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Innovation capacity in the public sector: Structures, networks and leadership

LIPSE Project Working Paper No 3

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Abstract:
Innovation in the public sector has become an important focus for governments around the world over the last decade, helping to frame issues and priorities within the public sectors of many developed countries. An amplified focus on innovation in the public sector has created a need to understand the innovation capacity of public organizations. Innovation is defined as: *"the process from ideas to successful implementation of these, which makes a substantial difference to an organization's understanding of the needs it is addressing and the services it delivers."* This paper examines the innovation capacity of municipal governments, by examining their innovation environments - governance structures, social networks, and leadership qualities. An empirical study of this has been recently completed, through a survey of politicians and senior administrators in Denmark (Copenhagen), the Netherlands (Rotterdam), Spain (Barcelona), and Scotland (West Lothian, which borders Edinburgh). This paper analyses the data for Copenhagen.

The aim of this paper is to establish a framework for the comparative analysis of the four cases (municipalities), which will link innovation environments (governance structures, social networks and leadership qualities) to innovation capacity and innovativeness. It begins with a discussion of innovation, and then describes the governance structures in each nation and the 'innovativeness' of the four nations and cities. It explores the theoretical importance of social network concepts and leadership dimensions to innovation, and provides an overview of the relationship between structures, networks and leadership and innovation capacity. The analysis provided for the single city of Copenhagen, outlines the framework for the future comparative analysis.

Introduction

Innovation in the public sector has become an important focus for governments around the world over the last decade, as they try to solve intractable policy problems. The pressure on governments to do more with less in response to shrinking budgets and expanding community expectations and obligations has led to a much greater focus upon how the public sector manages change and innovation (Bartlett and Dibben 2002). This heightened focus has created a need to understand the innovation capacity of public sector environments. What organizational elements either open up or close down pathways for innovation in a public sector context?

Innovation means producing something new; that is; doing things differently or in a new form. Looking at the concept in a historical perspective it is an economic phenomenon – meaning new ways of producing more for less. It is the process of invention; whether that is a product, a technology, a service, a new type of production, a new process or a new form of collaboration. It dates back to Adam Smith even though it is Schumpeter (1934) who usually takes credit for the idea of 'creative destruction'. Innovation is defined here as: *"the process from ideas to successful implementation of these, which makes a substantial difference to an organization's understanding of the needs it is addressing and the services it delivers."*

Hence, innovation is seen as the process of bringing in something new that breaks with existing practice and routines. Skills that have obtained some type of routine and practice are what defines capabilities (Barney 2001), therefore innovation challenges an organization's accumulated capabilities according to Osborne and Brown (2011), who call it 'a transformative discontinuity with existing practices'. This specific feature of innovation has often been referred to as a competency struggle between path creation versus path dependency (Garud and Karnøe, 2001) or as Thelen (2002: 224) says, it is a 'game changer' which breaks through path dependencies (Voorberg et al 2013).

Public organizations are often referred to as institutionalised in the innovation literature and characterized by having a long history of routinisation and path dependency. Furthermore, they are usually equated with the formal hierarchical structures of Weberian bureaucracy. Much of the debate has been on the role of government (including municipal government) in boosting the innovation capacity of the private sector; it has been on public procurement, subsidies and taxes (exogenous factors) and less on the formal public organization itself (endogenous factors). More recently, networks (in contrast to formal and hierarchical structures) have been the focus of research on public sector innovation (Osborne 2010; Lewis, Considine and Alexander 2011).

The aim of this paper is to establish a framework for a comparative analysis of four cases (municipalities), which will link innovation environments (governance structures, social networks and leadership qualities) to innovation capacity and innovativeness. More specifically, the focus is on 'social innovation', defined as innovation that is related to creating new services that have value for stakeholders (such as citizens) in terms of the social and political outcomes they produce. The paper presents a framework and some initial hypotheses that will guide the comparative analysis. The four municipalities that will be compared are Denmark (Copenhagen), the Netherlands (Rotterdam), Spain (Barcelona), and Scotland (West Lothian, which borders Edinburgh).

Governance structures

The innovation capacity of any public sector organization is related to the environment within which it is located. Therefore, an important first set of considerations is the formal structures within which each municipality is located. What kind of governance structures have an impact on social innovation?

These include the political and administrative context, the legal culture of the public sector, state and governance traditions, and resource arrangements. These characteristics can either function as a trigger for innovation or as constraining it. Based on an analysis of the literature, Bekkers et al (2013) found that the following aspects of the environment could function as important drivers and barriers of innovation:

1. The social and political complexity of the environment in which public organizations operate which leads to specific demands that function as an external 'trigger' for innovation
2. The characteristics and degree of the legal culture in a country or policy sector, which shapes the level of formalisation and standardisation and the degree of rule-driven behaviour
3. The type of governance and state tradition in a country or policy sector, which affects the amount of discretion that public sector organizations have to explore and implement new ideas
4. The allocation of resources, resource dependency and the quality of relationships between different (public and private) organizations at different levels, which all have an impact on how well innovation practices are supported.

More specifically, the formal structures that have been previously identified as being positively and negatively related to innovation capacity (Bekkers et al 2013) are political and administrative triggers such as crises and competition (positive effect), a strong formalized, centralized, rule-bound and silo-bound legal culture (negative effect), and a decentralized state, corporatist governance traditions, and strong civil society (positive effect).

The four cities in this study reflect different geographical areas and varying state and society traditions, which are likely to influence their innovation environments. A comparison of the strength of local government and the innovativeness score for each of the nations included in this study is shown in Table 1. The innovation score is based on 25 indicators of human resources, research systems, R&D expenditure, investment, entrepreneurship and intellectual assets, innovators and economic effects. It is essentially a knowledge economy measure, created by the European Commission and as all such indicators, should be treated with a good deal of caution. This particular indicator appears to reflect the relative strength of each nation's economy. The strength of local government is based on an assessment by Loughlin and Peters (1997) and Pollitt and Bouckaert (2011).

Table 1: Strength of local government and innovation in countries in the study

Country	**Strength of local government**	**Innovation Union score 2013**
Scotland	Strong central government	.613 (UK)
The Netherlands	Moderately strong local government	.629
Denmark	Moderately strong local government	.728
Spain	Strong local governments	.414

Sources: Loughlin and Peters 1997; Pollitt and Bouckaert 2011; European Commission Innovation Union Scoreboard
< http://ec.europa.eu/enterprise/policies/innovation/facts-figures-analysis/innovation-scoreboard/index_en.htm>

Scotland has the strongest central government (weakest local government) of these four nations, while Spain has the strongest local governments, and the other two nations lie in between with moderately strong local governments. Denmark is the 'most innovative' based on this index, while the Netherlands and Scotland are quite close together and lower than Denmark, and Spain is substantially lower than the other three cities. There is no clear relationship based on this very simplified assessment of strength of local government and innovativeness.

Table 2: Innovation cities index for cities in the study

City	**Innovation city score**	**Rank in the world**	**Classification (on a 5 point scale)**
Copenhagen, Denmark	56	9	1 – NEXUS: Critical nexus for multiple economic and social innovation segments
Barcelona, Spain	48	56	2 – HUB: Dominance or influence on key economic and social innovation segments , based on global trends
Edinburgh, Scotland	47	66	2 - HUB: Dominance or influence on key economic and social innovation segments , based on global trends
Rotterdam, The Netherlands	47	71	2 - HUB: Dominance or influence on key economic and social innovation segments , based on global trends

Source: Innovation Cities 2014 Index by 2thinknow <http://www.innovation-cities.com/indexes>

A different innovation index which ranks the potential of cities as innovation economies, is shown in Table 2 for the four cities. There are 445 cities compared in this index, and the analysis is based on the

potential for creation, implementation and communication of ideas in urban economies. It is calculated using 162 indicators across 31 segments and the three factors of cultural assets, human infrastructure, and networked markets. Hence, it has a much broader scope than the EC measure. Most of the things included within it are not directly related to government. This has a large impact on the place of Barcelona, which moves from fourth position out of four in regard to the EC national measure, to second on this city measure. In the comparison in Table 2, Copenhagen again stands out as first and is scored quite a bit higher than the other three which are very similarly ranked and scored. Edinburgh is used as a proxy for West Lothian since this is not included in this index.

Before concluding this section, it should be reiterated that both the information on governance structures within nations and the strength of local government, as well as national and city-level indicators of 'innovativeness' are quite broad and very imperfect measures. They suggest that Copenhagen might be 'more innovative', as it scores highest of the four on both of these simple indexes. This provides some information on the local context that helps frame the innovation capacity of municipalities.

Social networks and innovation

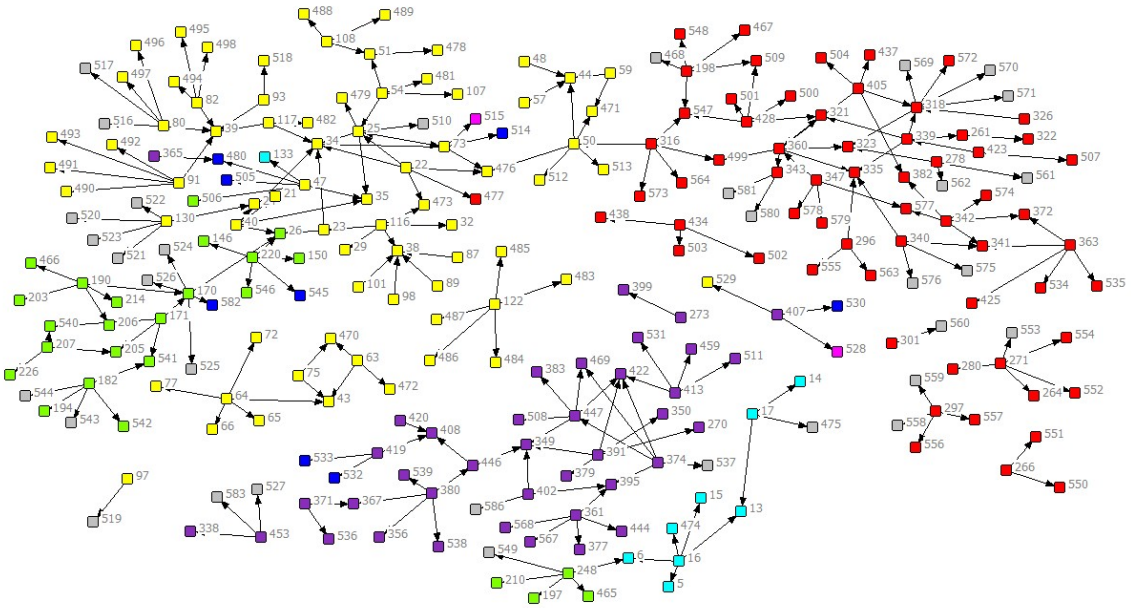
Innovation capacity is expected to be linked not only to contextual factors such as those discussed above, but also to informal social structures. Social networks based on interpersonal communication, generate embedded resources such as social capital and trust relations. The importance of networks in facilitating innovation and shaping innovation pathways at the organizational, sectoral and national level has long been recognised within the private sector innovation literature (see: Lundvall 1992; Nelson 1993; Conway 1995; Jones, Conway and Steward 1998; Jones and Beckinsale 1999; Love 1999). Huijboom (2010) has shown in a cross-country case-analysis of the innovation in electronic identification data management systems, and based on a combination of social capital and advocacy coalition framework theories, that the characteristics of the actors involved (e.g. expertise and position), their ties (strength and levels of trust) and networks (closure, heterogeneity and brokerage) generate certain network dynamics which affect innovation strategy, decision, output and impact.

Relationships have also been acknowledged as important in the public sector literature: The innovative capacity of local governments has been linked to the presence of strong internal and external networks (Newman, Raine and Skelcher 2001). Network governance describes (and sometimes attempts to prescribe) how policy-making and governance occurs in contemporary societies where governing conditions are fragmented, complex and multi-level (Lewis 2011). The type of networks of interest here are social networks. They are fundamentally based on social connections between individuals, and hence they consist of a set of nodes (people) connected to other nodes by interpersonal ties of some kind (e.g. friendship, work relationships, advice seeking).

Such a network is shown in Figure 1. This is a network map of all the interpersonal connections reported by those who participated in the study in Copenhagen, in relation to who they go to for strategic information (see further information in the methods section on this). Each dot is a person, and the lines are nominations of relationships (ties) between people. The direction of the nomination is shown by the arrowhead – as an example, in the bottom left hand side of the map, person 97 nominates person 519 as someone they seek strategic information from. In network studies, it is

generally not possible to map the entirety of a network, and indeed it is often difficult to know where a particular network finishes. Sampling of individuals (egos) who nominate those they are connected to (alters) is used to obtain a view of the network. The maps in this paper were produced using Netdraw (Borgatti 2002).

Figure 1: Copenhagen strategic information network



- Healthcare
- Children and Youth
- Social Services
- Others i.e. IT and External
- Employment and Integration
- Culture and Leisure
- Finance
- Environment and Technical

Social networks are expected to play a key role in shaping the innovative capacity of governments, as they are a prime means to facilitate information exchange and hence, to diffuse innovative ideas and practices. A social network analysis based approach has been applied to address innovation in the public sector in a research project that shows how informal networks contribute to an explanation of innovation inside government (see: Alexander, Considine and Lewis 2011; Considine and Lewis 2007; Considine, Lewis and Alexander 2009; Lewis, Considine and Alexander 2011;Lewis, Alexander and Considine 2013). This study found that how you conceive of innovation, what formal position you hold, and who you communicate with, are all significant in shaping whether you are regarded as an innovator. Significantly, network relationships are the most important predictors of innovator status.

Innovation often takes place in the interstices. It occurs in the spaces between the formal structures, although governance structures shape and constrain opportunities for informal interactions and innovation capacity. Having spaces where individuals can meet each other without the burden of formal responsibilities, positions and rules is seen as crucial to innovation (Nooteboom 2006; Considine, Lewis and Alexander 2009; Lewis, Considine and Alexander 2011; Van der Voort 2011).

In short, previous research on social networks in municipal governments provides solid evidence that they are crucially important to innovation. In the remainder of this section, a number of concepts from social network theory that are regarded as important for innovation and capacity building are introduced. These are centrality, the strength of weak ties, structural holes, social capital and trust.

Centrality

Network centrality is a crucial network concept, and there are different types of centrality that are relevant here. In-degree centrality is a measure of the importance or prestige of individuals, as it rests on the number of direct nominations they have received from others (Wasserman and Faust 1994). Betweenness centrality is a measure of which actors are positioned between other actors who are not directly connected (Wasserman and Faust 1994). These actors are important in relation to innovation (which relies on openness and variety), and entrepreneurs are often regarded as being interested in seeking and benefiting from brokerage positions (Boari and Riboldazzi 2014; Burt 1992) which are associated with having a high level of betweenness. Finally, closeness centrality measures how close an actor is to all the other actors in a network. Actors with high closeness centrality can quickly interact with others and need not rely on others to relay information (Wasserman and Faust 1994). Hence they can distribute information more efficiently than those with longer paths through more connections.

Previous studies of innovation networks in municipal governments have shown that in-degree centrality is related to hierarchical seniority, and that innovators who are more adept at working through relationships outside formal structures are more able to get things done (Considine, Lewis and Alexander 2009; Lewis, Considine and Alexander 2011). Further, being central in strategic information networks seems to more important than being central in advice networks to innovator status (Considine and Lewis 2007).

The strength of weak ties

Mutual dependency indicates something about the connectedness of the actors in a network: the positions that these actors take in the network and the 'ties' that connect them. This issue has been most famously addressed in terms of 'strong' and 'weak' ties (Granovetter 1973), or considerations of homophily and heterophily (McPherson and Smith-Lovin 1987). Strong and close (homophilous) ties imply that actors know each other very well, which can generate the trust that is necessary for the exchange and sharing of resources. Trust is often seen to be an asset of a network, and a necessary condition for innovation. But weak (heterophilous) ties provide access to different resources. These are often seen as important to innovation as they allow actors to break out of the 'groupthink' that can occur in situations where everyone is similar and tightly bound into closed networks (Lewis 2010).

Innovation is alleged to emerge in environments where there is high openness and variety. Openness and diversity are hard to manage, and diversity (heterophily) might be hard to achieve within an organization or an organizational network that is rather homogeneous (Rogers 2003; Mulgan 2009; Bason 2010; Koppenjan & Klijn, 2004). Hence, managing innovation is especially related to the creation of organizational slack - safe havens and informal spaces. Openness refers to the free flow of ideas, knowledge and experiences, in an informal space with few restrictions on developing new and creative ideas (Foldy, 2004). It is linked to the availability of a variety of perspectives, related to the degree of heterophily amongst the actors involved, and to the embedded resources that can be accessed through networks, like social capital.

Structural holes

Burt (1992) labelled specific network configurations, where actors have opportunities to act as brokers between unconnected others by dint of their network position, 'structural holes'. This gives an actor the ability to be a *tertius gaudens* (a third party that benefits) and to use this position to play one competitor off against the other, as long as the two others are not directly connected. Redundancy is a measure of the diversity of network ties. If an actor has many ties that provide the same information, they have a high level of redundancy in their network, and this is regarded as inefficient since the same information could have been gained from a smaller number of contacts (Burt 2005). Effective size is a second measure related to the brokerage potential held by certain individuals in networks: It is the number of alters that ego has, minus the average number of ties that each alter has to other alters. In other words, it is ego's network size, reduced by its redundancy (Burt 1992).

It is not clear what combination of strong and weak ties, structural holes, and a variety of other network brokerage concepts, offer greater opportunities for innovation (Powell and Grodall 2005). Ahuja (2000) argues that the relationship between innovation capacity and network structure is contingent on personal relationships, and that what constitutes an enabling social structure for one specific type of action may well be disabling for others. Thus, the form taken by social capital is likely to be contingent on what actors seek to enable through it (Ahuja 2000: 452).

Social capital and trust

Social capital is an embedded resource that is created through ties between people within networks: While individuals can hold financial capital and human capital, social capital is only

generated by connections with other people. The notion of trust is often related to social capital and they are both often mentioned as factors that influence innovation (Walker 2008; Lewis 2010). However, it is important to separate distinct network configurations from the assumed values, emotions and actions arising from these.

Network structures provide the potential for individuals to exploit the opportunities associated with their own positions within these. However, two important authors with very different views on social capital are Ron Burt and James Coleman. Burt claims that social capital is a metaphor for social structure, defining a form of capital that generates advantages for some individuals and groups (Burt 2005). His focus is on the competitive advantage to be gained if you are the link between otherwise unconnected actors or groups (structural holes) and so can access different resources. In contrast, Coleman (1988) emphasized closure and density in networks to provide support and resources. This reflects their different orientations to the subject - Burt was interested in bridging and loose networks as providing opportunities for entrepreneurs, while Coleman was interested in the cohesion of family support and its link to educational attainment.

A pictorial version of these two different ego-network structures (where ego is the person in the centre of these maps) can be seen in Figure 2. The left hand map is in line with Burt's structural hole view of ego as the broker who is able to achieve his/her goals by accessing diverse information that others do not have. The map on the right represents Coleman's cohesive model, where almost everyone is directly connected to everyone else and not just to ego, so there is high redundancy.

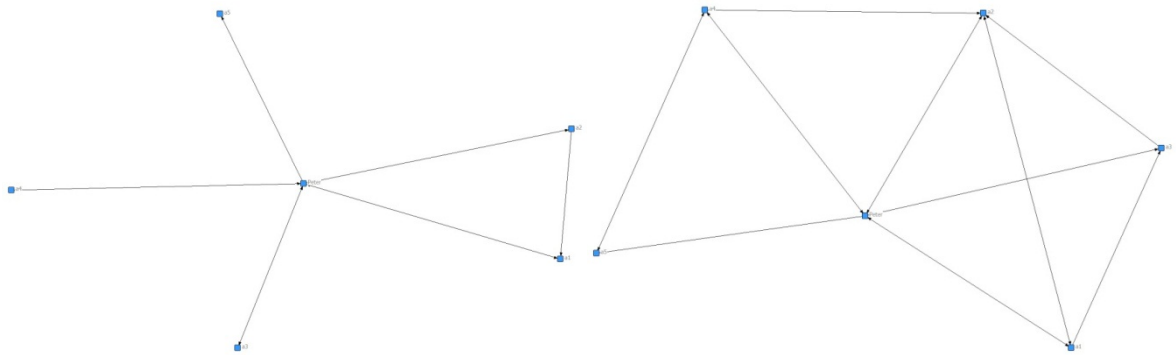


Figure 2: Low and high redundancy ego-networks

Not many studies have explicitly examined the level of trust in relation to specific social network ties. Rather, trust is often taken as naturally arising from network ties between individuals. The notion of trust is often related to social capital, which is an embedded resource that can be accessed through ties within networks (Lewis 2010). Rather than assuming that the presence of a network tie indicates trust, or assuming that the same level of trust could be inferred for all network ties, this was tested empirically. Respondents were asked to rate their level of trust for each alter and to rate each alters' level of importance to decision-making (see the section on strategic information networks for more information).

Networks, in which ideas are exchanged, are generally seen to be important to the innovation process. As noted above, it is weak ties that can facilitate innovation, by linking up loosely coupled actors, which creates opportunities to bring in new perspectives, new ideas and other resources. They are also important in creating bridges between parties that lack ties, creating the potential for bridging social capital, rather than the bonding social capital that arises from strong ties (Lewis 2010). Ties, trust and brokerage positions have been found to be more important in the initiation and development phases of innovation, than in latter phases (Huijboom 2010). In addition, innovation is sometimes linked to the concept of boundary spanning (Voets and de Rynck, 2008).

The preceding discussion indicates that while there are several theoretical and observed associations between network concepts and innovation, the relationship is not a straightforward one. Indeed, it seems that it is some blend of centrality, homophilous and heterophilous ties, brokerage, social capital and trust, that provide the necessary network capacity for innovation. It is also apparent that certain types of networks might be important for specific innovation processes, but it is unlikely to be the case that there is a 'one size fits all' ideal type that supports innovation of all types and in all circumstances.

Leadership and innovation

Having outlined both governance structures and social networks as likely contributors to the innovation capacity of municipalities, the third component of this study is leadership. The link between leadership and innovation in the public sector is weakly conceptualized: Much of the focus on innovation through the lens of New Public Management has been on individual entrepreneurship to drive through change, while the Network Governance or New Public Governance version emphasizes 'co-creation' as producing innovation through new government-society interactions. Here it is argued that innovation in the public sector is related to the leadership qualities of both politicians and senior administrators.

The leadership qualities briefly reviewed here relate to five different concepts that deal with innovation in the public sector, and each highlight the leadership skills considered necessary. The concepts are; transformational leadership, interpersonal skills, entrepreneurial skills, wicked problems /co-production/ collaborative skills, and dynamic capabilities. See Beinicke (2009), Osborne and Brown (2011), and Voorberg et al (2013) for an overview of the public sector leadership literature.

New Public Management included the concept of transformational leadership (introduced by Burns, 1978), which focuses on managers leading change with skills such as; visioning, managing complex change, and goal setting (Beinicke 2009). It was established in contrast to the traditional administrative and rule-bound role for public managers, casting them instead as inspirational leaders, helping employees to reach their potential by focusing on their performance. This was seen to be important to the creation of efficiency in the public sector (Fitzgerald and Schutte 2010; Osborne 2010).

Beinicke (2009) adds interpersonal skills as important to innovation and change management. His list covers; communicating, teamwork, coaching, and negotiating and conflict resolution. This stands in contrast to the idea of the entrepreneur, who is supposed to be adept at seizing opportunities, and seeing conflicts as opportunities (Teece 2007). An entrepreneur is usually a

maverick-type, somewhat of a risk taker, and typically a 'lone rider'. Charisma is what attracts followers to these leaders. Entrepreneurs are generally regarded as being more likely to be found in the private sector, but some of these skills are included here as they are important for innovation (Drucker 1985; Roberts and King 1996; Bartlett and Dibben 2002; Windrum, 2008). Transformational skills, interpersonal skills and entrepreneurial skills, are all centred on the individual, rather than the environment, the organizational or the institutional context (Osborne et al. 2008; Osborne and Brown 2011).

Network Governance might be characterized as changing the focus from the individual to the organization; on the motivational and efficiency forces of the organization, on handling intractable problems (wicked problems), and on facilitating processes that include not only internal employees, but also external collaborators, e.g. local citizens, community leaders, and volunteers from the informal sector (Storey 2011; Van Wart 2013).

Taking complexity into consideration in aspects of implementation at an early stage of the innovation process may contribute to the creation of more robust solutions. New Public Governance is said to entail a new perspective on citizens as associates in the innovation process, rather than service-receivers - as co-producers of solutions in collaboration with users/citizens (Osborne 2010; Sørensen & Torfing 2011; Voorberg et al. 2013). The New Public Governance literature view co-production with the citizens as a necessary condition to develop new public services that meet the citizens' needs, and relates this to the term 'social innovation' (Bekkers et al. 2013).

Public sector environments change rapidly due to frequent changes in policy (Pablo et al. 2007; Piening 2013). This points to the importance of a resource based view of how organizations adapt to such rapidly changing environments. The dynamic capability framework is new to the public sector (Piening 2013). The concept has been applied to private organizations to understand how firms stay competitive by adapting to changing environments. Dynamic capabilities are the "ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997: 516). Such capabilities within a company are meant to be an add-on to the resource-based view of the firm. Dynamic capabilities are distinctive processes that facilitate not only the ability to recognize changes in the strategic environment, but also the processes of changing and shaping the company's asset positions in its adaptation to its environment (Teece 2007).

Dynamic capabilities are therefore closely related to a company's 'performance', which according to Teece (1996) is to create, deploy, and protect the intangible assets that support the business in the long run. While their purpose is not exactly the same as for public sector organizations (which provide the services that markets otherwise would not fulfill satisfactorily or govern those areas considered necessary as public goods), the dynamic capability framework provides some useful concepts when it comes to investigating the link between innovation and leadership qualities in the public sector: The innovation capacity of a public sector organization is related to its capabilities in adapting to a changing environment.

For this research, these five concepts – transformational leadership, interpersonal skills, entrepreneurship, collaborative skills, and dynamic capabilities, were used to generate a list of 21 sub-questions for the survey. These are shown in Table 3. Some of these are expected to be negatively related to the concepts (indicated by a negative sign in the table).

Table 3: Leadership qualities aligned with the five concepts

	Variables	Transforma-tional leadership	Interperson-al skills	Entrepre-neurship	Collabora-tive skills	Dynamic capability-es
A.	Good communication skills		X			
B.	Visionary	X				X
C.	Takes initiative			X		X
D.	Authoritative		X	-X	-X	
E.	Visible leadership	X	X			X
F.	Displays a long term perspective (+)					X
G.	Displays a short term perspective (-)					X
H.	Good at gathering information		X	X	X	
I.	Problem-oriented	X	X	X	X	X
J.	Results-oriented	X	X			X
K.	Inspirational		X	X		
L.	Provides intellectual stimulation	X	X			
M.	Committed to colleagues and organisation	X	X		X	
N.	Willing to sacrifice self-interest	X	X		X	
O.	Good at mobilising the resources needed	X		X		X
P.	Worked collaboratively	X	X	X	X	X
Q.	Knowledgeable		X	X		X
R.	Good at learning from mistakes			X		
S.	Willing to risk mistakes from employees			X		
T.	Open towards new ideas	X	X	X	X	X
U.	Takes all decisions alone (-)		X	X		
V.	Involves others in key decisions (+)				X	
W.	Always follows procedures		X	-X	X	

Methods

As indicated at the start of this paper, the final product from this study will be a comparison of four municipalities in different nations. The methods outlined here have been used in each of the four cases and the data has been collected, and this comparative analysis is in progress. Here some of the findings from Copenhagen are reported, as a step toward establishing a framework for the conduct of the comparative analysis.

Copenhagen

The city of Copenhagen is the capital city of Denmark, and also the largest municipality with a population of 569,557 people (2014 figures from Statistics Denmark). The city is governed by Copenhagen's municipal council (the 'Borgerrepræsentationen') and a substantial administration. Council elections are held the third Tuesday of November every four years. The political leader (the Lord Mayor) of city of Copenhagen has since 1903 been a Social Democrat. The most recent election was held in 2013.

The City Council is the supreme political authority in the City of Copenhagen. Its 55 members outline the framework for the responsibilities and duties of the committees. The Lord Mayor is the Chairman of the City Council, convening the meetings and setting the agenda. The City Council is then divided into seven committees: the Finance Committee and six standing committees with specialised fields of responsibility. The responsibility of the administration is therefore divided between seven Mayors, with seven administrations and seven committees, and the Lord Mayor is the Mayor of Finance.

The seven mayors are all elected politicians, and the only politicians working full-time in the municipality. The remaining politicians (48) in the city council are not receiving any salary from the municipality, they are regarded as part-time politicians and usually they follow the practice of keeping their day-time job as a school-teacher, student or consultant if not appointed to be mayor. Politicians do, however, receive fees from the standing committees, as board members or from their seats in the external companies owned (or partly owned) by the municipality like the metro, harbour, water, central heating and renovation companies etc. Some of these seating are quite prestige and lucrative. The seats are divided among the parties after the local election (held every fourth year).

The seven committees and seven administrations are: Finance, Healthcare, Employment and Integration, Culture and Leisure, Social Services, Technical and Environmental, and Children and Youth. In addition to a mayor, each administration has one executive director and two executives (similar to individual CEOs in other municipalities), then various levels of staff beneath these.

Six of the seven administrations agreed to participate in the study, and the numbers of senior staff in each of these areas plus the numbers of responses are shown in Table 4. Invitations to participate in an online survey resulted in 175 responses from the municipality. From a selected list of the whole population of 464 senior managers (the top-three levels) and mayors, we managed to collect at least partially completed surveys from 173 senior managers and one politician, and one mayor was interviewed face to face. The data represents the opinions of those senior managers in the city of Copenhagen who participated in the study.

These data were collected during November 2013- January. From the 175 responses, only 90 people completed the name generator question (and the trust and importance follow up questions). In the questionnaire, it was stressed that all names were to be given a new ID, but actual names were needed to map the interactions. The topic is sensitive and not all leaders felt comfortable in filling in names, trust and importance. Out of the 90 people who did complete these questions, some entered responses such as 'the leaders' or 'my colleagues' and not the actual names (15). This can be interpreted either as people being unwilling to provide specific names, or that no individuals were particularly relevant. These were therefore left out of the analysis. However, the 75 people who did provide names, is enough to create a picture of the strategic information network in Copenhagen municipality. We have yet to do a comprehensive analysis of whether those who completed the social network questions are broadly representative of the administrations and the larger sample who participated in the survey.

Table 4: Copenhagen - numbers of staff in administrative divisions and estimated response rates[1]

Division	Number of staff at senior levels	Number of responses[2]	Response rate (%)
Mayors	6	1	16.6
Politicians (not mayors)	16	1	6.3
Total politicians	**22**	**2**	**9.1**
Health and care	118	52	44.1
Children and youth	21	7	33.3
Employment and integration *	29	3	10.3
Culture and leisure	88	53	60.2
Technical and environmental *	106	17	16.0
Social services	102	41	40.1
Total administrators	**442**	**173**	**39.1**
Total	**464**	**175**	

1. These are 'worst case' estimates – there were significant numbers of email bounce-backs that have not yet been factored into the response rates, and people who did not complete the survey but indicated they were in relatively junior positions and should not have been in our sampling frame (particularly the case in divisions marked *). When these are excluded, the actual response rate is likely to be around 50 per cent.
2. Those who answered more than the first few questions.

The survey asked questions about: the innovation environment, innovation challenges and the role of leadership in innovation; networking behaviour (engagement with external groups and boundary spanning); work and strategic information ego networks and the level of trust and importance of these network ties. In this paper, participants responses to a small number of questions are analysed.

Networking behaviour[3]

The level of external communication is shown in Table 5. This shows that the most frequent external communication is with administrators in other municipalities, unions and citizens groups, and community sector organizations. There is remarkably little contact with the regions, the EU, and the national organization for municipalities. There is also very little contact with politicians in other municipalities but this is not surprising since almost all the participants in the survey are administrators rather than politicians. The level of contact with firms and business associations is also quite low.

Table 5: Copenhagen – external communication

(n=138)	Percentage				
Frequency of communication about a municipality-related matter with:	Never	Less than Monthly	Monthly	Weekly	Daily
1. An officer in another municipality	15.2	34.1	23.9	22.5	4.3
2. A politician from another municipality	79.7	15.2	5.1	0	0
3. An officer in the region	65.9	22.5	9.4	2.2	0
4. An officer in the national department that regulates municipalities	59.4	29.0	10.1	1.4	0
5. An officer from another national government department	52.9	32.6	13.0	1.4	0
6. An officer from the EU	89.9	7.2	2.9	0	0
7. A representative from a business association	37.7	39.1	17.4	5.8	0
8. A leader of a medium or large private firm	34.8	35.5	22.5	6.5	.7
9. A representative of citizen's group	17.4	39.1	26.1	13.8	3.6
10. A representative of a union	5.8	39.1	35.5	15.9	3.6
11. A representative of a community sector peak organization (e.g. the Danish Cancer Society or an NGO)	18.8	44.9	28.3	6.5	1.4
12. A representative of the media	19.6	54.3	18.8	6.5	.7
13. An officer from the national association of municipalities	78.3	20.3	.7	.7	0

The scores for each of these 13 items were recoded to reflect weekly levels of contact, and then summed to give an overall score for external communication. The resulting score can theoretically vary between zero (no contact at all with any organization) to 65 (daily contact with each of these organizations). The mean score for this new variable was 1.74 (SD=2.51), indicating that most people surveyed were in contact with external organizations about twice per week. Further information on networking behaviour can be found in Lewis and Ricard (2014a). This does not tell us much in and of itself, but will be used to compare the levels of

[3] The question asked was: How often do you communicate with each of the following? Please circle the number for each item that comes closest to describing how often you have some form of personal communication with that group about a municipality-related matter. Include communication by phone, email, or in person, but exclude bulk email circulars.

external communication with that of other municipalities, so that the relationship between this and innovation can be examined.

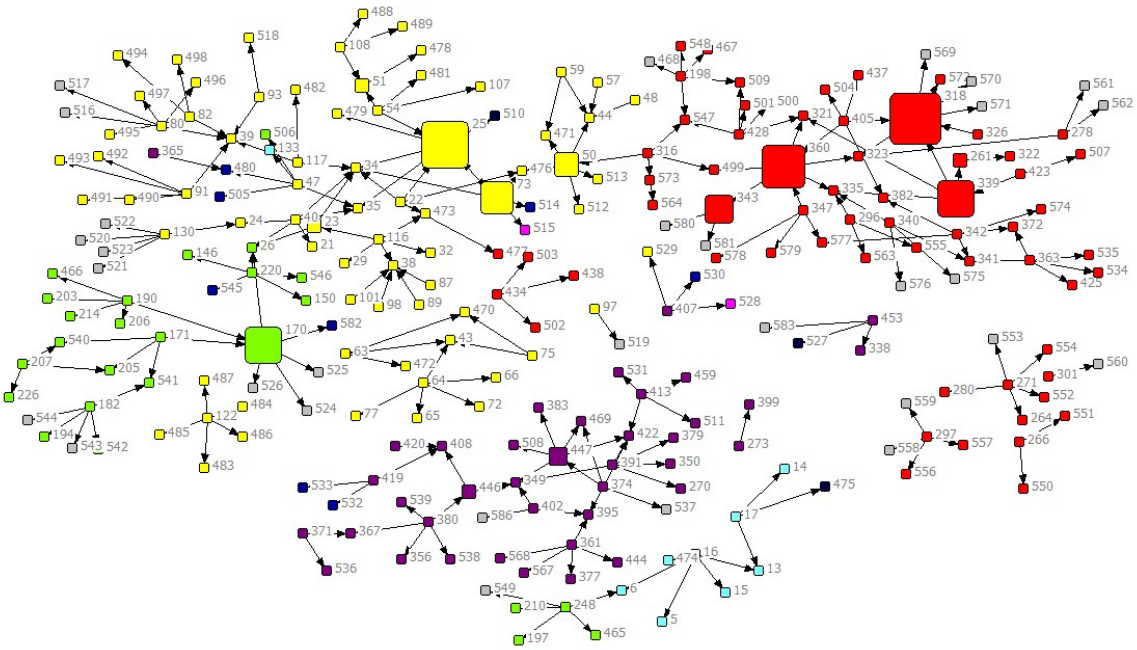
Strategic information networks[4]

The social network analysis that follows is based first around the whole network (that is, everyone who participated in the study) and then around ego-network structures.

Whole network

Betweenness centrality, which shows who is placed between actors who are unconnected, and can act as a broker or an entrepreneur (this is related to Burt's idea of structural holes), is shown in Figure 3. Betweenness is shown as node size in this network map. That is, the size of each node is proportional to its betweenness centrality measurement. This makes it easy to see who the most central actors are. This, and in-degree centrality and closeness centrality measures were used to create a list of the most important egos for the next step in the analysis. Eight egos (25, 50, 73, 170, 318, 339, 360, and 447) stand out by being in the top-three list in one or more of the centrality measurements: Five of them are in the top three on one measure (73, 50, 339, 360, 447), one appears in two (25) and two appear in all three (318, 170).

Figure 3: Copenhagen strategic information network showing betweenness directed



[4] The questions were: 1. Looking back over the last six months, who did you go to most when you wanted to get strategic information about something in the municipality (including background information not yet available in reports etc)? (spaces were provided for up to five names plus positions and organizations); 2. How much do you trust these people you get strategic information from? (on a five point scale from very low trust to very high trust); 3. How important do you think each of them are in making decisions (in general) in the municipality? (on a five point scale from not at all important to very important).

As was noted earlier in this paper, it is often assumed that trust arises naturally from network ties. While this makes sense in situations where networks have high levels of closure and there is high cohesion (such as in Coleman's version of social capital), there is less reason to believe that it is always present in more open and diverse networks. As Burt (2005) argues, there is indeed good evidence to support the link between closure and trust, and this makes sense as closure creates a reputation cost for behaving badly. He also argues that the same applies in the case of third-party ties, as if one party is trusted by the broker, then the other is likely to trust the second party too. While it is possible that the two unconnected parties might go on trusting the broker without knowledge that the broker has a bad reputation, this is not likely to last for long in rapidly changing organizations with permeable boundaries, where the chance of word spreading is high.

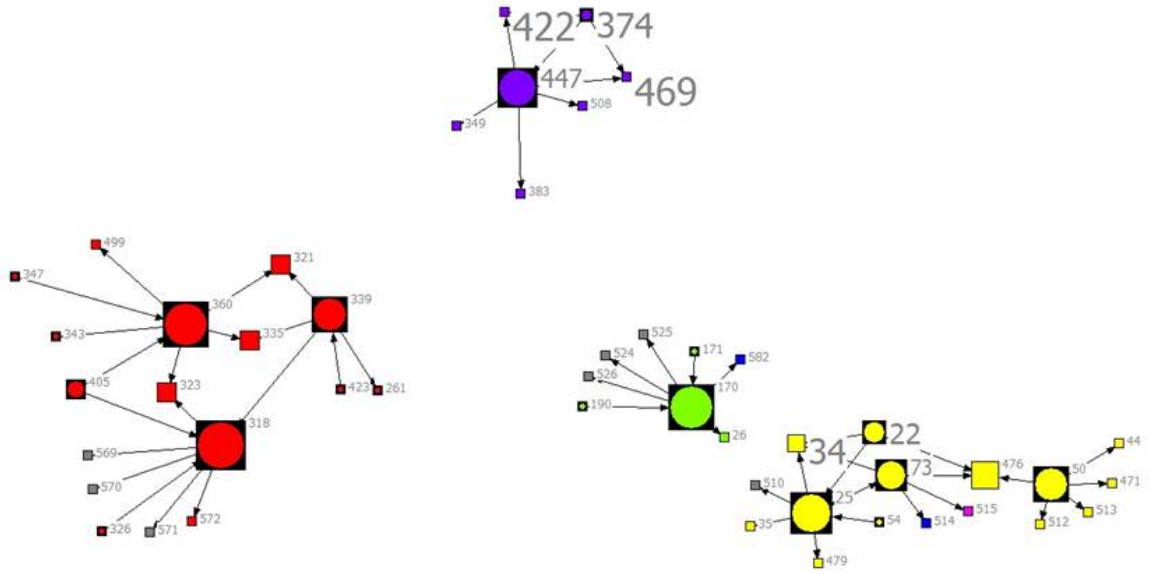
The interest in asking about trust in this project was both to test if there is trust associated with all the alters nominated by those surveyed about who they go to for strategic information, and to examine the degree of variation in the level of trust within the municipality. In addition to asking about trust, we also asked about the importance of each of the alters to decision making, and this is contrasted with levels of trust in this section, based on the 264 ego to alter nominations collected in this survey.

First, it is the case that the levels of trust associated with these ties are very high with a mean of 4.49 (out of a maximum score of 5) and a small standard deviation (.652). The mean score for importance is lower at 4.03 and the variation larger with a standard deviation of .945. Trust and importance are related (Pearson's correlation coefficient = .170, $p < .01$), but that correlation is quite low. However, there are only a few cases where egos have alters that they claim to trust, but then claim that they do not regard these people as important to decision making. Second, an examination of the differences in the levels of trust and importance of ties across the divisions showed very little variation in regard to trust (mean scores varying between 4.31 and 4.54), but greater variation for importance (means scores between 3.63 and 4.24). Further information on this can be found in Lewis and Ricard (2014b).

Ego-networks

From the strategic information network for Copenhagen municipality, some central actors were identified as subjects for further examination, because they had high centrality scores in one or more of the top three list of centrality measures. Those that are the most interesting for this analysis are shown with their ego-networks in Figure 4. Ego-networks are comprised of a focal individual ego and each alter that has a direct connection to that ego. The structural hole measure of the ego-networks used here is effective size. As noted earlier, this is the network size (average degree of alters in the network not including ego) minus redundancy in network. Burt argued (1995, 2002) that unconnected alters are more likely to provide ego with different set of viewpoints and can be played off to ego's benefit (no constraints). In contrast, connected alters in high density networks are more likely to provide ego with redundant information. Higher effective size indicates that ego is able to act efficiently. Figure 4 shows that ego 25 (yellow) and 447 (purple) have reasonable effective size through the number of unconnected alters they have in addition to their redundant ties. But ego 318 (red) in Social Services is the one least constrained and with the greatest structural hole opportunity, followed by ego 360 (red) and ego 170 (green). The large labels indicate the important actors in these networks, based on constraint.

Figure 4: Copenhagen strategic information ego-networks showing effective size



These ego-networks within the boundary of an organization demonstrate two potential and contradictory individual strategies using social network theory. These are related to the degree of redundancy in an actor's ego-network and can be regarded as indicators of the capacity of pursuing two different strategies – divide and conquer, or distributed leadership. Three types of brokers with different optimal performance in their ego networks can be seen in Figure 4. First, three of them (318, 360 and 170) fit with the classic statement of structural holes by Burt. More interesting are 25 and 447, with redundancy and cohesion more in line with Coleman's view of social capital. Ego 447 is constrained by alters 469, 422 and 374, and ego 25 is constrained by alters 34, 22 and 73. Further analysis of these specific individuals and their direct connections can be found in Lewis and Ricard (2014b). The future question is, to what degree are such brokerage patterns repeated in other municipalities?

Leadership qualities[5]

Participants were asked to rate a set of leadership qualities on a five point Likert scale, in relation to their importance to innovation. The order of these was randomised in the survey, so that the order of the items was different for each person answering. Table 6 show the results of the exploratory factor analysis.

Three principal components were found in the exploratory factor analysis. The three types extracted are shown below, with a summary statement that encapsulates the strongest variables for each component. More on this can be found in Ricard and Lewis (2014). As for the preceding sections which provide the analysis of networking behaviour and strategic

[5] Thinking about your administration/municipality in relation to innovation, to what degree do you think the leadership (both politicians and administrators) has the following qualities & behaviours (capabilities)?

information networks, the more interesting analysis relates to the comparison of the four municipalities, and whether the same dimensions of leadership appears in each of them.

Table 6: Copenhagen leadership qualities factor loadings (n=175) [6]

	Motivator	Entrepreneur	Futurist
A. Good communication skills	.45		
B. Visionary	.40		.71
C. Takes initiative	.43	.47	.43
D. Authoritative		-.66	
E. Visible leadership			.56
F. Displays a long term perspective			.81
G. Displays a short term perspective			-.68
H. Good at gathering information	.56		
I. Problem-oriented	.47		
J. Results-oriented	.53		
K. Inspirational	.48	.43	
L. Provides intellectual stimulation	.59		
M. Committed to colleagues and organisation	.60		
N. Willing to sacrifice self-interest	.62		
O. Good at mobilising the resources needed	.60		
P. Worked collaboratively	.52	.48	
Q. Knowledgeable	.53		
R. Good at learning from mistakes		.62	
S. Willing to risk mistakes from employees		.57	
T. Open towards new ideas		.50	
U. Takes all decisions alone		-.50	
V. Involves others in key decisions	.52		
W. Always follows procedures		-.51	

1. Principal Component Analysis with varimax rotation, 48% of the variance explained.
2. Only factor loadings with magnitude of .40 and greater are included for ease of interpretation.

[6] Prinicipal component analysis was used to extract the maximum variance from the data and varimax (orthogonal) rotation was used since it is the most common. In the comparative analysis, oblique rotation will be compared with this for each case before a final decision is made.

Motivator =	Willing to sacrifice self-interest, committed to colleagues and organization, inspirational, good at mobilising the resources needed, involves others in key decisions, works collaboratively, somewhat open to new ideas, and is knowledgeable.
Entrepreneur =	Good at learning from mistakes, is willing to risk mistakes from employees, and only infrequently follows procedure. Is generally open towards new ideas and is the opposite of authoritative leadership.
Futurist =	Is visionary, displays a long-term perspective, and visible leadership

Innovativeness

Table 7 shows the results of a question that asked the survey participants to self-rate the innovativeness of their municipality, on a seven-point scale. Between 40 and 45 per cent of people think that each of their municipality, their immediate colleagues, and their own division, are reasonably innovative. They are more likely to see their immediate colleagues and their own division as innovative, than Copenhagen municipality in general. This result is as expected, given that people generally rate those they know personally (or are closer to) more highly. However, this rating is lower when compared with other municipalities in Denmark and in other European cities, with only 27.2 and 21.4 per cent seeing Copenhagen as innovative in relative terms.

Table 7: Copenhagen self-rated innovativeness of municipality

(n=155)	Percentage						
	not innovative at all (1)	2	3	4	5	6	extremely innovative (7)
1. This municipality is	.6	2.6	20.6	36.8	29.7	9.7	0
2. My immediate colleagues are	.6	1.9	14.8	36.8	27.1	17.4	1.4
3. The division I work in is	.6	5.8	14.2	34.8	29.7	13.5	1.3
4. In comparison to Copenhagen, other municipalities in Denmark are:	1.3	6.5	21.4	43.5	22.7	3.2	1.3
5. In comparison to Copenhagen, municipalities (within my work area) in other European countries are	1.9	7.1	21.4	48.1	16.9	2.6	1.9

Two new measures were constructed from these items – the first is a measure of internal innovativeness (the first three items summed), and the second is a measure of innovativeness overall (summation of internal innovativeness plus the two comparative items reversed). These

two new measures can vary between a minimum of 3 (internal only) or 5, to a maximum of 21 or 35. The internal innovativeness rating had a mean score of 13.0 (SD=2.66) and the overall rating had a mean of 21.2 (SD=2.55). The interesting results will again come from the comparisons of these measures across the four municipalities. Comparing these measures against the earlier reported innovation indices for each case will also provide information on whether (internal) self-rated innovativeness is related to external measures of innovation.

Conclusion

This paper and the analysis from Copenhagen provide a first-cut at the task of uncovering the relationships between each of structures, networks and leadership, and innovation capacity. It described some of the relevant literature and the theoretical importance of each of these to innovation. It also used the results from Copenhagen to build on this theory and establish a framework for the future comparative analysis which will link innovation environments (governance structures, social networks and leadership qualities) to innovation capacity and innovativeness.

The comparative analysis that will follow this foundational work will be able to utilise some fairly well established and some more emergent hypotheses about the links between structure, networks and leadership, and about each of these and innovation – and these will be added to as the analysis progresses for each of structures, networks and leadership in relation to each other, and in relation to innovation capacity.

For example, there are some fairly well accepted links between governance structures and innovation capacity in the literature, so it is possible to put forward a hypothesis that:

> *H1: Municipalities located in states that are decentralized, have corporatist governance traditions, and a strong civil society have greater innovation capacity.*

Similarly, there is widespread agreement in the literature that being outward looking and open to new ideas is linked to innovation, so it is reasonable to hypothesize that:

> *H2: Municipalities with greater levels of external contact have greater innovation capacity*

and

> *H3: Municipalities with more connections across the internal administrative boundaries have greater innovation capacity.*

More speculatively, the preliminary work on ego-networks suggests that:

> *H4: A mixture of different types of brokers (with different levels of redundancy in their ego-networks) is related to innovation capacity*

Finally, some examples of hypotheses that could be used to examine the relationship between leadership and networks, and leadership and self-rated innovativeness (respectively) are:

> *H5: Views on leadership qualities are related to ego-network positions*

and

H6: Municipalities with more 'motivator' leaders have higher levels of self-rated innovativeness.

These and other hypotheses will be tested empirically against the data for the four municipalities. The ultimate aim is to gain an understanding of how the innovation capacity of public organizations is related to innovation environments, based on the framework outlined here, which consists of governance structures, social networks and leadership qualities. The task is now to examine each of these individually, to analyse the links between them, and to assess the relationship to innovation capacity. Comparing this across four different municipalities will add to existing knowledge about the relationship between the innovation environment and innovation capacity.

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