interplay between proximity dimensions and systemic failures by linking five forms of proximity, namely *geographical, social, institutional, organizational and cognitive* - and four groups of systemic problems of innovation systems – *actors' problems, interaction problems, institutional problems and infrastructural problems*- and, by employing the concept of proximity, to determine the role of PPPs in bridging systemic gaps of regional innovation systems.

The growing body of literature in this field is abundant and diverse. Yet nearly all of the studies in the innovation literature share similar limitations. *Firstly*, there is a strong tendency to focus on one particular dimension of proximity namely geographical as it has traditionally been argued that spatial closeness of innovation agents such as universities, innovating firms, public research institutions and governmental agencies triggers collective learning and knowledge spillovers (for an overview see e.g. Arundel & Geuna 2004; Laursen, Reichstein & Salter 2011). However, recent evidence suggests that its significance is modestly overstated (e.g. Boschma 2005; Torre & Rallet 2005, Malmberg & Maskell 2002, Herrmann, Taks & Moors 2012). *Secondly*, analysis of relations between various forms of proximity for innovation processes (e.g. Ponds, van Oort & Frenken 2007; Hansen 2014; D'Este, Guy & Iammarino 2013) does not sufficiently consider the heterogeneity of an innovation milieu. In his recent study Mattes (2012) has made an attempt to conceptually disentangle spatial and non-spatial logic of innovation in order to provide a better understanding of learning processes, claiming that intensity of proximity links varies depending on the underlying knowledge base. However, the heterogeneous nature of innovation processes along with differing knowledge domains also raises questions of communication efficiency and

rationales. This implies that effectiveness of innovation efforts strongly depends on collective actions of diverse actors integrated in a collaborative alliance (Mattes 2012) along with their interaction with other elements of the innovation system, namely institutions and infrastructure. *Finally*, there is a clear lack of evidence on the impact of systemic policy instruments in bridging the gap between proximity dimensions and systemic failures.

The remainder of the paper proceeds as follows. Section 2 outlines the conceptual background to this chapter and defines the key research questions that need to be answered to address the objective. It then develops a conceptual matrix linking four groups of systemic problems with four dimensions of proximity and brings in a partnership perspective into the discussion. Section 3 provides methodology of empirical research, followed by an empirical illustration of six in-depth case studies to reveal some inter-sectoral and inter-regional patterns (section 4). The final section (section 5) discusses implications of linkages established.

2. Conceptual framework

i. Defining key concepts

Edquist (1997) defines technological innovation in the context of interactive learning among multiple innovation agents involved in creating ‘new knowledge or combining existing knowledge in new ways – and of transforming them into economically significant products and processes’ (p.16). The process of technological knowledge creation involves a high degree of risk and uncertainty requiring effective control mechanism to ensure intellectual property rights (IPR) and sufficient returns on investment (RoI). Transaction costs are high and market forces are not capable of meeting this kind of challenge (Boschma & Frenken eds 2010:122). As Chaminade and Edquist (2010) point out the high degree of uncertainty inherent in innovation processes causes systemic problems that cannot be mitigated exclusively by private actors requiring new forms of governance where public participation is essentially motivated by the presence of systemic problems and not by market failure (p. 102, 106). The PPP model provides an ideal vehicle for connecting relevant actors from the public and private sectors and creating productive dynamics within a regional innovation system. The OECD defines a PPP largely in terms of a contractual relationship as ‘an agreement between the government and one or more private partners (which may include the operators and the financiers) according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of

the private partners and where the effectiveness of the alignment depends on a sufficient transfer of risk to the private partners' (OECD 2008: 17).

Allowing for the systemic nature of innovation processes, the performance of heterogeneous actors (often operating in various contexts) will strongly depend on the quality and efficiency of that system as such and various subsystems (e.g. R&D, users, supportive infrastructure) in particular (Smits and Kuhlmann 2004). Consequently the imperfections that can occur within such systems/subsystems would block innovation-related activities of all actors involved in these processes (Mierlo et al. 2010). Four groups of systemic problems are distinguished by Wieczorek and Hekkert (2012).

Actors' problems are related to the (non-) presence of major actors and their capacity to articulate identified requests and utilize available competences/resources (also termed 'transition problems' by Chaminade and Edquist (2010)). Actors are distinguished based on their economic function i.e. government, companies (e.g. large firms, multinationals, SMEs), knowledge institutions (e.g. universities, research centers) and other parties (e.g. legal organizations, financial organizations/banks). *Interaction problems* are related to the presence and the quality of interactive links between actors both at the level of a network and at an individual level (also termed as 'network problems' by Chaminade and Edquist (2010)). Insufficient supply of complementary knowledge due to inadequate power management between actors hinders interactive learning and innovation (Wieczorek and Hekkert 2012). *Institutional problems*¹ are linked to the presence and the quality of formal or hard (e.g. regulations and laws) and informal or soft institutional (e.g. practices, norms and routines) frameworks for supporting innovation and preventing the occurrence of "appropriability traps" and "favour incumbents". *Infrastructural problems* are related to the availability and quality of physical infrastructure (including networks as in Chaminade and Edquist (2010)), knowledge/scientific infrastructure, and financial infrastructure.

An elimination of system imperfections will change the relationships between heterogeneous actors (Mierlo et al. 2010); therefore the ability to manage multifaceted interfaces, the effectiveness of allocation, absorbing and integrating diverse knowledge bases and the dynamics of interaction will strongly depend on the degree of proximity between innovation agents (Mattes 2012). This chapter applies Boschma's (2005) definition of proximity

¹ Edquist and Johnson (1997) defines institution as common sets of habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups and organizations.

distinguishing its five dimensions: cognitive, organizational, institutional, social and geographical.

Cognitive proximity refers to knowledge base diversity of economic actors and their learning capability. Insufficient cognitive proximity might have a negative impact on communication efficiency since it decreases partners' cognitive potential to communicate, understand and process new knowledge (Boschma 2005). Therefore, to ensure effective learning an optimal level of cognitive proximity should be achieved (Mattes 2010; Boschma 2005). Boschma & Frenken (2010) define *cognitive optimum* as a balance enabling both the generation of new ideas through recombination and effective communication between actors and knowledge exchange (p.126).

Organizational proximity identifies the extent to which relationships between partners are shared in an organizational arrangement. In a narrower understanding, organizational proximity defines the rate of autonomy/control exerted upon organizational arrangement ranging from weak networks to hierarchically organized joint ventures (Boschma 2005; Letaifa and Rabeau 2013; Boschma & Frenken eds 2010:122). A high degree of bureaucracy and hierarchy might impede the collaboration and innovation process affecting intra- and inter-organizational learning (Boschma 2005; Letaifa and Rabeau 2013). Boschma & Frenken (2010) argue that the *optimal level of organizational proximity* could be reached when loosely-interconnected networks comprising independent agents combine the benefits of flexible coordination structure (p.126).

Social proximity denotes socially-embedded relations between actors at the micro level resulting from friendship, family relations or experience. Development of trust-based relations facilitates communication and knowledge transfer between agents presenting, at the same time, certain opportunistic risks (Letaifa and Rabeau 2013). Nooteboom (2000) defines trust in terms of thresholds: 'people will not be opportunistic until temptation exceeds a certain threshold of resistance to temptation, and this threshold depends on values and norms, experience, character, kinships and friendship' (p.166). Accordingly, the *optimal level of social proximity* could be achieved by creating a balance between embedded intragroup relations and strategic intergroup relations (Boschma & Frenken eds 2010:126).

Institutional proximity is closely related to social proximity (particularly in terms of creating mutuality among actors (Mattes 2012)); however, it refers to macro-level factors that create coherence with regard to laws and values and provide favorable conditions for interactive

learning (Boschma 2005; Mattes 2012; Boschma & Frenken eds 2010:123). Operating concurrently in various institutional milieus e.g. multinational corporations in different countries or research labs cooperating with academic and non-academic organizations will enable reaching an *institutional optimum* (Boschma & Frenken eds: 126).

Geographical proximity is narrowly defined as a physical distance between economic actors both in absolute (e.g. miles) and relative (e.g. travel time) terms. Physical distance between agents does not serve as a sufficient or necessary prerequisite for interaction: on the one hand, it needs to be supplemented with cognitive proximity to initiate genuine interactive learning and on the other hand, it can be substituted by other forms of proximity in order to solve coordination problems (Boschma 2005). Boschma & Frenken (2010) claim that *geographical optimum* is found in the balance of local and non-local linkages (p.126).

A PPP model of cooperation has the potential to incorporate all forms of proximity. With regard to *cognitive linkages* between actors, PPPs facilitate knowledge based interactions and exploitation of public and private complementarities. *Organizational proximity* is manifested in a dynamic interplay between organizational milieus of stakeholders and their active involvement in the decision-making and management process of public-private cooperation. In this chapter, institutional proximity is regarded as part of organizational dimension as it ‘entails humanly devised constraints’ that govern political, social and economic interactions (Heringa et al. 2014), obscuring the differentiation between organizational and institutional forms of proximity. This obscurity is manifested, for instance, in the rigidity of the hiring process in the public sector, where institutional (e.g. *public law*) and organizational (e.g. *management hierarchy*) dimensions of proximity clearly overlap. Given that, organizational dimension of proximity in this account entails also an institutional form of proximity. With regard to *social linkages* between partners, frequent face-to-face interactions among public-private partners facilitate inter-organizational trust-building resulting in reduced uncertainty and risks. Finally, *spatial co-location* of actors improves the connectivity within an innovation system and external networks by filling gaps in the knowledge infrastructure.

This paper aims to take a further step by *first* applying a partnership-based approach to investigate the interrelation between dimensions of proximity and systemic failures that potentially might increase the efficiency of IS operation; and *secondly*, by observing potential regional and sectoral variations with respect to proximity dimensions and its implication for innovation system efficiency.

ii. Linking systemic problems and forms of proximity

Matrix 1: linking systemic problems with proximity dimensions

| Systemic problems/ Proximity forms | <i>Actors problems</i> | <i>Interaction problems</i> | <i>Institutional problems</i> | <i>Infrastructural problems</i> |
|---|--|--|--|--|
| <i>Cognitive</i> | (1) Lack of expertise variety | (5) Weak learning capacity | (9) Poor communication between partners | (13) Insufficient supply of qualified research & business resources |
| <i>Organizational</i> | (2) Conflicting organizational logics | (6) Inefficient power management | (10) Lack of innovation strategy & vision | (14) Inadequate control mechanism to safeguard innovation output |
| <i>Social</i> | (3) Lack of interpersonal context & trust | (7) Poor networking & inter-sectoral mobility | (11) Failure to implement norms & change informal structures | (15) Failed collaborative efforts in identifying needs for new & emerging innovation |
| <i>Geographical</i> | (4) Insufficient openness to external forces | (8) Limited spatial connectivity & complementarity | (12) Inadequate institutional conditions | (16) Poor quality or unavailability of local research facilities |

Actors' problems. The complexity of innovation processes vividly highlights the importance of *cognitive proximity* between heterogeneous stakeholders incorporated in a dynamic interactive milieu. Knowledge is usually widely dispersed among different agents suggesting that in order to initiate learning and innovation diverse competences and knowledge bases should be combined within and between organizations (Boschma 2005). Accordingly, the lack of knowledge diversity might deprive partners (particularly private sector actors) of an opportunity to create interdisciplinary synergy (Camagni ed 1991:141-42) and to exploit knowledge and competence complementarities (Herrmann, Taks & Moors 2012; Nooteboom et al 2007).

Organizational proximity is also strongly linked with cognitive diversity of innovation agents. On the one hand, pooling the diverse skills of actors emanating from distinct corporate cultures creates a competence balance within innovation systems by filling in respective knowledge gaps. On the other hand, however, inadequate organizational proximity among innovation agents might pose a challenge to communication efficiency and information management allowing for organizational variations between public and private sectors e.g. a hierarchal and stiff organization of public sector vs. a network-based and flexible organization of the private sector (OECD 2004). Yet sharing similar operational patterns would create a risk of status quo decreasing actors' ability to explore or exploit new knowledge (Letaifa & Rabeau 2013).

In this context, *social proximity* between innovation agents plays a crucial part because despite all modern technological advancements that significantly facilitated knowledge and information exchange, a notable coordination gap still exists: competitive success in today's economic environment still depends heavily on partners' mutual intelligibility achieved through a complex network of social interaction (Saxenian 2006:15). A social context that transcends formal organizational patterns facilitates the leverage for adapting new perspectives/ideas and aid trust-building that eventually results in voluntary, non-obligating exchange of assets and services between innovation actors (Uzzi 1996; Nooteboom 2000:156). Furthermore, given the knowledge-based mode of contemporary production, often requiring exchange of sensitive and confidential information, trust relations became an important attribute of collaborative activities (Lane eds. 2000:1). This suggests that a certain amount of mutual trust and familiarity (Nooteboom et. al 2007) fostered through social networks additionally fortify bonds and commitment of partners, aiding the achievement of mutual understanding and solution finding.

However, insufficient or limited interpersonal communication i.e. too little social proximity will possibly lower expectations of repayment and reciprocity (Fleming, Mingo & Chen 2007) in the long run and reduce the intensity of knowledge and resource flow. Hence, diversity should be sustained and enriched by combining internal and external modes of cooperation (Mattes 2012) extending the scope of *geographical proximity*. Furthermore, when the scope of external connections is limited (implying the inflow of fresh information and new perspectives is inadequate (Fleming, Mingo & Chen 2007; Chesbrough 2006)), the innovation agents will show less interest in cooperation thereby contributing to innovation system malfunctioning.

Interaction problems. Considering that knowledge spillovers is not a mechanical process, the presence of heterogeneous knowledge-bases will not automatically initiate the learning process because the transfer of knowledge always involves ‘some intention to interact, to learn, to share and absorb information’ (Mattes 2012). Innovation processes involve varying degrees of uncertainty that might potentially put a strain on the learning intensity among innovation agents, who may often be reluctant to accept a reasonable risk of failure (sort of creativity bias). Learning entails selection of activities and practices that will allow actors to stretch their knowledge bases (in attempt to cover existing cognitive gaps) and form novel linkages within respective innovation systems ensuring thereby sufficient *cognitive proximity* between innovation agents (Cohen & Levinthal 1990). Furthermore, managerial diversity of innovation agents is proven to stimulate innovation by providing a ‘particularly favorable seedbed for creativity’ (Fromhold-Eisebith 2004). However, insufficient *organizational proximity* of actors manifested in the presence of asymmetrical power relations might create an imbalance between different components of innovation system and adversely affect innovation interaction and learning processes (Mattes 2012; Letaifa & Rabeau 2013).

Given that collaborative and learning activities are embedded in a social context, the increasing mobility of highly-skilled labor force and social networking contributes to bridging *organizational and social* diversity gap by stimulating exchange of experts and professional personnel who can supply new ideas and knowledge and creating the necessary linkages between the actors of innovation system as well as providing necessary feedback loops. *Geographical proximity* is most likely to stimulate these social relations implying that limited spatial connectivity between local partners might degrade actors’ capacity to fully utilize available learning potential.

Institutional problems. The existence of a common understanding of the framework, values and strategies of academic and non-academic organizations promotes effective communication among innovation agents. Innovation cooperation reveals a certain clash of communication styles: the purpose of academic research is to increase the ‘existing stock of knowledge’ and to spread the newly created knowledge as wide as possible; whereas industrial research is focused on contributing to ‘the streams of rents that may be derived from possession of (rights to use) private knowledge’ (Dasgupta & David 1994). This suggests that reaching adequate level of *cognitive proximity* is essential to ensure a proper balance of academic and non-academic incentive structures on the subject of knowledge creation where academia and industry are pursuing conflicting goals of maximal and minimal diffusion (Ponds, van Oort & Frenken 2007).

Hence, to avert communication failures (at least to some extent), certain *organizational proximity* should be maintained to stimulate a dialogue and facilitate communication efficiency among innovation partners in reaching a common goal yet it shouldn’t be carried too far, diminishing existing diversity (Cohen & Levinthal 1990; Nooteboom et. al 2007). Lack of team-efforts in incorporating diverse agendas that are essential for common vision building might limit actors’ sphere of influence and result in inadequate support of innovation and new knowledge creation.

Furthermore, when the balance between ‘value of collective action’ and ‘opportunity costs’ is disrupted, innovation agents might start to pursue individual competitive goals, increasing opportunistic risk. This brings *social proximity* to the frontline: the establishment of common norms and competition structures among innovation partners, seen as essential for innovation advancement, strongly depend on frequent and enduring interactions.

In this context, *geographical proximity* acts as a facilitator to the creation and modification of institutions (Hansen 2014) where regional authorities would favor local forms of collaboration to keep the capital within the region (Hong & Su 2013). Failure to ensure such adequate institutional conditions e.g. the lack of flexibility in funding/grant policies might hamper effective operation of regional innovation systems.

Infrastructural problems. As the importance of knowledge for innovation processes has increased, the universities begin to play a more prominent role within innovation system acting as both ‘human capital provider and seed-bed of new firms’ (Etzkowitz et al 2000). *Cognitive* heterogeneity embedded in human resources facilitates R&D, production and

innovation by creating competence complementarities among innovation actors. Consequently, an inadequate supply of qualified workforce capable of carrying out research both in industrial and academic spheres might negatively influence the direction and intensity of knowledge-based processes and the overall efficiency of innovation system.

From an *organizational proximity* perspective, given the increased role of academic R&D activities in science-based industries (Lee 2014), solid control mechanism (i.e. intellectual property) are required to reduce uncertainty and the risk of opportunism and to ensure the maximization of return on investments and utilization of innovation outputs (Boschma 2005). University researchers increasingly test their research findings for commercial and technological value in search of ‘fundamental advances in knowledge and innovations that can be patented and marketed’ (Etzkowitz et al 2000). Hence, failure to adequately protect intellectual property rights might decrease economic value of research outcomes, unduly impairing the competitiveness of innovation actors.

Furthermore, considering that innovation process often crosses boundaries of a single scientific field, information ‘fusion’ opens up new venues for expanding data access, analysis and knowledge exchange. In this context, *social proximity* between researchers and industrial engineers should enable actors (by blending diverse resources and technologies) to jointly scan and scout for potential innovation opportunities, reducing ‘uncertainty’ and lowering ‘transaction costs’ (Boschma 2005).

Finally, *geographical proximity* manifested in the presence of research institutions and universities generates added value for private stakeholders within innovation systems by adding ‘the prestige and environment of a major institution, including its faculty and physical resources’ and acting as ‘a real estate anchor, and as a growing source of applied research and technical professionals’ (Kysiak 1986).

iii. Partnership perspective: interplay between proximity and systemic failures

This section presents a discussion on how PPPs may fortify proximity linkages between innovation agents in addressing specific groups of systemic problems. Obviously, the intensity of proximity linkages might vary across regions and economic sectors since particular IS components are very much context-specific (e.g. knowledge infrastructure,

intellectual capital etc.). Based on analysis from *section ii*, theoretical expectations will be discussed and presented below.

Actors' problems. By bringing multiple agents and diverse knowledge/experiences together, PPPs could emerge as a useful mechanism capable of enhancing *cognitive linkages* required for innovation processes. However, competences and skills of partners might vary across industries as cognitive proximity is likely to be higher between stakeholders working within the same field than stakeholders originating from different sectors (Hansen 2014).

Despite heterogeneity of organizational logics concealed in public and private sector's agents (Boschma 2005; OECD 2004), inter-sectoral cooperation should potentially increase *organizational proximity* by enabling stakeholders' management development, which is built on effective experience and strategy exchange between partners.

Further, PPPs usually promote *social links* between partners by enhancing a cohesive social structure and developing common norms and trust within a group of partners (Fleming, Mingo & Chen 2007). Trust is particularly valuable in situations when the interests and incentives of partners are not perfectly aligned because it supports knowledge exchanges that would not have been possible otherwise (Liebeskind and Oliver eds 2000: 119). Moreover, socially embedded ties shift the focus of public and private partners from the 'narrow pursuit of immediate economic gains toward the enrichment of relationships through trust and reciprocity' (Uzzi 1996).

A recent shift from closed to open innovation processes and the 'growing division of innovation labor' (Chesbrough 2006:2), puts PPPs in a position to act as a bridge between internal and external knowledge flows by ensuring sufficient *geographical proximity* between partners and enabling access not only to local but also external sources of information.

Interaction problems. By its very nature, innovation and interactive learning require commitment and long-term relations among innovation agents compared to pure market interactions (Boschma 2005). A contract-based and well-structured form of public-private collaboration enables different types of learning activities on a regular basis to facilitate *cognitive linkages* between actors resulting in dynamic knowledge exchange and critical assessment. The process of knowledge creation also requires efficient coordination of information exchange on both intra- and inter-organizational levels (Boschma 2005).

A PPP mode of cooperation allows a high degree of organizational flexibility and autonomy to partners, which on the one hand, ensures the openness of knowledge networks for intra- and inter-organizational learning and on the other hand creates the balance of power between the involved agents (join forces in areas where agents have common/complementary interests) (Mattes 2012; Letaifa & Rabeau 2013). Therefore, PPPs can increase *organizational proximity* by enabling equal distribution of power and influence among public and private partners and aligning interests that might result in a mutual perception of individual and collective benefits from knowledge and competence sharing.

In addition, flexible organizational structure of PPPs might allow a sufficient level of *social proximity* among stakeholders by widening the scope of actors' social interaction through 'new patterns of mobility of both knowledge and researchers' (Lee 2014). Regular informal interactions within the frame of a PPP project stimulates 'the generation and exchange of non-standardized and complex knowledge' (D'Este, Guy & Iammarino 2013) particularly in the early discovery phases. However, the degree of social mobility will differ across disciplines varying from 'open' to 'restrictive' in terms of public access to produced knowledge (Lee 2014).

With regard to *geographical proximity*, PPPs provide space for international cooperation but also strengthen regional links in order to exploit synergies between the local research and business groups and create a network with a sufficient mass to attract highly-qualified labor force. Regular face-to-face interactions between partners aid the development of a common commitment to advancing research activities as well as facilitating information flows between agents (Fromhold-Eisebith 2004). However, the spread of advanced multimedia systems and virtual technology as well as falling costs of transportation and communication (Saxenian 2006) has enabled effective collaborations at a distance (Nooteboom 2000:163); hence, making spatial collocation more of a relative notion that can also be easily replaced by temporary geographic proximity (Gallié 2009, Hansen 2014).

Institutional problems. Ideally, partners should maximize their organizational identity and mutuality within a PPP i.e. power equality, arising from the diversity of actors' institutional and organizational 'heritage'; however, in actuality an effective compromise and perfect alignment of interests is hard to achieve (Brinkerhoff & Brinkerhoff 2011; Boschma 2005). This suggests that active involvement of public and private partners in formal and informal networks (Chaminade, Intarakumnerd & Sappasert 2013) might enhance *cognitive linkages*

between them and promote an effective dialogue in order to smooth out the differences between partners' academic and non-academic operational routines and prevent the occurrence of basic mismatches with regard to deliverability, time horizons and application.

Furthermore, PPPs might also fortify *organizational links* and coordination efficiency by extending the scope of stakeholders' influence and involvement in strategy and vision building of a partnership, enabling them to influence shared goals, processes and outcomes (Brinkerhoff & Brinkerhoff 2011). To enhance collaboration outcomes, the value and input of both public and private partners should be strongly recognized by all stakeholders. Lee (2014) argues that companies, governments and universities engaging in 'bottom up' planning and 'road mapping' are more likely to reap future benefits compared to their peers focused on the short-term strategies. Besides, the durable form of PPP cooperation imposes certain commitments on both public and private partners that might serve as cues, which initiate collective action and balance social incompatibilities. Hence, PPPs have a potential to increase the intensity of *social linkages* between innovation agents.

With regard to *geographical proximity*, integrating major regional actors into a single framework of cooperation allows innovation agents to exert certain influence on local policy decisions and regulations that would sufficiently support cooperation and new developments. At the same time, however, the efficiency and quality of the institutional framework will depend to a large extent on the competence and experience of public organizations in ensuring favorable conditions for PPP cooperation.

Infrastructural problems. PPPs enhance *cognitive linkages* between partners by enabling private companies to expand their research capacity through the development of closer ties to universities and other research institutions serving as a source of applied research and technical skills and competence (Kysiak 1986). Through public and private cooperation synergies and added value are created (and this rather unique form of organizing research activities).

Cumulative nature of knowledge leads to larger interdependency, complexity and interconnectivity among different actors; hence it requires strong control mechanisms to avert opportunism (*organizational linkages*). Accordingly, entering into a PPP might increase the intensity of organizational linkages between partners in safeguarding rights to new technologies and avoid complex bureaucratic contract drafting specifying technology rights.

IPR within a PPP assist in structuring relations between stakeholders and managing the potential output of collaborative efforts.

PPPs also facilitate *social proximity* among partners that potentially may aid efficiency optimization by enabling access to market information (Uzzi 1996) and enhancing an effective information flow (Fleming, Mingo & Chen 2007) in search for innovation opportunities and emerging market trends. However, achieving this adequate level of social closeness in the connected learning environment might be a challenge since long-term partnerships often run the risk of innovative and learning lock-in due to excessive trust (Boschma 2005) and inadequate monitoring that increases chances of opportunistic behavior (Lane eds. 2000:22).

With regard to *geographical proximity*, the involvement of governmental representatives, universities and other public research institutions with a PPP assists in aiming innovation policies at solving infrastructure provision problems, contributing to effective implementation of new ideas and innovation (Boschma 2005; Chaminade & Edquist eds. 2010) and provides access to an ‘untapped mine of university resources’ and facilities at a reasonable cost (Kysiak 1986).

Furthermore, the interplay between proximity dimensions and systemic failures might operate differently in different regional and/or industrial settings. Industries selected for the analysis are distinguished by their corresponding knowledge base - analytical and synthetic. The former refers to economic activities requiring high-level scientific knowledge generated through cognitive and rational processes whereas the latter implies application of existing knowledge aimed at delivering specific practical solutions (Asheim & Coenen 2005; Martin & Moodysson 2011a). This suggests that industries with analytical knowledge-base entail close and systematic interaction with research institutions as opposed to industries with synthetic knowledge-base². To put it differently, the underlying knowledge-base shapes proximity patterns of knowledge exchange (Mattes 2012). Besides, proximity-systemic failures interactions can be influenced by regional economic imbalance. The core regions are generally richly endowed with human capital and tangible economic assets, benefiting from economies of agglomeration, knowledge spillovers and specialization/diversification externalities (Fitjar & Rodríguez-Pose 2011) whereas peripheral regions neither have the

² Allowing for research focus on technological innovation, industries with symbolic knowledge-base were left out of the chapter given less reliance on formalized knowledge sources (i.e. application of scientific laws) in their economic activities (see Martin & Moodysson 2011b for overview).

diversity of technological resources nor adequate knowledge support essential for innovation interface nor sufficient capabilities to exploit existing innovation (Doloreux 2003; Martin & Tripp 2014; Jauhiainen & Moilanen 2012). Bearing this in mind, the regions and sectors were chosen to capture possible variations of proximity linkages with regard to heterogeneity of competences, rationales, personal networks and availability of knowledge-based infrastructure.

Allowing for significant cognitive and organizational variety embedded in public-private form of cooperation, proximity will most likely work differently compared to more homogeneous forms of cooperation e.g. cooperation between companies or cooperation between research institutions (Herringa et al. 2014). Public-private partnerships aim at striking a balance between establishing enough common ground to sustain mutual accountability expanding the potential of functional collaboration and ensuring enough diversity to allow for complementarity of knowledge and competences.

3. Design of Empirical Research

This section operationalizes the concepts discussed in section 2 for empirical research, which is based on the analysis of six cases of PPPs related to regional innovation policy in Sweden. The cases emanate from two Swedish NUTSII regions – South Sweden (SE22), representing a core region, and North Sweden (SE33), representing a peripheral region, – and focus on ICT (Industry Excellence Center System Design on Silicon (SoS), Faste VINN Excellence Center (FL)), life science (Medicon Valley (MV), Biotech Umeå (BU, Umeå Cluster) and automotive industry (Competence Center for Combustion Processes (KCFP), Center for Automotive Systems Technologies and Testing (CASTT)). Economic sectors were selected because they are considered to be crucial for economic diversification of both regions into high-technology and medium-high-tech activities (Halléncreutz, Bjerkesjö and Daal 2008; Moodysson and Zukauskaitė 2014; European Commission 2010; Jones & Woods 2011; OECD 2010).

The empirical analysis is based on the data obtained through semi-structured interviews with public partners (e.g. universities, hospitals) and private partners (companies) involved in the PPPs and with other public stakeholders (representatives of regional/local authorities, central government agencies). A total of 17 interviews (plus additional 6 follow-up interviews) were completed. The private sector respondents were selected according to their history of

collaboration with public sector and the degree of their reliance on collaboration in their economic activities (*See Matrix 2 for comparison*).

To empirically analyze a four-row by four-column array of 16 conceptual elements, a number of proxies were selected to fill each cell array. As regards *actor's systemic problems*, in order to operationalize *cell array 1*, respondents were asked about the availability of knowledge and expertise variety needed to spur creativity and innovation development. As 'proxy' for *cell array 2*, the interviewees were asked to describe major differences (if any) between public and private management strategies. The proxy is used to capture potential organizational barriers to increase actors' communication efficiency resulting in redundant bureaucratic routines of cooperative incentive. For empirical use of *cell array 3*, the respondents elaborated on the role of trust and interpersonal context that facilitate social diplomacy and teamwork advancement within the PPP. The rigidity of collaboration focus is used as a 'proxy' for *cell array 4*. The proxy is used to emphasize the necessity of integrating external and internal types of knowledge for innovation development.

Regarding *interaction systemic problems*, operationalized through cell *array 5*, the respondents were asked about the learning practices prevailing in the PPP and their significance in increasing knowledge processes. Distribution of power and influence between public and private partners in the PPP is used as a 'proxy' for *cell array 6*. Any fluctuations or shifts in power balance may reduce incentives for public and private interaction. As a 'proxy' for *cell array 7*, the interviewees were asked about inter-sectoral mobility targeting predominantly research staff exchange. The greater interaction of research-related staff and increased mobility between public and private sectors helps to break existing or perceived barriers between academic and industrial sectors. As it is difficult to distinguish empirically between *cell array 4* and *cell array 8*, the same 'proxy' i.e. rigidity of collaborative focus is used in both cases.

As for *institutional systemic problems*, in order to empirically use *cell array 9*, the respondents were asked about the consensus-building efforts and achievements in the course of cooperation. Achieving mutual agreement is a significant success factor for the PPP allowing public and private sector stakeholders to provide an input into a decision-making process and establish frameworks for development of commonly acceptable and beneficial solutions. Partners' influence over strategy and vision building is used as a 'proxy' for *cell*

array 10. Joint strategy and vision development fosters public and private sector actors to articulate common interests and create alignment. As a ‘proxy’ for **cell array 11**, the interviewees provided information on present incompatibility (if any) of social norms within the partnership framework. This proxy is used to consider potential influence of normative social context on the intensity of collaboration among innovation agents. To operationalize **cell array 12**, regional institutional framework is used as a ‘proxy’ since the lack of sufficient support from the local authorities may affect the PPPs performance negatively.

As regards *infrastructural problems*, to empirically use **cell array 13**, the respondents were queried regarding the sufficiency of high-quality human resources supply and regional business growth. IPR regulation was taken as a ‘proxy’ for **cell array 14**. Information sharing is an essential component of successful completion of designed research and partner’s motivation to enter into partnership in the first place. As a ‘proxy’ for **cell array 15**, the interviewees were asked to describe how PPP’s cooperation helps stakeholders to explore new venues for innovation i.e. market trends and emerging innovation opportunities. Finally, to operationalize **cell array 16**, the respondents were asked about the availability of research facilities in the framework of PPP cooperation.

Empirical research also relies on secondary data i.e. independent evaluation reports, legislative documentation and other written material to supplement information gained through interviews.

Matrix 2: comparative matrix with ‘proxies’ used

| Systemic problems/ Proximity forms | <i>Actors problems</i> | <i>Interaction problems</i> | <i>Institutional problems</i> | <i>Infrastructural problems</i> |
|---|--|--|---|---|
| <i>Cognitive</i> | (1) Variety of expertise | (5) Learning practices & their significance | (9) Consensus achievement | (13) Qualified human resources & regional business growth |
| <i>Organizational</i> | (2) Differences between public & private management strategies | (6) Dominance & power relations between partners | (10) Benefits of joint strategic planning | (14) IPR regulation |
| <i>Social</i> | (3) Role of trust & interpersonal context | (7) Inter-sectoral mobility | (11) Incompatible social values | (15) Market trends and emerging innovation opportunities |
| <i>Geographical</i> | (4) & (8) Rigidity of collaborative focus: local & international | | (12) Regional institutional framework | (16) Availability of research facilities |

4. Empirical findings

This section illustrates how well PPPs embrace proximity dimensions with regard to four groups of systemic failures/problems discussed in section *iii* in the six cases discussed in previous sections³.

Actors' Problems

The findings indicate that PPPs initially facilitate *cognitive proximity* between public and private-sector stakeholders. Generally, the scope of PPP mode of cooperation allows taking in a wide range of expertise and complementary skills to enable creative brainstorming necessary for innovation development and maximize positive synergies between public and private knowledge systems aiming at generating a collaborative advantage. Yet competence potential significantly varies among partners and across cases. In a majority of cases (e.g. KCFP, FL, MV, CASTT), large-sized companies are generally endowed with a variety of knowledge and competences as well as a long record of good collaboration practices with the university in terms of technology research and business operations; whereas small and medium-sized businesses often lack basic competences (e.g. employees holding a PhD degree) and terminology needed to perform adequate levels of R&D therefore requiring more tight collaboration with research organizations.

The results also show that by and large PPPs fail to sufficiently stimulate *organizational proximity* between public and private partners. In all selected cases, a large amount of PPP's actors' heterogeneity vividly discloses two contrasting management logics that differ in terms of bureaucracy, rigidity and autonomy in the decision-making process since they are controlled by different 'forces' i.e. political and economic respectively. For instance, public sector actors, namely governments or governmental agencies, are usually more redundant and risk-averse than their private sector counterparts whereas private partners are more short-term-oriented compared with their public counterparts (e.g. KCFP, MV, CASTT). Furthermore, the internal organizational characteristics of PPP's stakeholders vary significantly even within the same sector as some partners are more research-oriented and have better understanding of an academic approach whereas others are more product-oriented focusing predominantly on efficiency of new product development (e.g. SoS). Additionally, as the case of Medicon Valley illustrates, partners also face international differences in

³ Potential variations with respect to regional and sectoral/industrial attributes are discussed in section 5.

research culture e.g. often research institutions outside the cluster lack collaborative practices in project development and implementation, focusing instead on selling research projects to private companies. As one interviewee on MV cooperation stated '[...] *they [auth. university researchers] have never seen it before. They did not expect a company to have such an open collaboration*' (personal communication, 4 September 2013).

In all cases that were selected for analysis, PPPs appear as a catalyst for promoting *social closeness* between partners. Both public and private partners seem to agree that effective interpersonal communication and trust-based relationship among agents promote win-win situations and stimulate confidential information sharing within the framework of PPP. For instance, one interviewee highlights the importance of trust and social relations in the following way 'we [auth. industrial and academic partners working under the framework of a PPP] *know each other personally and that means I can tell them things in confidence and I know that they will not abuse that. So, the personal networking is important*' (personal communication, 3 September 2013).

Empirical analysis shows that PPPs noticeably stimulate *geographical proximity* between participating stakeholders by allowing them to gain external network access as well as to strengthen local links and exploit opportunities for synergies. In a majority of cases, PPPs maintain strong collaborative ties with international research groups but also support local level interaction. Particularly industries drawing on a synthetic knowledge base (i.e. ICT and automotive sectors) depend on a set of strategic networking offered by a PPP mode of cooperation as they require applied and problem-related expertise for innovation processes. For instance, FL have adopted an open interaction strategy with external potential partners e.g. Stanford University (Vinnova Report 2009) but at the same time it assists the local companies considerably in introducing new technologies and working methods. Partners within SoS, however, seem to favor regional research collaborations over international ones, which can be partially attributed to strong personal links with the local university. Life science cases (i.e. BU and MV) appear to require significant external force and expertise pooling to push forward innovation breakthroughs (more radical innovations, which are typical for industries drawing on an analytical knowledge base). '*Life science requires a lot of cooperation; both within the research group and with other research groups all over the world. And also more or less with business community. You need to put everything together*' (personal communication, 31 May 2013). Another respondent added '[...] *if we are looking*

for the causes of Alzheimer disease and we are interested in a particular area within that field, so we know that best groups in the world are sitting outside New York and we would like to collaborate with them. [...] But it does not mean we do not have local collaborations' (personal communication, 4 September 2013). In this context, the volume and variety of knowledge exchange between public and private partners strongly depends on effective application of technology for distributed collaboration (e.g. FL, CASTT).

Interaction Problems

The analysis shows that all cases of PPP (due to their non-for-profit nature) initially stimulate *cognitive proximity* between partners. Public and private stakeholders undertake regular sessions that stimulate knowledge exchange although these activities do not always lead to innovation output (e.g. BU, MV, CASTT). Private partners of CASTT, SoS, KCFP and FL strongly rely on interaction with customers and suppliers/vendors in order to obtain essential knowledge resources; hence, in this context, PPPs serve as a back-up unit for partners by assisting the companies to build up the professional network and gain access to an extensive range of essential expertise. BU and MV act as catalysts for creative thinking among stakeholders, needed to obtain new ideas for products and technologies that will eventually provide robust and steady profit.

Findings also indicate that PPPs generally facilitate *organizational proximity* as in the majority of cases; there is no power asymmetries vividly displayed within the framework of a partnership. BU and KCFP constitute a small exception, however. In the case of BU, significant power-weight towards the interests of two dominant public actors namely Umeå University and Umeå municipality (which are main financiers) does not actually affect the intensity of current cooperation yet in the long run it might result in undervaluing cooperative efforts. In the case of KCFP, heterogeneity of partners' resource potential, places large stakeholders like Scania and Volvo in more dominant position in the partnership, as the Center strongly depends on their funding, *'therefore they have a vote proportional to how much money they invest'* (personal communication, 2 May 2013).

PPPs also stimulate *social proximity* by encouraging inter-sectoral mobility of research staff. In most cases, PPPs enable social networking via industrial PhDs, temporality staff exchanges, part-time positions etc. that facilitates expertise sharing and cross-fertilization of innovative ideas between public and industrial stakeholders (e.g. KCFP, FL, MV, SoS). In

cases where the industrial base is composed predominantly of SMEs (e.g. BU, CASTT), ‘research mobility’ is rather low due to financial challenges; although SMEs have sufficient potential to assist in identification and implementation of relevant projects.

Due to a strong empirical overlap between actors’ and interaction systemic failures, *geographical proximity* is discussed at the intercession of these two groups of problems (see ‘Actors’ Problems’ above). By and large, PPPs stimulates both external and local links between existing and potential partners; yet given the advancement of communication technology that enables cooperation at the large distances (e.g. FL, CASTT), spatial closeness becomes a rather relative notion.

Institutional Problems

To a varying extent, PPPs enable *cognitive proximity* by enhancing both formal and informal linkages among partners that may potentially help to resolve straddling communication issues and create value. In some cases e.g. FL, SoS, PPP’s form of collaboration permits the partners to reach a comfort level with their multiple perspectives and business goals resulting in an ability to agree on project focus areas and attract new resources through the partnership. They do it by ensuring that *‘research is pre-commercial and does not involve product development yet; and it needs further work before that can happen. This ‘further work’ is then done by the companies independently if they want to pursue a certain research direction’* (personal communication, 3 September 2013). In other cases e.g. MV, KCFP, and CASTT it is more difficult to lessen inter-sectoral differences and reach mutual agreement. In the case of MV for instance, the large pharmaceutical enterprises require major scientific breakthroughs for efficient business operation whereas small biotech companies focus predominantly on systematic technological exploitation to bring capital interests into their business activities. In the case of BU, the scope of public-private cooperation does not provide enough room for developing a common ground for action and creating solutions that transcends sectoral boundaries (given that participating companies are not committed partners of BU and have no executive power in influencing cluster decisions).

Findings also show that PPPs strongly encourage *organizational proximity* by enabling the detailed articulation of partners’ operational requirements in identifying the short and long-term R&D needs towards priority areas. In all cases, both public and private stakeholders exert significant influence over strategy and vision building with the aim to ensure

organizational efficiency, maximize resources and emerging opportunities, reduce costs and increase returns on investment. BU constitutes an exception and in the long run might be exposed to some risk if it fails to respond to new opportunities timely and ensure tangible impact of cooperative efforts (as private stakeholders are not involved in strategy and vision development).

Allowing for a legally binding and cost-sharing form of cooperation, all participating stakeholders are compelled to regard the relational norms of all stakeholders, promoting thereby social cohesion within the partnership (e.g. SoS, CASTT, FL, KCFP). This implies that all selected PPP cases significantly stimulate *social proximity*. One interviewee on cooperation in KCFP said ‘*you need to make a lot of compromises and eventually all people may be a bit happy ...at least. Not perfectly happy but good enough. But if it is cost-share type of organization you have to accept that ...*’ (personal communication, 23 April 2013). Again in the case of BU, uncommitted status of private stakeholders and obvious dominance of public partners in decision making averts major conflict over incompatible social norms.

The results reveal that PPPs stimulate *geographical proximity* by influencing institutional framework of the local government to ensure proper conditions for cooperation and economic growth. All PPP cases selected from the core region reported favorable institutional environments that facilitate cooperation and innovation creation in the region (e.g. KCFP, SoS, MV). For instance, given that personal health and life science are key areas of Sydsverige’s regional policy, municipal and regional public authorities provide a lot of support to ensure balance between public research investment and business development. Övre Norrland has well-established institutional setting entailing public and semi-public support agencies at all governmental levels (Jones & Woods 2011); despite that, however, BU, FL and CASTT have to cope with excessive bureaucratic regulations and lack of understanding from the side of financiers i.e. the ‘younger’ institution is the more bureaucratic burden it places on the PPP.

Infrastructural Problems

All PPPs strongly facilitate *cognitive proximity* between stakeholders by supplying high-quality human resources in a multidisciplinary research field to increase the chances of a successful collaborative outcome. Allowing for the importance of scientific knowledge in industries drawing on an analytical knowledge base, PPP cases emanating from life science

sector have particularly strong demand for qualified human resources staff. Within BU, for instance, 1100 people are involved in R&D in the life science cluster representing more than ½ of total employment; whereas in MV approximately 10, 000 people are reported to be allocated in R&D activities constituting ¼ of the total employment (European Commission 2011). In addition, availability of skilled professionals in the region enhanced through personal professional networking facilitates quick ‘internal’ search of necessary expertise to solve abrupt technical problems (e.g. SoS).

In all PPP cases *organizational proximity* is significantly facilitated by the presence of strong controlling mechanisms like IPRs. The patent system is particularly important in cases when PPPs entail a large number of small research spin-offs (e.g. BU) since it allows them to safeguard their ‘survival’ in an international environment with large-sized companies that have substantially more resources than they do. Generally, IPR-related issues are specified and regulated by the partnership agreement stating that either all stakeholders share a right jointly (e.g. SoS, FL) or they are assigned solely to the main financier (e.g. CASTT, KCFP). Considering that knowledge processes are more formally organized in industries drawing on an analytical knowledge base i.e. life science, and their research activities are continuously improving in an attempt to develop innovative breakthroughs, efficient functioning of the IP system is particularly important in this field (although 99% of patents never become sellable drugs (personal communication, 4 September 2013)). Cross-border partnership i.e. MV discloses certain differences. For instance, Sweden practices teacher’s exemptions entailing full ownership of research results by a researcher if other agreement has not been reached; whereas in Denmark, intellectual ownership of the research outcome vests with the university. Normally, however, general partnership agreements set out the full terms of IPR regulation between the companies and the universities within MV.

The findings reveal varying degrees of PPPs’ ability to stimulate *social proximity* between public and private partners. In a majority of cases (e.g. FL, KCFP, SoS, CASTT), stakeholders gain a lot from participation in PPP projects namely better understanding of emerging changes, technological developments and business interaction necessary to capture value from innovative technologies and solutions. BU seems to constitute an exception since it merely provides information on collaboration and funding opportunities.

Finally, all PPPs strongly facilitate *geographical proximity* between partners. By providing access to high-quality research facilities, PPPs serve as hub for excellent research and know-how not available for individual agents (e.g. CASTT, FL, BU, KCFP). For instance, high-quality research facilities like the Experimental Studio (FL), ESS and Max Lab IV (MV) attract potential strategic partners and scientists.

5. Discussion and conclusion

This paper sought to link forms of proximity with systemic problems of regional innovation policy and illustrate how effective are PPPs' in this context. The analysis reveals a generally high potential of PPPs to facilitate proximity forms essential to address all types of systemic failures. The intensity of *cognitive links* is particularly enhanced by PPPs in addressing actors', interaction and infrastructural gaps of innovation system, partly as a result of heterogeneity and interface regularity associated with innovation processes. Diversity of knowledge sources and systemic interactions between stakeholders creates a trade-off between the novelty value and knowledge transfer. On the one hand, PPPs increase access to novel and non-redundant knowledge that facilitate learning; on the other hand, however, they decrease communication efficiency necessary for an effective knowledge sharing. Diversity fosters adaptability and creativity by allowing the coexistence of various competence levels; however, often it might result (on a cognitive level) in opposing and inharmonious perceptions and goals making even minimal 'unification' impossible (Grabher & Stark 1997) (this also explains why a cognitive dimension is not clearly manifested in the category of institutional systemic problems). New knowledge and innovation arise through the interaction of diverse actors, therefore cognitive proximity can be regarded as an essential condition for cooperation and learning. PPPs evidently facilitate *organizational proximity* between innovation agents in tackling interaction (by and large), institutional and infrastructural groups of systemic problems. PPP's organizational practices reflected in the rate of autonomy and degree of control that can be exerted facilitates coordination of intended and unintended knowledge flows. Further, PPPs increase the intensity of *social linkages* between actors in addressing actors', interaction (depends on industrial composition of a PPP) and institutional systemic failures. PPP mode of cooperation generally involves the modification of partners' value systems, affects the openness of stakeholders to new experiences and shapes the patterns of dealing with innovation. Informal relationships among heterogeneous actors serve as a 'knowledge and expertise depot', providing access to the resources embedded in social

networks. Finally, PPPs enhance *geographical closeness* between innovation agents in dealing with actors', interaction and infrastructural systemic problems. However, knowledge-based interaction transcends spatial borders and can easily be substituted by temporal geographical proximity. PPPs that have external partners (as in all six cases studied) create greater value by linking regional economies to wider sources of innovation, markets etc.

Although in general the paper does not reveal a clear pattern of regional or sectoral variations with respect to proximity dimensions and types of systemic problems, certain regularities can still be observed. As regards ***actors' systemic problems***, the strength of cognitive linkages between public and private partners seem to depend on the regional context a PPP operates in and can be explained by economic and technological discrepancy between Övre Norrland and Sydsverige. Having higher proportions of skilled and complementing labor force locally available backed by resources and support of networking, provides a better 'head-start' for PPPs from Sydsverige. Övre Norrland, in contrast, has been struggling to reach a sufficient critical mass for effective innovation generation and exploitation due to its remote location. However, this only reflects the presence and not capability/or quality component of the actors involved. All PPPs failed to derive potential benefits from mutual management development by stimulating more *organizational proximity*. *Social closeness* among PPPs stakeholders seem to be related to sectoral/industrial differences. The need for trust arises from partners' interdependence, which is built on mutual self-interest (Bevir 2011); and cumulative nature of knowledge increases such interdependence between agents (e.g. ICT and life science) which in its turn requires a high degree of trust in the validity of research findings performed by other scientists (Hesse-Biber & Leavy 2011). At the same time, however, it is difficult to claim that trust always generates reciprocity. As regards *geographical proximity*, combining internal and external sources of knowledge under the framework of joint collaboration should potentially reveal significant variations in terms of partners' openness and technological interdependence based on the specific industry context they operate in. However, considering that the stakeholders from selected PPPs are all integrated into a highly innovative setting i.e. ICT, life science and automotive manufacturing, these differences are not clearly exhibited.

Interaction systemic problems. The strength of *cognitive proximity* among public and private partners seems to depend on the specific industry context in which PPPs operate. ICT and automotive manufacturing sectors strongly depend on knowledge sources obtained through networking with suppliers and customers whereas life science industries rely mostly on close

cooperation with scientific institutions, often obtained through non-localized interactions. Given organizational structure of a PPP constellation, *organizational proximity* does not seem to depend on either regional or sectoral attributes. Despite adherence to different management logics, public and private partners within the PPP seem to avoid the high risk of asymmetric power relations by focusing on complementary properties of partners. Regional context seem to influence the intensity of *social links* among partners. The absence of a strong industrial base (dominated predominantly by SMEs)⁴ and rather limited venture capital inflow to Övre Norrland considerably restricts the scope of inter-sectoral mobility.

Institutional systemic problems. Given different organizational structures of PPPs in ICT, life science and automotive industries, the strength of cognitive linkages among public and private actors vary across sectors. Rigid configuration of public-private cooperation combined with rather short product development processes in the ICT sector eases information flow and enables open communication and transparency. In contrast, the automotive industry and life science are characterized by flexible organizational structures and sufficiently longer product development processes that limits free and open exchange of information due to secrecy and competitiveness issue. *Organizational* and *social* forms of proximity are equally facilitated in all cases. Organizational structures of PPPs allows the involvement of multiple expertise and experience where influence and power is equally distributed among the stakeholders through joint planning and decision-making e.g. cooperation objectives, accountability and management of assets. The relevance of *geographical links* between public and private partners seems to depend on regional settings of PPPs since inadequate institutional capacity decelerates innovation and results achievement in the peripheral region (i.e. Övre Norrland).

Infrastructural problems. Given the science-based nature of selected sectors, *cognitive proximity* between public and private partners is equally relevant in all six cases. However, the continuous technological and scientific advances in life science and ICT should potentially require greater breadth of existing expertise and new knowledge generated through technological breakthroughs. Furthermore, given the absence of sufficient support mechanisms to stimulate innovative entrepreneurial activity in Övre Norrland (e.g. the presence of a large company as a seedbed for new firms), the region exposes itself to a potential risk of ‘brain drain’ to more developed regions of Sweden, thus becoming exporters

⁴ According to European Regional Scoreboard (2006), Övre Norrland's ranks 46 among EU regions with RRSII = 0, 57 compared to Sydsverige ranking 8 with RRSII = 0, 76.

of highly-educated and ready-trained workforce. PPPs stimulate *organizational proximity* differently across cases, which is most likely to be attributed to specific industry contexts PPPs operate in. Patenting seems to be particularly important for life science companies. It protects specific discoveries and the target markets, but also attracts venture capital so as to safeguard the entire product development process covering multiple test phases. Patenting is of less importance to the ICT and automotive industries since they tend to use trade secrets and long time leads to protect their IPR. Large companies that use ‘patent portfolio’ to remove or challenge the key competitors on the market seem to get most economic value from IPR (e.g. in the ICT industry any infringement by the competitor might result in a patent pooling or reciprocal/cross-licensing among the major ICT competitors, leaving new entrants out of the market). Consequently, giving universities exclusive rights to research will have little effect and may inhibit commercial exploitation of publicly funded research and information flow between universities and enterprises (Wessner 2001: 40). *Social proximity* seems to be manifested in PPPs also based on sectoral rather than regional differences. For instance, collaboration within BU and MV is not a source of market information for partners involved because usually life science companies need to plan the entire life cycle for each potential product requiring enormous amounts of working capital, resources and strategic partnerships (often with the partners outside the cluster). The ICT and automotive industries especially benefit from a PPP mode of cooperation, which help them to expand their collaboration in downstream product markets, considering that these sectors are in a state of continuous technological and economic fluctuation driven by intense competition and new technologies. Finally, all PPPs strongly facilitate *geographical proximity* by bringing innovation cooperation closer to universities and research institutions and providing high-quality research infrastructure necessary for successful generation and exploitation of innovation.

This paper demonstrated how proximity dimensions relate to systemic problems of regional innovation policy and how effective PPPs are in stimulating various forms of proximity in this context. As this analysis concentrates on three industries – all of them being research intensive – further research should extend the scope of sectors by including industries in which activities are not as strongly driven by research and scientific progress. While this paper concludes that PPPs can have an impact on systemic problems of regional innovation policy via influencing the proximity relations between agents this conclusion is only a first step on the path to exploit if PPPs are actually successful elements of regional innovation policy. For

this purpose further research on the analysis of “success” of PPP-based collaboration in regional innovation policy is needed.

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