Innovation in Waste Management

A case study of the Oslo Region as an Emerging Regional Innovation System in Waste Management

By Anja Beate Svensson

Master Thesis at TIK Centre for Technology, Innovation and Culture
Faculty of Social Science, University of Oslo

Master of Society, Science and Technology in Europe (ESST)
The European Inter-University Association on Society, Science and Technology
Fall 2015 16.11.2015
Word Count: 19960

« I'm in the waste management business. Everybody immediately assumes you're mobbed up. It's a stereotype. And it's offensive. » Tony Soprano

Specialization: Innovation and Global Challenges (TIK 4021)

Innovation in Waste Management – a case study of the Oslo Region as an Emerging Regional Innovation System in Waste Management

Supervisors: Magnus Gulbrandsen and Anders Underthun

http://www.duo.uio.no/

Trykk: Allkopi AS, Oslo

Abstract

We are witnessing a movement towards a circular economy in Europe where a significant part of the European Commission's strategy against the year 2020 has emphasized sustainability as reuse and recycling. It has been announced that by the end of this year there will be launched a new legislative proposal with ambitious targets.

Waste is an engaging sector seeing that it represents both a problem and a solution in the bigger picture of social and environmental concerns and the circular economy movement has been visible in the capital of Norway, Oslo, and in the surrounding areas. Although waste management is a public matter, the realization of the potential has been found in the interaction between different actors. New thinking, great projects and innovative developments as well as experts in academia and firms and local technology providers, have put this region on the map.

This thesis presents a region in Norway which has prioritized and invested heavily in the field of waste and thus it contributes in a central area and sector which is in need of more precedence and research. Regional Innovation System, the Triple Helix and Cluster theory builds a conceptual framework and through in-depth interviews with various actors representing research institutes, universities, industry and public sector, the empirical material is rich and exiting in understanding how a system has developed in a political prioritized area.

Preface

It is with great honor that I now can bring to close my master thesis and hereby my time as a student. In many ways this thesis symbolizes the personal growth I have experienced this past year, considering it has challenged me to step out of my comfort zone.

Little under a year ago I was introduced to the theories that I today practice and just a few months back my knowledge about the waste industry in the Oslo region was quite scarce. Not only am I grateful to be able to enlighten such an important and interesting field, but I`ve also acquired a lot of new knowledge and discovered a field that engages me.

For this I want to thank everyone who has participated in the interviews and those that have been most helpful and eager to share their knowledge and experience. Additionally I have been very fortunate to receive excellent guidance and assistance from two supervisors who complement one another very well. The deepest appreciation and thanks to Magnus Gulbrandsen at the Centre of Technology, Innovation and Culture (TIK) and Anders Underthun at the Work Research Institute (AFI). And thanks to AFI for the cooperation and support.

To my dear family; thank you for all your counsel and encouragement throughout this process. And to my other family, Catherine and Helene, thank you for dinners, hikes and endless amount of love. Lastly I want to show a big appreciation to Catherine and Elizabeth who have assisted me in proofreading this thesis.

Anja Svensson, October 2015

Table of Contents

1 Introduction

1.1 The complexity and potential in our waste

Waste. Visible or not, it is around us at all times in different forms and at different stages. Waste is as heterogeneous as the products we buy. Although some things get reused as inheritance or get antique status, the majority will turn into waste and new products will be replacing the old.

One way to define waste is as a by-product of human activity. It can be classified after its physical state, origin, original use, safety level or material type (McDougall et al, 2001). Both how we consider waste and how we manage waste has changed a lot over time. However, there still exist enormous differences with this around the world. Some of the things we throw away are being reused or are recycled into something new. Waste also provides heat through incineration and can even generate fuel for vehicles. Yet, a significant amount of our waste ends up on landfills and in the worst cases hazardous waste are being dumped in the sea or other inappropriate places as a result of illegal waste disposal.

Rapid population growth, demographic changes and urbanization, as well as economic and technological development has not only led to an increase in the amount of waste but has also brought with it new types of waste. Growth has also generated a need for more raw materials. This pressure on Mother Earth has accelerated issues and concerns on finding new and alternative ways for the future.

Waste is an engaging sector seeing that it represents both a problem and a solution in the bigger picture of social and environmental concerns. One example is the Europe energy systems expected transition from the old fossil fuel base into renewable fuel base which has brought potential for waste-to-energy technologies (Coolsweep, 2014). Overall, we have the movement through a more circular economy in Europe where a significant part of the European Commission's strategy against the year 2020 (EU, 2011a) has emphasized sustainability as reuse and recycling (EU, 2014). Also related to this is the emergence of the

Bioeconomy (EU 2011b, EU 2015). Some search for various ways to reuse more of the raw materials so we can reduce littering, pollution, cutting the production costs, energy used and at the same time saving scarce resources. From the sorting of food waste there are examples on how important nutrients like phosphorus and potassium are being reused in bio-fertilizer for food production. We are also witnessing a growth in various zero waste movements. Focusing on how to eliminate waste instead of managing it, they are adopting a clear position at the top at the Waste Hierarchy (EU, 2008).

The introductory examples have exposed what potential for innovation and value creation there is in the context of our comprehensive waste. Although collection and treatment of waste is a public matter, the realization of this potential can be found in the interaction between different actors. To be able to realize political ambitions of change the public can be dependent on other sectors and industries to best find those new solutions and to stimulate to new thinking.

The urbanization and climate issues have also given rise to questions on how to organize big cities so they can be modern, climate friendly and sustainable (Coolsweep, 2014). The last ten years we have witnessed a movement against a circular economy approach and an increased focus on waste as a resource in the capital of Norway, Oslo, and the surrounding areas. New thinking, large projects and developments have put this region on the map, involving significant public investments, local technology, consultancy firms and specialists within waste (Menon Business Economics, 2014).

The Oslo region has received praise and attention for its ideas and investments, both nationally and internationally. Representatives from every corner of the world have been visiting some of region's facilities to be inspired by what they have achieved. This has created an impression of a region with both competence and will.

Waste is kept high on the agenda in the capital of Norway. The Climate and Energy Programme in Oslo recently finished their outline for a new strategy encouraging all areas and sectors to pull in the same direction to achieve the goals of zero emissions of greenhouse gases. The strategy illustrates how innovative work within waste management will continue to play a significant role (Oslo kommune, 2015a).

1.2 Research Questions and Objectives

This thesis explores the waste sector in the Oslo Region under the title

The Oslo Region as an Emerging Regional Innovation System in Waste Management

Seeing as the Oslo Region exhibits a great deal of progression, and ongoing development is prominent, it appears as an interesting case to explore. This is done through a case study of the Oslo Region. The thesis builds on data collected through a document study, 16 interviews from 12 different organizations and agencies in the Oslo Region and attendance from two regional arrangements: a workshop for public waste management agencies and -companies and an annual national waste conference. The research question is

What characterizes the emergent RIS in waste management in the Oslo region?

Identifying the region as an emerging innovation system lets us search for, capture and understand the different actors and institutions that exist in the waste industry and in the Oslo Region and the interaction between them. The thesis has three sub questions, where the first one is

I) What are the main actors and characteristics of the waste innovation system in the Oslo Region?

The objective is to get a better understanding of what the system consists of by exploring some of its main actors and their roles. Second, to improve the further understanding, the thesis asks what arenas of interaction that exist in the system and what defines these. Potentially revealing key linkages in the system and bring to light how knowledge and learning develops within this system.

II) What characterizes the arenas of interaction in the RIS?

Some of the systems main arenas where the actors meet and interact will be elaborated. The thesis also discusses factors that seem to promote or inhibit the functioning of the system

which is the third sub question.

III) What factors seem to promote or inhibit the functioning of the waste innovation system in the Oslo region?

1.3 Contribution

The examples from the introduction depicts how waste issues are affecting us all, consequently making it a greater challenge of our time. Research on innovation and development in this area has eminent social relevance. I would argue that this thesis contributes with new knowledge to the field of innovation studies, which has so far devoted little attention to this complex area. The European Commission is currently working on a revised circular economy proposal and this thesis demonstrates examples from a region in Norway which has prioritized and invested heavily in the field of waste (EC, 2015). Learning from the case of the Oslo region can be of relevance also for those outside Norwegian borders. The thesis is contributing in a central area and sector which is in need of more precedence and research, nevertheless the results can also become relevant in discussions on regional development and policy in general.

The thesis uses concepts from Regional Innovation Systems approach, Triple Helix and Cluster theory as a theoretical and conceptual framework and thus it contributes to an ongoing academic debate over twenty years after the concepts' arrival. Through in-depth interviews with various actors from industry, universities and public sector the thesis presents a rich and exiting empirical material which can give insight in how a system develops in a political prioritized area. It also captures the roles of the government and public organizations, which have been understudied and need more attention in the RIS and Triple Helix literature. The thesis applies a broad version of the concept of Absorptive Capacity and thus contributes with a more actor-oriented approach to the RIS literature.

1.4 Thesis Outline

The thesis is structured as follows: chapter 2 presents the thesis' theoretical and conceptual framework and has a particular emphasis on concepts from the Innovation Systems Approach and Regional Innovation Systems. Also a literature review will be given. Furthermore, chapter 3 presents the methodological approach used to answer the research questions and elaborates the research process. In chapter 4 the empirical findings from the case of Oslo is presented and analyzed against the theoretical and conceptual framework and the literature presented in chapter 2. The thesis in chapter 5 presents some last discussions, concluding remarks, implications as well as some proposals for further research.

2 Theoretical and conceptual framework

In this chapter I will outline concepts, theories and literature that will be used in the empirical and analytical chapter. It gives a brief presentation of innovation studies, innovation as well as some aspects on innovation in public sector. Then the Innovation Systems Approach together with Cluster Theory and Triple Helix is presented. The framework has special emphasis on Regional Innovation Systems and reviews some of the literature. The thesis also touches upon the concept Absorptive Capacity.

2.1 Innovation

Innovation studies emerged as a field of research during the 1960s. Numbers of publications have since then highlighted the role of innovation in economic and social change. A cross-disciplinary orientation has made it possible to capture the many aspects of innovation but also constitute a diverse and complex field of research (Fagerberg, 2005).

Innovation can be hard to capture in just a few sentences but there are several attempts. The first example emphasizes knowledge and learning in a comprehensive way: *"Innovation can be understood as a process of learning and knowledge creation through which new problems are defined and new knowledge is developed to solve them"* (Lam, 2005:124). Others are more established and descriptive, like the one in the Oslo Manual *"An innovation is the implementation of a new or significantly improved product (good or service), or process, or new marketing method, or a new organizational method in business practices, workplace organization or external relations."* (OECD, 2005:47) Further, the minimum requirement is that it is *"new (or significantly improved) for the firm"* (ibid.).

The latter also categorizes innovation after different types which are similar to Joseph Schumpeter's well used classification after new products, new methods of production, new sources of supply, exploitation of new markets, or new ways to organize business. The separation between process and product innovations was done because of their different consequences of cost reduction or increased income. Another way is to distinguish after how

radical the innovation is according to the current which gives the two archetypes: radical innovation and incremental innovation (Fagerberg, 2005).

2.2 Innovation in the public sector

After observing how innovation develops Hartley (2005) pointed at the drivers for innovation and how they sometimes varied between private and public sector. Innovation in public sector could for example be of a more ambiguous type and involve new practices more often than new products. When considering innovations in public sector one should therefore include the processes, impacts, and outcomes to better capture these.

2.2.1 Public Procurement

Public sector can also stimulate innovation through procurements and *"conceptually, public procurement of innovation consists of a public "problem" whereas the solution is attained through the utilisation of knowledge available among suppliers*" (Rolfstam, 2009:352). Demands that don't require R&D are regular public procurement, but when a public agency orders a something that doesn't already exists in the market it is public technology procurement. PTP has been proven to be potent in influencing directions and speed of innovation (Edquist et al.,2000). Public procurement was one of two innovation-stimulating instruments that had significant effect on Germans firms (Aschoff & Sofka, 2008).

Even though public procurement has been acknowledged as an innovation policy to increase urban competitiveness did Lember et al. (2011) point to several European cities which lacked awareness of this link and also had tendencies to be risk-averse in promoting innovation through public procurement. Others have also looked at regulations and innovation. The first is often associated with constraints, but in the case study of German biodegradable materials and sustainable technology they also came with opportunities for innovation. Regulation and innovation adapt to each other (Delaplace & Kabouya, 2001).

2.2.2 The Entrepreneurial City

Some have studied western cities' transformation towards entrepreneurial cities. Local government has become more than the traditional provider of welfare and services, it has gained characteristics similar to the ones in private sector and become *"a more outward-*

oriented stance designed to foster and encourage local growth and economic development" (Hall & Hubbard,1996:153) In such entrepreneurial modes of urban governance it has also been highlighted as a sometimes difficult relationship between entrepreneurialism and environmentalism. Environmental concerns are creating demands for more sustainable development in urban areas and a balance between economic, social, and environmental demands has turned out to be challenging. While et al. (2004) present two cases of cities in the UK and find that urban environmental governance is complex: *"The transition to a post-industrial city presupposes a series of 'light green policy' actions".* They argue that the 'urban sustainability fix' often is no more than a change in the political discourse.

2.3 The Innovation Systems Approach

The innovation systems approach has roots back to the 1980's and here innovation is in the centre of economic growth and acknowledged as dynamic and interactive processes. It is in these processes we find relationships, spatial and relational, which can be significant for innovation and competitiveness in globalizing knowledge economy (Asheim et al., 2015).

An innovation system consists of organizations, institutions, and the different economic, social, political, and institutional parts that are affecting innovation possibilities, processes, and outcomes. Organizations, or actors, can be companies, public actors, and universities (Edquist, 2005) and it's familiar to think of institutions as 'the rules of the game' or *"[…] "intangible" aspects of social life such as rules, practices, routines, habits, traditions, customs and conventions"*(Asheim et al., 2015:274). The parts of a system interact through production of new knowledge but also in the diffusion and use of knowledge (Lundvall, 1992). Interaction can be understood as *"formal and informal meetings of communications focused on innovation such that firms and relevant network organizations and members could associate to earn, critique or pursue specific project ideas or practices of collective and individual economic, commercial or communal relevance"* (Cooke, 2001:954). Interactions can be market or non-market, between organizations, between institutions and between organizations and institutions (Edquist, 1997).

Consequently, it becomes relevant to understand the working of the linkages, for example through a search for congruent patterns among a systems parts or pay attention to particular forces, institutions and organizations (Fagerberg, 2005). One can also search for 'system

failures' such as missing organizations, institutions, interactions, or functioning linkages (Edquist, 2001). The approach has been remarked as a solid framework for specific empirical analyses of concrete conditions (Edquist, 2005).

The Innovation Systems Approach holds concepts like National Systems of Innovation (ex. Freeman 1987, Lundvall, 1992, Nelson 1993) and Regional Innovation Systems (ex.Lundvall & Johnson 1992, Cooke 1998, Braczyk et al,1998). Others emphasis the cognitive boundaries of innovation like in Sectorial Systems of innovation (Malerba, 2002) or through Technological Innovation Systems (Bergek et al, 2008).

The next sessions present Cluster theory and Triple Helix before returning to Regional Innovation Systems. Cluster theory has together with the innovation systems approach become relevant in how European economies have tried to create regional advantages (Asheim et al., 2015). Even though they are developed at the same time and share similarities, one can usually draw a distinction between them. This is because clusters of firms can exist solely on market relationships and lack any network relationship which RIS emphasizes. Another, and related to the first, is their different effects on a regions competitive advantage; for clusters it is created by market processes, while in networks the firms are engaged in cooperative activity, training, joint investment and new organizational forms (Asheim et al., 2011). Another difference is their theoretical foundations; clusters are influenced by mainstream economic theory and RIS has an evolutionary framework. This underpins why the latter has focus on social capital, learning and networking and the literature on clusters are more concerned with competitiveness and performance (ibid.).

2.3.1 Successful Clusters

Porter (1998) argued that several persistent competitive advantages arise from local knowledge, relationship, and motivation. Porter recognized a development towards a global economy and changing conditions for competition, yet he believed that local elements could be hard to match. This was explained as 'successful clusters', which was *"critical masses – in one place – of unusual competitive success in particular fields"* (Porter, 1998:78). Such clusters consist of companies and institutions that are interconnected, share a given field, and are located in the same geographic area. A cluster can also include governments, universities, and trade associations. It is linkages that are believed to be important for competitive advantages. Although competition is the main driver for innovation, a successful cluster will

contribute with efficiency and flexibility because of its balancing of competition and cooperation. Furthermore, a successful cluster can expand and strengthen itself through the formation of new businesses in the area. From this, policies should promote formation and development of clusters by focusing on the uniqueness of local sources. The market forces determine a cluster's success and the government should not imitate the successful ones or prioritize to build new, but help those already existing (ibid.).

2.3.2 The Triple Helix

The Triple Helix concept centres on university, industry, and government relations in the way they generate, transfer, and use knowledge. This is relevant for innovation and economic development. The role of universities in technology and knowledge transfer is particularly relevant and often referred to as *The Entrepreneurial University* (Etzcowitz & Leydesdorff, 1998). It created discussions on how academia could encompass a third mission of economic development, in addition to research and teaching (Etzcowitz and Leydesdorff, 2000).

Universities create links by training of new students, development of science parks, spin-offs, incubators, act as a source for new formations of firms, and it therefore becomes a great source of regional development (ibid.). They also have a prominent role in creating partnerships with industry and government especially as industrial sectors and states are induced by new technologies such as biotechnology and ICT (Etzcowitz & Leydesdorff, 1998). Companies have become more reliant on external sources of knowledge and technology in a highly competitive global environment and Triple Helix is used to explain innovation and development in knowledge-based economies (Leydesdorff, 2012). The driving force of interaction is expectations of profits, but the meaning of 'profit' can differ between various actors. TH-relationships can also be found as strategic alliances across sectors and governments that act on regional as well as international level. For example, the EU is a trade block which provides new options for breaking lock-ins without risking the competitive advantage from constellations (Etzkowitz &Leydesdorff, 2000).

2.3.3 Regional Innovation Systems

Although both clusters and the triple helix are important components in a Regional Innovation Systems, the latter is often presented as a more generic concept which also has focus on *"[...]*

a range of other factors, agents, institutions that combine to promote and diffuse innovation within a region" (Asheim et al.,2011:880).

National Systems of Innovation

NSI has studied nations' innovative capacities, which are dependent on the ability to produce and commercialize new technology in a long-term perspective (Edquist, 2005). Interactive learning has also been used to explain why innovation performance and economic growth differs across countries (Asheim & Coenen, 2005). Interactive learning is "*[…] a socially embedded process which cannot be understood without taking into consideration its institutional and cultural context"* (Lundvall, 1992:1 in Asheim & Isaksen,1997:302). Another concept to understand a system's function is through institutional learning and is when knowledge bases embedded in firms' and innovation supportive organizations' routines and conventions (Johnson,1992 in Cooke,2001).

Path Dependency, Inertia and Bottlenecks

Another familiar concept in the innovation systems approach is path dependency which is used to describe the case of being 'locked in' on a specific path. It can be a lock-in with negative consequences if a firm invests in a novel market in search for 'first mover'-advantages but loses them as a superior path comes to vision; it can become costly and be too late to switch path. Fagerberg (2005) explains also how systems can be victims of such path dependency and lock-ins. In that case the system can be at risk of ignoring some potential important exploration areas. Thus a system that is open for outside impulses is more capable to challenge and face threats from lock-ins and path-dependencies. This openness can be challenged if suffering from inertia. Inertia can be visible at all levels of society and complicates new thinking and development. A system also tends to function better with relevant complementarities among its components. The opposite of this can create a system with bottlenecks in infrastructure, skills, or financial problems (ibid.)

Regional Innovation Systems

In the NIS-literature the researchers started to recognise how *"Regional production systems, industrial districts and technological districts are becoming increasingly important"* (Lundvall, 1992:3). The RIS approach has focused on innovative production in regional networks and local clusters as well as how they succeed in promoting innovation-based

regional development. In RIS, spatial and regional proximity is relevant in the way it can increase localised learning and connect knowledge infrastructure, -creators and industry. RIS are therefore based on a sticky type of knowledge (Asheim et al., 2015).

Tacit and Codified Knowledge

In a given geographic area there exist commonalities like language, shared norms, institutional environment, and personal knowledge of each other and more. This context-specific nature is highlighted as important for knowledge sharing but it also what can make knowledge sticky and challenging to copy, imitate, or exchange over distances (Asheim & Gertler, 2005, Nonaka et al. 2000). Sticky, or Tacit knowledge, often possesses beliefs, mental models, perspectives, holds subjective elements, and can be hard to formalize into manuals without losing its meaning. The opposite is Codified knowledge, which is more explicit and objective knowledge (Powell & Grodal, 2005). These two extremes in categories tend to be naturally involved in innovation processes and represent a need for different forms of knowledge transfer. For example tacit knowledge is believed to be easier to transfer in person-to-person relations and the potential increases the more they share (Asheim et al., 2011). The traditional distinction between tacit and codified knowledge in how they function over distances is however not always the case (Zhang et al., 2011).

Knowledge Bases

Another attempt to understand how knowledge emerges and what innovation that evolves is through different knowledge bases. Asheim and Gertler (2005) distinguish between analytical and synthetic knowledge. Biotechnology is used to explain the first one, where scientific knowledge is essential, in-house R&D, codified and formals models and often radical innovations. Analytical knowledge has therefore university or industry links of importance. The workforce needs university training and research experience to make use of the scientific knowledge (Asheim et al., 2015). A synthetic knowledge base is about solving specific problems, having more deductive processes, and know-how knowledge. The intention of the distinction is however not to see analytical knowledge bases as codified and synthetic as tacit; in both the knowledge types you can find tacit or codified knowledge (Asheim and Gertler, 2005).

It has also been argued that the knowledge bases of various industries play a crucial role. In their study of a life science cluster, Asheim et al. (2006) made a distinction through analytical

and synthetic modes of knowledge creation and found how globally distributed analytical knowledge creation complemented a locally oriented synthetic knowledge creation. It is believed that diverse and broad knowledge bases can create a larger scope for innovation and that this variety also can be found outside a region (Asheim et al.,2015).

Knowledge sharing doesn't always happen intentionally. Knowledge can be spread through innovation failures and the possibility to get to know about it, and thus learn from it; can increase because of spatial proximity (Asheim & Gertler, 2005). Another way is through job hopping, a familiar phenomenon in successful clusters like Silicon Valley. Skilled workers switching jobs have been concerned with risk of knowledge spill-overs, lowered the incentives for R&D and training, and also a reason for contractual clauses. But in addition to challenging, a study pointed to job mobility as socially beneficial. It also argued that high levels of job mobility lead to increased overall technical progress (Cooper, 2001).

Empirical findings and criticism of the approach

In RIS, production and circulation of knowledge is the core of innovation and therefore asks what role regional conditions have in knowledge circulation. However, it does not believe all systemic relations to be regionally contained, and it is not rare to involve institutional framework at national and international levels when studying regional systems (Asheim & Gertler, 2005). RIS is for example often connected to a NSI through its basic research funding, university level training and national scientific priorities in general (Cooke, 2001). There can also be sectorial systems in a RIS and different innovation systems can complement each other (Edquist, 2001).

RIS can provide a picture of cluster interactions as well as revealing potentially interconnected global interactions. This was the case for Biotechnology in Massachusetts, where a range of local partnerships was of relevance but also the role of non-regional interactors like federal research funding and connections with other industries (Cooke, 2001). Isaksen's (2005) comparative cluster survey stated that regional resources and collaboration had impact on the economic activity. For several of these clusters the firms had supportive services and relevant research activities at the regional level and the formal organizations and institutions were highly relevant in the coordinative work of these activities.

Several have continued to discuss the system boundaries and degree of openness in a RIS (Asheim et al.,2011). Ter Wal and Boschma (2011) saw tendencies that the role of

geographical proximity had been over-emphasized and the effect of networks underestimated in knowledge exchange. This is in line with earlier critics stating that there has been too much focus on proximate relationships and to too little on non-local ones (ex. Hess, 2004 and Grabher, 2006). In another discussion on openness in RIS did Meyer et al. (2011) illustrate that there is not necessarily a contradiction between technology systems and regional ones and stressed the need for an integrated systems of innovation literature. Examples from nanotechnology had firms clustering geographically as well as they took part of networks with others located outside it. Regional concentration and strong non-local networks co-existed.

RIS can occasionally feel a bit confusing since it is both a theoretical concept and a policy objective. The RIS literature has been criticized for having inconsistent use of concepts and sometimes vague defined. In addition, the concept lacks a component to say something about the state's role in the system. This is highlighted as problematic because several laws, rules and regulations that are influencing regional innovation processes are often set by the state (Edquist, 2001).

The RIS-approach is not about comparing systems to an ideal system (Edquist, 1997). But there are several ways to consider RIS-potential. Cooke spoke about a RIS' embeddedness or *"the extent to which a social community operates in terms of shared norms of cooperation, trustful interaction and untraded interdependencies"* (Cooke, 2001:960). A non-systemic and weak interactive region has thus low embeddedness and could have 'not invented here'-mentalities and firms with little knowledge exchanges. Others have pointed at asymmetric knowledge as problematic for regional innovation. This can be the case where a region lacks analytical knowledge or has low research oriented institutions. From this, regional development is more significant when the knowledge between the parts is symmetric (Cooke, 2007 in Gausdal,2008).

Also the ties between actors in a network are discussed as relevant for regional innovation. A tie represents the relationship or connection between persons. A strong one indicates frequent communication and is believed to create solid conditions for collaboration. In line with this, weak ties are characterized by occasional communication, but it is stressed as important because it can avoid too much group thinking in strong networks with strong ties (Granovetter,1973).

While the RIS approach traditionally has studied institutions at macro levels and social systems at the meso level it has also been complemented with perspectives that are more actor and activity oriented (Asheim et al. 2015) Some have included the role of firms' capabilities, absorptive capacity and the ability to renew these over time (ex. Meyer et al.,2011). Others have asked for more attendance to firm heterogeneity when analyzing clusters and how firms' capabilities can help the understanding of how learning happens and knowledge is transferred (Zhang et al.,2011). Others have studied Knowledge Intensive Business Services (KIBS) and how these had a two-fold role in innovation systems and were functioning as "bridges for innovation". They operated as a purchaser, provider, and a partner (Muller & Zenker, 2001).

2.3.4 Absorptive Capacity

Regional factors like educational training, regional R&D or the transfer of R&D can also inhibit innovation in the way they affect a firm's Absorptive Capacity. (Nooteboom, 2006 in Gausdal, 2008).The concept of Absorptive Capacity (AC) is when and how a firm makes use of external knowledge (Tidd & Bessant, 2013). It is a firm's ability *"[…] to recognize the value of new, external information, assimilate it and apply it to commercial ends"* (Cohen & Levinthal, 1990:128). External knowledge is assigned a lead role in innovation processes and high AC is relevant for how firms succeed with being innovative.

In one of the first presentations the concept is explained through mathematical modelling particularly focusing on R&D investments (Cohen & Levinthal, 1990). This statement of in-house R&D and prior knowledge as particularly relevant for AC, has given assumptions that smaller firms, often with smaller internal resources, should interact more with the outside world. Lack of ability to recognize and apply external knowledge can increase the risk of the NIH–syndrome, which intended or not can make a firm skeptical or less inclined to acquire and assimilate new knowledge. In that case are the organizational routines complicating the innovative ability of a firm (Fagerberg, 2005).

Zahra and George (2002) redeveloped the concept to include Potential Absorptive Capacity and Realized Absorptive Capacity. The authors made the concept of transformation more explicit and realized that it was not enough to acquire and assimilate new knowledge and how different internal and external factors also affected a firm's transformation and exploitation of external knowledge.

Powell et al. (1996) argued that collaboration in networks could strengthen the absorptive capacity, for example in the awareness for new projects. Others have examined the role of external search strategies in shaping innovative performance**.** Laursen and Salter (2006) argued that firms open to external sources or search channels were more likely to have a higher level of performance. However, it can become time consuming and expensive, resulting in 'over-searching'. The authors also pointed at the reliance between different innovations and the amount of search. For incremental innovations and mature technology and markets, a wider search was needed to find new combinations of existing technologies to improve existing products. They also found support for the NIH-syndrome when they looked at the relationship between openness to external search activities and R&D intensity (ibid.).

2.4 Summary

The chapter started with some concepts from innovation studies. Since the case contains several public actors and projects, the chapter presented some concepts regarding innovation and public sector. The Innovation System Approach was then presented through its key concepts which gave understanding for what a system consists of. This perspective exemplifies how innovations happen through interactions with the environment and is not only emphasizing the innovation outcomes but also the potentially determinants of innovation. In between, cluster theory and triple helix was presented and concepts for understanding regional development, clustering and innovation. They are also complementary as the first tend to look at the clustering of firms in similar industries and the second highlight the role of universities. In the RIS-approach both clusters and triple helices are relevant. The presentation of RIS, building on NSI and several common concepts, contributed to understanding for the functioning of a system and how to consider one. A presentation of literature also highlighted some empirical findings and limitations. Then the concept of Absorptive Capacity stated how a firm's capability to explore and exploit external knowledge is relevant for the innovation ability, and how this is considered relevant for the development of a Regional Innovation System. And also the other way around can RIS affect a firm's AC.

These concepts form the foundation of this study and are revisited in the presentation and analysis of the empirical findings. The thesis combines concepts from a system approach with a more actor-level approach to discussion the empirical findings from an regional systems' main actors and subsystems. The way they interact through different arenas and thus searches for, produce and spread knowledge can be relevant for their own and the regions innovative innovation ability. The thesis uses Zahra and George's (2002) concept of AC generally to the systems actors. It doesn't look for measures on innovation output from use of external knowledge, but uses the concept to discuss the regions and actors knowledge exchange. In addition, the political system of regulations, laws and public actors is presented more explicit and can contribute empirical to the understanding a government's role in the triple helix.

3 Methodology

In this chapter I will outline the choices of design and data collection. I will also describe the process of conducting the interviews as well as the analysis, and include some of the changes and challenges along the way. In addition, I review the quality of this thesis by discussing its validity and reliability, and also some ethical concerns. With this I hope to provide a sincere and rich description of the methodology used in this thesis.

3.1 Design

Research questions can have an explorative or descriptive character. The thesis asks what characterizes an emergent regional innovation system, what it consists of and what this can tell us about the functioning of the innovation system, and has thus a more explorative character (Hay, 2010).

One of the reasons behind this choice was my prior knowledge about the waste sector and the Oslo Region. In the spring semester I made contact with the Work Research Institute (AFI) through The Science Shop. AFI searched for a student to contribute in their project *«Understanding the Dynamics of Regional Innovation Networks in Regional Innovation Systems»* which is a Research Council of Norway's Programme for Regional R&D and Innovation (VRI) (Forskningsrådet, 2015). AFI and researchers from the Norwegian Institute for Urban and Regional Research (NIBR) and Buskerud Vestfold University College are studying four networks in Vestfold and three in Oslo/Akershus (AFI, 2015). Project leader Helge Svare and senior researcher Anders Underthun at AFI introduced me to these networks and Oslo Renewable Energy and Environment Cluster (OREEC) stood out as interesting. Together with Anders, which also has been one of my two supervisors; I met one of OREEC's project leaders which gave an introduction of what had happen and was happening in waste management in the Oslo Region. After living in Oslo for ten months most of this was all new to me and it caught my attention as it has eminent social relevance and was an interesting case for studying regional development and clustering.

From this, an explorative research question felt natural and also affected my choices of research design. An intensive design was appropriate because it concentrates on understanding the case specific, for example how processes work, what is being done and

why. The opposite is an extensive design which can be relevant in finding regularities and patterns in a larger population (Hay, 2010). As a consequence, an intensive design often has more variables and fewer units then an extensive design which has few variables and many units (Jacobsen, 2005).

A case study is useful to understand how something happens and in what context and was therefore appropriate to answer the thesis RQ's (Yin, 2009). A case study can use both qualitative and quantitative methods and my choice landed on the first one (Hay, 2010). I felt that my prior knowledge was too limited to collect quantitative data in a good way. For instance it felt difficult to formulate questions to a survey and it also was difficult to state testable hypothesizes. Parts of the secondary data in the document study are based on quantitative data, but it could have been complementary to do an analysis of already collected CSI-data as well. Or a survey could have tested some of this thesis' hypotheses in an extended research project, and consequently resulted in a method triangulation which potentially could have strengthened the thesis validity (Jacobsen, 2005).

The choice was also related to the objective of capturing what was system specific. In the System of Innovations approach there are literature and concepts which bring ideas on what to look for, but no "best practice" systems or no ideal system to measure against (Edquist, 2005). Since a RIS can be understood through its activities and actors (Asheim et al.,2015) I felt a qualitative method was helpful in exploring some of these. A qualitative method has also been highlighted as appropriate to interpret social processes and social, cultural, environmental, economic and political structures (Hay, 2010). And because the research questions also ask to capture arenas of interactions, which can be places and events, in-depth interviews could have be appropriate in revealing underlying structures (ibid.).

3.2 Data Collection

Choices regarding the data collection are often an extension of the choice of design. The thesis uses primary data as well as secondary data and is therefore built on data collected to answer this thesis' research questions and data which is collected with another purpose and sometimes interpreted and tailored into a another context (Jacobsen, 2005).

To get width and multiple angles to the case it was helpful to collect data from several sources and the different collection methods have different strength and weaknesses and thus they can

complement each other and contribute to rich and deep data (ibid.). The data is collected through a document study, observation and participation on two events and semi-structured interviews with representatives from different organizations, departments, agencies and institutes involved in waste management in the Oslo Region.

Document study

I used the document study to search for additional data on waste management and region. I have read different reports, public papers, white papers, European Commission, statistics from the SSB, but also a lot of articles in local, regional and national papers and information from different homepages to get more information. For example, data on regional projects, actors which I didn't get to interview. The document study gave me knowledge that became useful when I later interviewed actors and it also contributed with a greater understanding of the system political and supportive framework and the role of different institutions. The document study continued throughout the whole process as there often were new elements I needed additional information on.

Observation and Participation

Second, I collected data through participation at a workshop arranged by OREEC and two days at the annual Waste Conference 2015. The first was an arrangement for professionals involved in planning and service development within household waste and invited the participants to discuss how the waste sector in the region could be (even) more innovative. The conference had the title CSR and industrial profitability and offered a various angles and topics on this. Participating in such events can create opportunities for informal conversational interviews with questions that occur from the given context (Patton, 2002). In case of such conversations it became important to go with the flow to see what came out of it (ibid.). For me there were several outcomes from these events. First, it was a way to learn more through participating and listening. Second, I got in contact with some key actors and third, it contributed to some data through notes from materials, meetings, observations and more. Through the workshop I experienced how actors actually meet in practice which contributed to more understanding of OREEC facilitating tools and instruments. At the conference I learned about relevant topics and got ideas on whom to interview through the presentations.

Semi structure interviews

Third, the data was collected through semi-structured interviews. Combining interviewing with observational data has been highlighted as a suitable way of doing qualitative research, because one can question what one cannot observe (Patton, 2002). This was also the case for me, and the three different collection methods felt complementary.

Selection

The selection process was built on strategic selection (Tjora, 2010). To be able to capture and analyse the system in the region I wanted to speak with actors which represented the different areas of waste management. I also wanted to speak with the traditional parts of a triple helix, the knowledge explorers, exploiters and the supportive framework. I therefor contacted public organizations, research institutes and universities, private companies, private spin-off firms. It is however challenging to capture all relevant actors and subsystems in the region. It was also difficult to know how to get most information. Because of the time and resources I had to make some limitations on the data collection. The thesis was also formed by the group of actors I did get in contact with. During the process were choices of RQ, concepts and theories adjusted.

In the selection process both Anders at AFI and Marianne at OREEC was helpful in deciding and finding candidates to interview. OREEC was somehow the beginning of a snowball sampling, which is a technique where one asks about others that might be interesting to participate (Hay, 2010). In this case it was also a way of finding key actors or several that had been involved in common events or projects. In several of the interviews I asked for this, but in the most cases it was brought up naturally by the candidate. This also made it easier to schedule interviews. I could refer to other familiar names which I had already spoken to and I experienced this to be useful. In those cases where I referred to others, no one declined and even scheduled an appointment only days after. In the other cases it was more difficult and took longer time to get response. One group that it was difficult to make contact with was some of the private firms and Spin-off companies. This changed the initial objective I had on studying the firms' Absorptive Capacity more explicit. The alternative became to make a broad use of the concept on the systems users – also those not profit-driven.

Execution

There were in total 16 interviews representing 12 different organizations or departments. In some organizations I spoke to several persons, for instance three at Hjellnes Consult, two at

ROAF and two at Oslo REN. I also interviewed some that were employed by several institutes or various departments. Two of the interviews, one at OREEC and a meeting with Hjellnes Consult at the waste conference, were shorter informal conversational interviews. Weakness of this type of interview is that the data can be hard to put together and analyse (Patton,2002). My experience was that they were useful as I built on them when I later met the same persons for a more structured second interview.

The persons interviewed represented the organization, agency, department, institute they worked at and the interview was not about them as private persons. Some of the interviews had elements of being more 'expert interviews' (Flick, 2006) where they in some parts of the interview also contributed with general considerations on relevant topics, techniques, the region and different industries. In some cases there was some confusion in the different use of words and expressions. When I was uncertain of the understanding I asked and I encouraged them to do the same. This, together with the checking of quotations, strengthened the data and avoided misunderstandings.

Most of the interviews was held at their offices or meeting rooms. This resulted in many hours on public transport to different locations in Oslo and Akershus. This was exiting because I also got to see some of the plants and facilities.

In the interviews I used a prepared interview guide**.** This was partly structured after concepts from the Triple Helix and RIS-literature, some questions inspired by the AC-model (Zahra & George, 2002) and I also used questions from a guide developed by AFI. Using an interview guide can ensure that the researcher follows the same lines of inquiry with everyone that are being interviewed (Patton, 2002).

For me it was just as much about structuralising my data so that it would be easier to conduct the analysis with use of concepts and literature form the theory chapter. I wanted to look for congruent patterns in the Regional Innovation System. I therefore developed a semi-structured interview guide which was divided into main areas I was free to explore within. The strengths from doing so is that it gives a good structure and effective use of the limited time you often have during an interview (ibid.). It was also useful because I could prioritize after what areas that turned out to be interesting, but still I was able to look for and compare different responses which facilitated the analysis (Patton, 2002). In addition, it was necessary to vary the questions after whom I was interviewing to capture and understand their roles. This led to

that some parts of the interview guide remained constant, but with some variation in the questions.

This allowed an open dialogue during the interviews and room for asking follow up questions when they arrived. This opened for digression and turned out to be important as many of the topics in waste management ware completely new for me and thus I didn't risk missing out on important aspects which I hadn't thought about before I created the guide. The qualitative method and the collection methods added flexibility in this (Tjora, 2010).

Analysis

Each interview lasted between 35 to 90 minutes and resulted in a transcription of 14 hours of data. I then translated it from Norwegian into English. During the translation from oral to written, and from one language to another, one can risk to lose or change some of the original meaning and context. I tried to be consequent on avoiding this and I also sent the summary and quotes I used to the informants so they could comment and correct if something had been lost during the translation.

I then codified the material using the already defined topics from the interviews, but also by adding several concepts from the literature to recognise examples on for instance knowledge diffusion, intersections between actors, concrete innovation processes and projects and more. I did this in word and also by hand, using colours to mark the different words and examples in the material. Some of the headings I used was "examples on knowledge sharing", "regional projects" among others.

Second, I structured the material analysis after the three sub questions. The first one focused on the actor and their role, the other section was about the systems arenas. In the analysis I have tried to identify firms and organizations in the regions knowledge structure, and then analysed their role and their linkages further. I have also used the findings from the document study and my own notes from the workshop and waste conference and analysed them together with the material from the interviews. The analysis has also searched for similarities and differences with previous findings in the literature to further develop concepts and contribute to theory development.

3.3 Quality

Has the thesis methodology been able to answer the research questions in a good way and will others be able to replicate this research to test its reliability?

Through earlier discussions I have argue for the strengths of my choices regarding design and collection and the way they are chosen to answer the research questions, and thus discussed the validity of my data. The qualitative method seems to have contributed with rich data to analyze this case (Hay, 2010). As mentioned, method triangulation could have been useful to understand more of what characterizes the system, and also covered a larger area of the waste management in the Oslo Region. Despite that some of my choices were affected by what was manageable due to prior knowledge, time and resources available I'm pleased with the outcome from the collection method on answering the research questions. The thesis builds on data from key actors from different parts of the sector and region, which has been involved in several of the regional processes and projects. Several in-depth interviews, events and document study have contributed to a rich and interesting data material to best answer the research questions. This also represents multiple sources of evidence, which can strengthen the reliability (Yin, 2009).

Since qualitative research is an interpretive tradition it is relevant to reflect over my role as a researcher through critical reflexivity (Hay, 2010). I have done so by explaining the process of selecting informants and how the interviews were conducted. I have also given information on how the data has been used, coded and analyzed. Several of the informants did share with me that the interview had given them some new thoughts and perspectives, and this illustrates the effects of research and that it might have changed the parts involved.

I have attached the invite from the workshop I attended, as well as the conference program and the interview guide in order to strengthen the reliability of the research (Yin, 2009).

3.4 Ethics

This research is also relevant in a bigger picture. It touches upon region policy, urban development and can be relevant for the government and actors in the waste sector. It is also relevant for the citizens who use several of these public services. The waste sector is also a transparent and small sector in Norway which has had some political debate during the summer, and it has been important for me to be aware of the potential contribution on this through my study. However, it was been important for me not be mistaken for a journalist with a mission on revealing different political opinions between sectors or actors, but a researcher in innovation studies.

To maintain the informants' rights I sent over an e-mail with information about the research project: what was the purpose, how the data would be used, as well as what the main topics for the interview and the right to withdraw anytime during or after the interview. The participation has been by free will and informed consent. Before the interview started I briefly repeated this and answered questions they had. After the transcription and translation I also sent an email for inspection and read-through. They were thus given a possibility to add or adjust. Some accepted it straight away and some required some corrections. All of my informants have approved their quotations. They were also given the opportunity to be anonymized, but no one saw the need for this.

The project is reviewed by the Norwegian Social Science Data Services (Norsk Samfunnsvitenskapelig Datatjeneste, 2015).

4 Empirical and Analytical Chapter

The chapter gives a presentation and discussion of the empirical findings. The data is collected through a document study, 16 interviews from 12 different organizations and agencies and attendance a workshop about the waste sector and innovation and an national waste conference.

First there will be a contextualization of the waste industry and the region and then the rest is structured after the research questions. The first section presents the system, its different parts, and some main actors. Then the next section presents some of the arenas of interaction that exists in the system. In this there will also be discussions on what factors seems to inhibit or promote the functioning of the system. The chapter uses concepts and literature from chapter 2 to discuss and analyze.

Since the transcriptions of the interviews were originally in Norwegian, the material has been translated. The interviews will be referred to in general and also with some quotations. Unless otherwise noted, all translations are the author's.

4.1 Contextualization

In the following sections a contextualization of the waste industry and the Oslo Region is given.

The Waste Industry

The development towards the waste industry that we know today has evolved through different perspectives on waste. For example can the wide use of landfills can be related to an early "Out of sight, out of mind"- attitude and in the year 1860 the municipalities became responsible for reducing the health- and hygiene problems which had aroused from littering (Avfallnorge, 2014a). The new perspective became destruction of waste and over time it became a central topic in environmental related issues which developed the industry further (Oslo kommune, 2013). Waste was also recognized as an energy source and created developments within waste-to-energy (Coolsweep, 2014). Today waste is related to questions of climate and resources and a role in a wider context of social and economic development.

As a result, the collecting and treatment of waste has become more organized, specialized and industrialized. With more waste and new types of waste, numerous different waste streams are moving through various businesses and markets, involving new technology, operations, and regulations. The extractions of waste value chains are revealing a quite complex and large area.

Although we today have a resource perspective on waste, the legal definition states that waste is all discarded objects or substances, including superfluous objects and substances from service industries, manufacturing industries and treatment plants. However, wastewater and emissions are not. The law separates waste into household waste and waste from public and private enterprises and institutions. A third group is hazardous waste; treated separately because of the size and the risk of serious pollution or injury (Forurensningsloven, 1981:§27).

The common way to define the waste industry has been through the main activities collection, treatment and recycling of waste. In this definition, there were about 8000 employees and an annual turnover on 22 billion NOK from the industry in Norway in 2012 (Avfall Norge, 2014b). Some are specializing in technologies and systems for waste collection; others are working with reuse, recycling stations and - systems. Some specializes in certain materials and there are experts on biological treatment and biogas plants creating compost, fertilizers and biogas from waste. There are also those working with energy recovery from waste in Norway's 17 incinerations. The first one was built in Oslo in 1967; today they are handling 1.7 million tons of waste and are responsible for 50 % of the production of district heating. There are currently actors looking at reuse and storage of CO2 from incineration of waste. Last but not least, there are those working with hazardous waste and landfills (Ibid.).

This displays a range of heterogeneous actors and the industry involves different disciplines, sectors, businesses and interacts with other industries. It has clearly evolved and examples from today give reasons to believe that we will continue to see some major changes - in both the perception of and in the systems for waste.

The Oslo Region

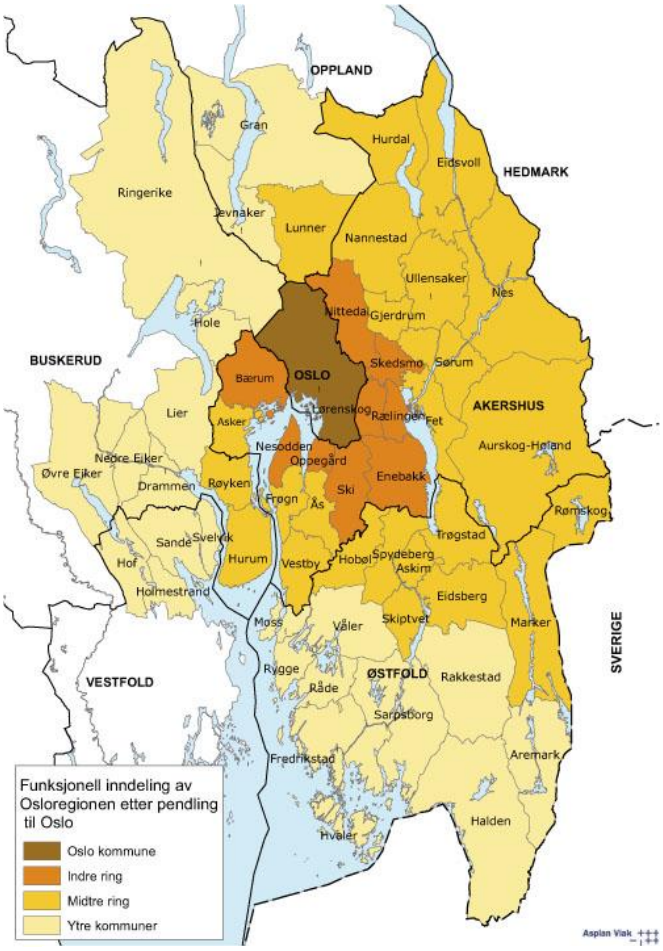

Figure 1 The Oslo Region

Figure 1 illustrates the Capital Region in Norway (Kommunal- og moderniseringsdepartementet, 2006) and is one way to illustrate the region. It involves the counties Oslo, Akershus and parts of the counties Østfold, Vestfold, Buskerud and Oppland. However, The Oslo Region must not be mistaken for the larger Norwegian region that we call Østlandet; that also covers the counties Hedmark and Telemark. The majority of the data material is from the brown, orange and dark yellow area, and is a result of practical aspects. The intention is not to draw a final line on what is outside or inside the Oslo Region.

A report on renewable energy and clean technologies in Norway in the period of 2004 to 2013, on behalf of OREEC, brings some interesting observations about the Oslo Region Waste management has experienced solid growth in this region and the report mentions examples of great public investments among municipalities on this. Representatives from around the world have been visiting some of the regions facilities to be inspired of what they have achieved and how they have managed to do so. Waste management is usually resolved

locally and the region is highlighted for companies that deliver specialized solutions. Some regional companies are experts in solutions for different waste types and streams and there is an impressive group of experts in academia, research and consultancy. These have functioned as support and strong contributors in the regional projects and elsewhere. There are also advanced technological competence in the region that is relevant for the waste industry, and some of these firms have experienced success international (Menon Business Economics, 2014).

4.2 The Emerging Waste Innovation System in the Oslo Region

The next sections will present and analyze the emergent innovation system in waste management in the Oslo Region. The first part focus on the system's parts and actors, the next section looks further into the arenas of interaction and what seems to inhibit or promote the functioning of the system.

4.2.1 Actors and Institutions

Figure 2 is inspired by the framework in chapter 2 and is meant to give a visual impression of some of the empirical data. An actor can be companies, municipalities, universities, cluster organizations or others from and around the subsystems (Edquist, 2005) Institutions are routines, established practices and norms, but also laws and regulations, which forms and are formed by the actors (Edquist & Johnson, 1997, Asheim, Coennen & Moodysson, 2015). In the circle we find examples on arenas of interaction which bring examples of intersections between subsystems. They can tell us something about the functioning of the system and will be elaborated in a later section.

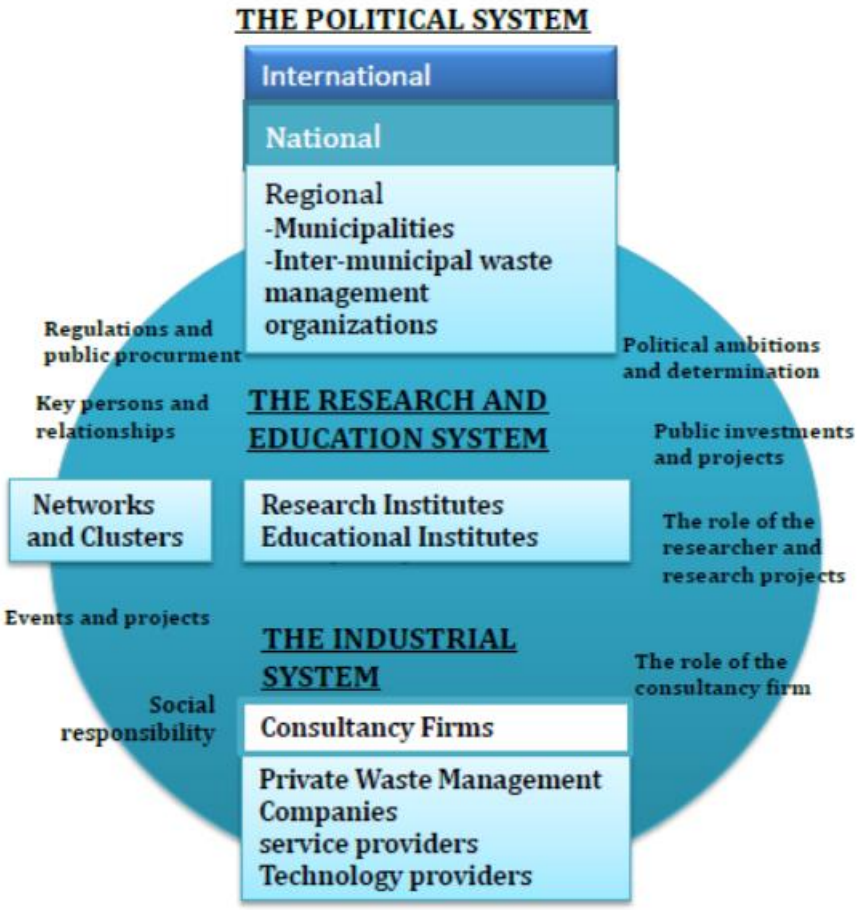

Figure 2 Visual presentation of the material

The political system

The waste sector is governed by various policies and laws developed at local, regional and national levels, increasingly also the EU level in particular based on the Waste Framework Directive (WFD) (EU, 2008). The WFD's five steps Waste Hierarchy has since the late 80s been governing in the EU and in the early 90's it became a guiding principle also in Norway, even though economical considerations still continued to determine (Avfall Norge, 2015).

Designed as a reverse pyramid it shows directions on how to prioritize between different solutions. The level at the top is most desired with its solutions for waste prevention. The second level is also waste reduction involving operations of cleaning, repairing, re-use and recovery. Third is a level for recycling and re-processing materials into new products and materials. The forth is a recovery level with solutions like incineration of waste and at the bottom is the disposal category (EU, 2008).

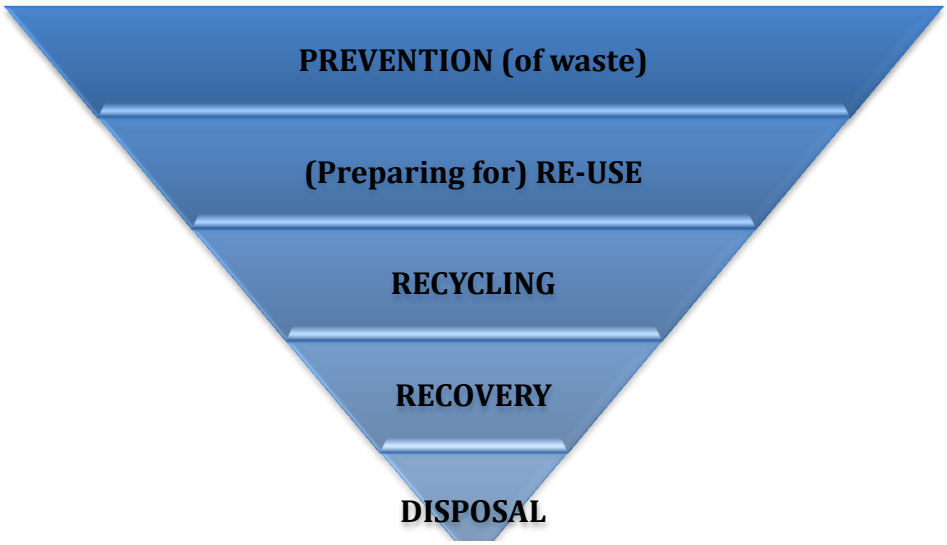

Figure 3: An illustration of the Waste Hierarchy

The Waste Hierarchy is a part of a bigger approach called the Circular Economy (EU, 2014). This is an opponent to the more linear economy and a use-and-throw- mentality; perceiving resources as limitless and waste as easy to manage (Utenriksdepartementet, 2014). In the movement towards a circular economy it becomes crucial to hold the resources in the economy. Recycling and re-use are highlighted as ways of providing resource efficiency and reduce negative environmental impacts. The movement is believed to reduce Europe's dependency on imported raw materials and further promote economic growth and employment (EU, 2014). A Circular Economy involve the entire value chain of production, consumption and the market for use of secondary raw materials; including design, product labelling and information, public procurement and more. On that account there is a need for further research, innovation and investments in technology and infrastructure to succeed (Europalov, 2014). Last summer the European Commission adopted a new legislative proposal as a part of the circular economy package with ambitious targets and instruments (European Commission, 2014). This proposal was withdrawn and they announced a more ambitious proposal in 2015 (EC, 2015).

The Ministry of Climate and Environment has the main responsibility for Norway's waste policy. They acknowledge waste as a resource, have specific targets related to the WFD, and a priority is to secure that neither the inhabitants nor the environment suffers from potential

negative effects caused by waste. They aim to ensure that the developments in waste quantities are kept lower than the economic growth and reduce the hazardous waste (Klima- og Miljødepartementet, 2013).

The practical guidelines and regulations are administrated at a national level and the municipalities are responsible for ensuring that waste from the households is collected and taken proper care of; with the county governors as supervisors. The residents pay a service fee for these public services, and the full-cost principle is ensuring that the fee doesn't exceed the cost of the public services dealing with the waste (ibid.). It is embodied in the national strategy (Klima- og Miljødepartementet, 2013:21) that the municipalities can decide what the best solutions are for their inhabitants and the service fee can therefor vary between municipalities. There are different political parties governing the municipalities, and consequently resulting in different ambitions regarding waste management, affecting the choice of solutions. Due to a pollution-pay-principle the municipalities are in a position to increase their charges establishing better systems (Avfall Norge, 2015).

The industrial waste is the enterprises' own responsibility and must be delivered to a proper waste deception (Forurensningsloven § 32, 1981). The most common solution is hiring private waste management firms (Avfall Norge, 2014). Also in related to waste policy are different producer responsibility schemes and industry specific agreements on packaging are signed between the Ministry of Climate and Environment and the industry (Avfall Norge, 2015).

The political system consists of both decision makers and those who implement. For instance, we have the municipalities and their waste agencies or companies. Some have also arranged this in inter-municipal waste management companies.

ROAF

One example is Romerike Avfallsforedling, an inter-municipal waste management company owned by 10 municipalities in Akershus. The company have their vehicles running on biogas from local food waste and in the beginning of 2014 a brand new central sorting facility was ready to handle waste from their 190 000 residents. For this work ROAF has been awarded with several prices; for its use of different technologies in new and excellent ways, its environmental contribution, and their knowledge sharing in the industry. One was the innovation price at the annual Norwegian Waste Conference in 2014 (ROAF, 2015).

The CEO at ROAF, Øivind Brevik, describes a six year period of great expansion and development for the company. In this period they have increased their workforce, reduced their purchase of services, advanced several of their services and added new ones.

"I remember from my first year how ROAF were considered to be quite slow and old fashioned, while today we are almost the spearhead. This illustrates that it is possible to achieve quite substantial changes in a few years, thanks to owners and a board that are willing to do the actions required" The CEO at ROAF

It is the full automatic central sorting of plastic in five different qualities that has been the innovation with a capital I. The 6000 square meter facility is the only one in the world doing this (ROAF, 2014) and the CEO underlines how the quality has been great.

Several regional companies were involved on this project; the technology was delivered by Tomra Sorting and Mepex Consult was working with the planning and design phase. Both the CEO and the Head of Development elaborate how ROAF from the beginning was involved with own ideas and supervision. In addition to good dialogue and support from their owners, solid research and meticulously planning, the determination and work of the CEO is highlighted as important for the success.

ROAF is one that seeks to be in the lead in reference to knowledge sharing from their processes, making it a deliberate strategy in the company (ROAF, 2010). Another of their pillars has been to direct their gaze beyond. The CEO explains that visiting others, both regional and international, collecting experience and ideas, have great utility for them.

ROAF has experienced an industry that is skilful in knowledge sharing and have all over witnessed a productive exchange of experience in the region. The head of development at ROAF remember how they shared all the relevant information needed when Interkommunalt Vann, Avløp og Renovasjon (IVAR) in Stavanger had an ongoing project similar to ROAF's. In the early phases of their own project it was ROAF who depended on collaboration with Øvre Romerike Avfallsselskap (ØRAS) in using their green bags to test their new facility. The CEO underlines that today, ØRAS, ROAF and Oslo are all using green bags for sorting out food waste, which means that approximately 900 000 of Norway's population are offered the same solution.

Follo Ren

Follo Ren is another inter-municipal waste management company. Five municipalities own this company and it's located in Vinterbro, Akershus. Until recently Follo Ren was working on an innovative holistic concept on waste management. The overarching goal of the project "Kretsløp Follo" was to contract more resources out of the residual waste and return it to the circuit. Furthermore, the solutions in both collecting, sorting and treating of the food waste was meant to be top notch (Follo Ren, 2014).

"I believe it would have revolutionized a lot and been a step in the right direction in relation to the challenges on what to do with what's left in the residual waste bags"
Head of Project and Development at Follo Ren

Follo Ren and their owners had landed on a solution for a new central sorting and biogas facility in 2009-2010. In this solution the residents would be responsible for sorting out paper, hazardous waste, glass and metal, and the rest would be up to the machines to sort. One of the main ideas and objectives was to bring out almost all the food from the waste bags, in comparison to the alternative at-home-sorting-solution with only 50 to 60 % extraction. Head of project and development, Astri Thomassen Ekroll, explains that they were considered to be the innovator during this work and in the planning of the project they had ongoing projects with Bioforsk, NMBU, Østfoldforskning and several others.

During this work they experienced how operating in an inter-municipal company can be complex when things do not run as planned. The board consists of representatives from the owner municipalities and can vary in background and knowledge on waste. Additionally, there is a supervisory board of (vice) mayors. And in case of issues involving big financial risks, each respective council has to vote over it. Hence, the amount of people involved in a decision can become enormous. In the case of Kretsløp Follo the project costs was adjusted up with 130 MNOK to be able to meet new and stricter requirements. This was almost a doubling of originally budgeted costs and eventually it toppled the project.

Follo Ren did learn a lot from this and Ekroll underlines that good dialogues with the owners, sharing the right information and also making sure it reaches the right individuals is crucial when working with innovative projects like this.

The city of Oslo

"In Oslo people can deliver waste from their gardens and leave with fertilizers made of last years' waste. A local circulation like this is beneficial and effective because it is visible and simple". Senior Engineer at Oslo REN, Andreas Dalen, about the circular economy ideas that exist in Oslo

Oslo has been recognized for its work towards a green and environmental friendly city. With a clear political mandate Oslo has dared to do things that haven't been done before. There have been some courageous choices and investments in for example infrastructure and facilities and in this work Oslo has explored and applied local technology from the region.

Recently, the Climate and Energy Programme in Oslo (KEP) finished their new strategy (Oslo commune, 2015a). The Development Director, Øystein Ihler, explains that this work involved 140 persons from 40 enterprises during a one year period. The overall aim has been to reduce the greenhouse gas emissions with 50 percent within 2030 and reach a zero emissions target within 2050. The city's circulated waste system has together with the program of fossil free public transport within 2020 been cited as examples of the suggested 74 in the action plan to reach the targets

"It is our mind-set that is new and leading. And what strikes me the more I think about it, is what we have managed to do in the field of circular economy as in the waste area, t, we wouldn't have been able to accomplish both the proposed strategy and the action plan"
Development Director, KEP

Ihler has since 2005 worked in Oslo EGE. The agency is Oslo's waste-to- energy agency and operates and develops the industrial waste treatment plants. Oslo EGE has for example two incineration plants and through the company Hafslund they deliver heat to the city residents through their district heating network (Oslo kommune, 2015b). And it was back in 2005 that EGE's first platform was created with an ambition of a circular economy. After several inspiring visits to Sweden, The City of Oslo decided that food waste should be removed from the waste stream so that they could produce renewable energy to fuel. The main force behind this operation was the interplay between the management at EGE, REN and Hafslund. Ihler

explains how the process was political driven with continually input and inspiration from Sweden and Germany. Oslo EGE actually became a member of Avfall Sverige[1].

"What we have managed to create of waste solutions is actually an example of an innovation that is politically driven" Development Director, KEP

Oslo EGE has invested in high technology treatment facilities. Ihler explains that the real innovations are their optical sorting solutions (which separate green bags of food and blue bags with plastic from the residual waste) and of course their biogas factory in Nes, Akershus, called Romerike Biogass Anlegg (RBA). The latter was in collaboration with Cambi and they won The Research Council of Norway's innovation award in 2012[2]. It was at that time Europe's most advanced biogas plant, based solely on food waste. Ihler explains how they designed a value chain that delivered biogas in two different conditions, either liquefied or compressed biogas and performed the engineering of two alternative end sections of the factory. They also negotiated two different contract systems to handle this. The project demonstrated how it was possible to use related industry competence. Oslo EGE also benefited from the competence and knowledge on biogas at Frevar KF during this project which has been a pioneer in this topic.

This summer, Oslo became a part of a new EU-infrastructure program (the GREAT project, 2015) which means that Oslo most likely will be the first corridor with energy stations that welcomes trailers running on biogas. Ihler underlines how this can be understood as a spinoff from the work with the biogas plant.

"Oslo was the first one to build incinerations; Oslo built sorting facilities, biogas plants and Oslo had waste collection through a pipe based underground system. We were also among the first in recycling paper and glass" Senior Executive Officer, Oslo REN

Oslo REN is responsible for the waste management in Oslo and Senior Executive Officer Håkon Jentoft describes that Oslo traditionally has played the part as a developer and a driving force in the industry. However, there was a ten year period from 1995 to 2005 when Oslo was more behind other regions. Jentoft explains how a lot of the work at Oslo REN and Oslo EGE is a result of politicians with high ambitions in terms of environmental concerns.

[1] The national waste organization in Sweden
[2] The statement can be read at www.forskningsradet.no

And over time it has become an alternation between these policies and the agencies, with mutual influences and shared focus.

ROAF, Follo Ren and the city of Oslo provides examples on public waste management. To summarize, these are public actors which sometimes seem to operate in an intersection between political instruments and more commercialized activities. They show great engagement, will, competence and have together with risk-taking owners managed to contribute with some great developments in the region. It indicates good, but also somehow complex, relationships with owners and politicians, and the inspiration seems to have gone both ways.

Several other public actors have been praised for being innovative and taking environmental concerns during this study: Frevar KF in Fredrikstad - highlighted for their biogas competence and Lindum AS in Buskerud in how they have been proactive in the field of hydrogen.

The System for Research and Education

This system of different research institutes and educational institutes explore and produce knowledge through education, scientific articles, spinoffs, research projects of both regionally, nationally and internationally character, which they also engage other actors to be a part of. The system has various training courses at high school levels and up to PhDs. This contributes to triple helix arrangements at different spatial levels and sources for economic development (Etzkowitz & Leydesdorff, 2000).

However, the number of young people choosing the recycling art and taking certificate of apprenticeship has been low in Norway. So has the interest of jobs and recruitment challenges were one of the topics at this year's waste conference (Avfallskonferansen, 2015). Still, there may be some reason for optimism as a result of the sharp decline in the oil industry, in the way it can contribute to increased attention to the sector.

At the higher levels of education there has been a joint action in lifting the competence in disciplines involving waste. Avfall Norge and Avfallsforsk (Network of waste-related R&D in Norway) have together with Norway's largest cities worked with the project *Kompetanseløftet 2020* which has an overall objective to highlight the industry and strengthen the waste subjects in colleges and universities. One way is including waste as a natural part of

topics in sustainable urban development and community planning, nutrient recycling, treatment technology, microbiological processes, renewable energy, climate change and logistics in a larger scale. So far it has initiated two professorships in waste. One of these will be at The Norwegian University of Life Sciences (NMBU) in Akershus (Avfall Norge, 2014c)

NMBU

Ole Jørgen Hanssen, who holds a 30 % position at NMBU in renewable energy, food science and packaging, explains that this competence lift is needed. NMBU are today offering different bachelor, masters and PhD programmes of relevance for the waste industry, and Hanssen has experienced a strong professional environment. Especially within the biological aspects NMBU have been excellent and have great potential of becoming the spearhead. But they have experienced a decrease in capacity and students in the waste related courses compared to the situation ten-fifteen years ago. If this is a lasting trend the country will, in the worst case, not have candidates for higher education programmes in the long run. Then we could end up without any national educated special expertise left for the waste sector, Hanssen underlines.

Østfoldforskning

Another actor is Østfoldforskning which is a national research company contributing to knowledge for sustainable development through innovation (Østfoldforskning, 2015). Ole Jørgen Hanssen works as a senior researcher and explains that Østfoldforskning has worked with different issues relevant for the waste sector for over thirty years. Even though they are located in Østfold, they have experienced to have more impact nationally than locally. The projects are in general distributed 20 % locally; 60-70 % are of national character whereas 10-20 % are international projects.

The senior researcher explains how the research communities have been a momentum for the waste sector. With a solid contribution of ideas they are also getting others on board. Hanssen elaborates that the philosophy at Østfoldforskning is to seek research with others and not research for. They have experienced that the waste sector in general is engaged and not difficult to involve in new thinking and projects. Lately, they have witnessed how the big municipalities and public actors have come forward and taken the lead. Hanssen mentions Lindum, Frevar and Follo REN as examples among others. The interconnection between research and the waste sector has also been important for project financings and support, for

example through the Research Council of Norway. However, Hanssen underlines that there is a lot of potential in establishing more projects, for example through the BIA program and the Environmental Technology Programme at Innovation Norway (Innovasjon Norge, 2015).

IFE

IFE is an international research foundation for energy and nuclear technology, located in Kjeller, Akershus. Among others, the institute works for a more climate friendly energy system based on renewable energy and CO_2 free energy. IFE has for instance a framework agreement with Oslo commune to give advice and inputs to the development and implementation of Oslo's new energy strategy (IFE, 2014, 2015). Research Scientist at the department of Environmental Technology at IFE, Julien Meyer, explains that through system analysis and technology development, IFE develops models and technological solutions that have the potential to allow the city reaching its ambitious goals on reducing local greenhouse gases emissions.

Meyer elaborates that their collaboration with Oslo EGE and The Climate and Energy Program, KEP, is strategic and important for IFE. As an example, Oslo's commitment to produce and use biogas in an efficient way opened the door for collaboration with EGE involving a technology developed at IFE. Enhancing the methane production in the anaerobic digestion process and converting the methane to renewable hydrogen is an attractive option for EGE. IFE's process can allow combining the CO_2 removal and methane conversion in one single step and is attractive due to process simplification, high efficiency and potentially reduced production costs. IFE and Romerike biogas plant (RBA) are now working on the possibilities to implement this new technology through research and development, using several research programs and funding schemes. IFE's research collaboration with universities like NMBU is also important and complementary for IFE to increase the national knowledge base and to contribute to better and advanced solutions for technology users like Oslo EGE, Julien Meyer explains.

To summarize, this subsystem consists of engaged actors which take initiative to spread and develop knowledge through different forms of collaboration. The competence and expertise seems strong, complementary and relevant for various parts of the waste value chains. Yet, there are concerns as to how the future will look like and initiated actions to deal with this. The strengthening of training courses at universities and encourage to contribute in more

national supported projects are two examples which can improve both the analytical and synthetic knowledge bases that exist within the waste sector (Asheim & Gertler, 2005). These initiatives can be important for the National System for innovation as well (Cooke, 2001). There are also examples where they take initiative to use their competence in new ways, which indicate a prominent role in creating partnerships with industry and government (Etzkowitz & Leydersdorff, 2000).

The Industrial System

In this system we can find consultancy firms, manufacturing companies and specialized service providers, among others. They are in different ways profiting on waste and they also illustrate the various and broad knowledge bases which operates in the waste sector.

The consultancy firms are somehow knowledge intensive firms in the way they work at various projects. Some are international and multidisciplinary consultancies, like COWI, Norconsult and Asplan Viak, others are smaller or more specialized and some have home base in the region. Hjellnes Consult and Mepex Consult are two firms which have been involved in several large projects in the region.

Mepex Consult

The CEO, Frode Syversen, describes Mepex Consult as a company involved in many different networks and projects. They have experienced that they have been the link in many networks because of their solid experience and competence. We often functions as an invisible hand, Syversen adds.

Mepex Consult has worked with private companies on producer responsibility cases and recycling and they have had projects with research institutes like Østfoldforskning. But it is the government and the public sector that has been the key clients. Mepex Consult was a part of the project of building the new central sorting plant at ROAF and they functioned as project leader for Oslo's new optical sorting facility.

The CEO explains how they are challenging their clients to think broader and better. They do so because they believe that good solutions emerge through dialogue and processes. The work at ROAF was an example on this and they came up with good solutions together with the client. ROAF had political drive, great belief in the project and took a calculated risk which was crucial for the success, and Mepex Consult played a significant role in the execution of

the project. They delivered a good process, broad competence and worked with under-suppliers and cost-effective requirements.

Due to the transformation process and movement towards a more lifecycle-based waste system the CEO sees how the company's social role and contribution can become relevant and important in the years to come. A lot of the concepts and ideas existing in the industry today are not new for them; they see great potential in increasing the efficiency in the waste value chains and wish to contribute in filling these concepts with informative and good content.

Through their work, Mepex Consult has witnessed that a lot of the development in Oslo region, and in the country as a whole, has been about adapting the technology development into Norwegian conditions. For example in how high payroll costs contribute to more automated solutions. Even though there have been some new solutions, Syversen explains that most of the innovations in the Oslo region have been system innovations more than radical technical ones. The development and commitment in Oslo has brought international attention and the CEO at Mepex believes that the Oslo model can contribute to inspire medium regions in finding holistic solutions. Nonetheless while aiming to develop markets, reach commercialization, and sell competence and concepts; it becomes crucial to show off local companies, businesses and technology.

Hjellnes Consult AS

Hjellnes Consult is an interdisciplinary company working in the two main arenas; Infrastructure and Environment and Buildings and Construction. The first one holds an expert group in waste and environmental issues and is one of Norway's leading consultancy firms in this area (Hjellnes Consult, 2015). Although Hjellnes Consult are localized in Oslo and have most of their projects in eastern Norway, they hold a strong reputation amongst clients based throughout the country.

Kjetil Hansen, leader of the waste and environmental consultancy, explains that many of their projects have been small, limited-time assignments with well-defined problems. This has given them solid breadth of competence in waste as it is through the projects they are learning and get better. Their main clients are in the public sector.

They also sign up on large projects where they are involved from start to end. This is because they are an actor with passion for waste management and wish to influence with their

competence. Hansen underlines that they experience to be capable of influencing their clients to take the right and important choices. Major projects are also an attractive arena in the way they meet other actors. By working together they become more confident in each other and it is easier to make contact later. Particularly exciting is it to meet others with another expertise field that they can learn from and vice versa.

It is given high priority to support local initiative and innovation, although the company is project-based and need to take commercial considerations. For example Hjellnes Consult has been active in OREEC; a cluster which they have experienced as capable of professionalizing its work where others have failed. However, Hansen adds that it can be difficult to be as open as the cluster wants them to be, precisely because the company is a profit driven company with business secrets. Marketing director in Hjellnes Consult, Roar Smelhus, explains that OREEC has been important for networking and for the company's internationalization opportunities. And since Hjellnes Consult has recognized competence and is prominent in many areas regarding waste they see great potential to succeed international.

Hjellnes Consult has gained a good reputation in for example the work with biogas. Hansen explains that they already had good prior knowledge from working with landfill gas and that they gained further promotion through major projects; for instance, the RBA-project in Oslo. Through this project they had an exciting and educational process, and the project has opened doors for similar projects in the country. The client took some innovative risks, for example with liquefied biogas which previously only had been run on a small scale and in labs, Hansen underlines.

Hjellnes Consult has been a professional actor for nearly 70 years, and the leader of waste and environmental consultancy explains that it can sometimes feel like the developments in the industry are going in circles. Hansen elaborates that political measures and instruments often is what has driven this industry forward. He cites the banning of organic waste in landfills in 2009 and the tax on landfills from 2000, and how this increased developments in biogas and incineration. In addition, the directives from the European Union have been important.

Within this subsystem there are service providers, waste management and recycling companies. They offer services like collection and treatment of waste locally and sell raw materials in global markets. Franzefoss, Ragn Sells and Norsk Gjenvinning are examples.

Norsk Gjenvinning

In addition to being a large national actor, Norsk Gjenvinning has been visible as a regional actor in the Oslo Region. They also have their biggest recycling facility at Alnabru, Oslo.

Head of Business Development and Innovation, Thomas Mørch, explains that Norsk Gjenvinning's intention has been to show what the waste industry can be in a greater extent than most peoples' traditionally view. They have lately made a clear positioning through emphasizing sustainability. NG has worked with this in two ways. First off was the recognition of the need for an internal clean-up in the industry. One of their banners has been to be more open and discuss the parts of the industry related to corruption and money laundering:

"Such attitudes and actions distort the competition and impede innovation and development in the industry" Head of Business Development and Innovation, Norsk Gjenvinning

The second part of this work, and which is highly relevant on the first one to succeed, is adopting the circular economics approach. Mørch elaborates how they have extended their horizon working with persons they traditionally haven't worked with before. NG has reached out to business constellations and organized collaborative projects to communicate this approach. Their work has proven to be relevant far beyond the industry, Mørch adds.

A concrete example is from last year when NG worked together with Nespresso and Hydro Aluminium in finding a re-cycling solution for the coffee capsules for the business customers in the Oslo area. Since these capsules are containing aluminum, they have the potential of being recycled indefinitely. Mørch highlights the value of having every part of the value chain represented when they developed the solution. This joint creation of a new value chain resulted in 100% material recovery (NGgroup, 2014).

Since they weren't able to rely on a significant volume of aluminum from this project, the alternative entrance became creating more awareness of aluminum in the household. Mørch explains how it's a small project in a NG scale, but a concrete one that has functioned as a great example illustrating how waste is niches and needs to be handled that way to ensure sustainability. In addition, it has also been effective for internal learning and they have continued to build on this model.

On a question about how they share knowledge, Mørch refers to public communication, for example through their homepage, blog and other social media. Sometimes they also team up with research communities in projects and they have been active at several educational institutes, like NMBU and BI, with guest lectures, student camps and cases. Mørch elaborates why such arrangements can be easier to implement:

"We share, but it is a matter of resources. It is easier to contribute in collaborations that are locally based and has a short time horizon, than research projects lasting for several years"
Head of Development and Innovation, Norsk Gjenvinning

Other companies are contributing and delivering specific technology to the industry (H), for example to use in biogas fabrics or sorting facilities. The region holds an international technology specialist, Cambi AS, which is a provider of technology for the conversion of sludge to renewable energy and high quality bio solids, having 19 countries using their technologies and 51 plants committed to their CambiTHP® process (Cambi, 2015). Another one is Tomra, which contributed with technology in ROAF's central sorting facility and is a company providing collection solutions and innovative sensor-based sorting solutions (Tomra, 2015). Green Gas AS is another actor and local supplier of modular biogas plants (GreenGas, 2015). There are also spin-offs companies operating in the extraction of waste value chains. One example is the incubator company Hynor Lillestrøm AS, which for instance uses biogas from Oslo EGE's biogas plant to produce hydrogen and electricity (Hynor Lillestrøm, 2015).

This forms a subsystem of engaged consultancy firms with great expertise, private waste management companies which has created innovative solutions throughout new forms of collaborations as well as several technology providers and specialists operating with or in with the sector.

Network- and Cluster organizations in the Regional Innovation System

The region holds several networks- and cluster organizations. They vary in type of members, geographical location, financial structure and framework, as well as concept, visions and objectives, although some of them have overlapping properties. Through their members, events and projects they are presented in different subsystem and the way they create

interaction between actors and institutions they are also a support for the system (Powell & Grodal, 2005).

Avfall Norge is a large national network for the members of the waste and recycling industry. They have various groups of experts; organize forums for different areas as well as arranging the annual waste conference (Avfallskonferansen, 2015). Others are Norsk Industri's (2015) and their group for the private recycling industry, KS Bedrift (2015) a network organization representing local and regional waste companies in Norway and OREEC (2015) which has become an acknowledged cluster in the Oslo Region. OREEC includes actors from the triple helix and similar industries and are thus like a formal 'Porterian Cluster' (Porter, 1998).

OREEC

Oslo Renewable Energy and Environmental Cluster, is located in Lillestrøm as a unit in Kunnskapsbyen Lillestrøm (Lillestrøm Centre of Expertise), but cover a wider geographical area and have a variety of members. OREEC is based on a belief that it is in the intersection of industries and actors that innovations occur. This is one of the reasons why they have continued with such a broad definition on their business and Marianne Rist-Larsen Reime, one of the project managers, explains that they want to stay representative and active in different markets, for different members and topics.

A lot of the work of OREEC is dependent on what type of projects that are running at a given time. Yet Reime emphasizes that from one year to another a there can be great differences in their main activities. OREEC has for example lead a three year international project on waste-to-energy. The project named COOLSWEEP (2013-2015), funded by the European Union under the 7th Framework Programme, was the organization's first EU-project and Reime has seen several other ideas and projects with same thematic spun out from this work. Waste has existed as a focal area, which is overlapping with OREECs activities focused on using biogas and hydrogen as transport fuel, as there are shared value chains between them. They are also working on a new application for an INTERREG-project (2015), which potentially will continue to strengthen OREECs waste perspective.

A challenging aspect with having a situation with funding through projects is that they sometimes miss the ability to plan events and workshops that will be possible to arrange in the future. Reime points out that with some basic funding they could have the opportunity to strategically plan the future and be more consistent in their work.

OREEC has turned out to be a cluster which has managed to bring great attention to the waste industry and gathered different actors. Reime believes they have created conversations with different angles:

"As far as I know, there are no other organizations or clusters doing the type of projects we do within the regional and triple helix focus on waste which we have in OREEC"
Project Leader at OREEC

OREEC has received feedback and praise from several of their members, especially after events where people from different areas, businesses and sectors have meet. Such types of gatherings don't just happen by themselves, Reime underlines. When they recently held a workshop for actors representing only the public part of the triple helix, OREEC received feedback from one participant who missed the presence of the actors within the private sector and the research communities.

Concrete outcomes from arrangements and projects are not always easy to measure. Although, According to Reime the COOLSWEEP project, where they arranged trips for regional companies to join in, has opened up to new applications, projects and ideas for the participants in the period after. Other members have highlighted networking as one important reason to why they take part at OREEC's events, but also that they get professional input through participating. In OREEC they therefor wish for an even greater attendance at their events. Reime explains that it would be great to see more people benefit from it when they are having events that are perceived as relevant and useful. Further, OREEC has seen potential in more dialogue and collaboration between public and private waste sector. Informal arenas, like the ones run by OREEC, can contribute to more knowledge and understanding of the different roles in the industry.

4.2.2 Arenas of interaction

The previous section created an impression of what characterizes the system through some of the actors and activities. Next, is a presentation and discussion of arenas where the parts interact, and also what seems to promote and inhibit the functioning of the system. The circle in the middle of figure 2 contained these examples of arenas, which are intersections of different helices in the RIS (Cooke, 2001) An arena can for example be a place, an actor, an

event, a project or a common political value or target, and an arena can open up for new arenas.

1) Arenas in the political system

Regulations and Public Procurement

We saw how laws and regulations played a characteristic role in and naturally interacts with other parts. They also seem to have created many fruitful discussions, inspired to action, interaction and further developments in the Region; enhanced by engaged and up-to-date regional actors. The larger projects in the region, Oslo EGE's Biogas plant or ROAF's sorting facility can thus be understood as a co-evolution of regulations and technology as the innovations has adapted to new regulations (Delaplace & Kabouya, 2001). We also saw the advisors state that several of the solutions and innovations in the region were adapted to other national and regional conditions like the characteristics of the national work force.

Another example is from Oslo REN, where the waste fee system actually has been the motor behind a current innovative project. Due to the regulations of the full-cost principle they have to separate household customers from enterprise and industry. Ideally, they should also distinguish their own residents from others for the system to work properly and fulfil the principle. This can sometimes be difficult because people are living near municipal boundaries and closer to other stations. Senior Engineer in the development department at Oslo REN, Anders Dalen, has been responsible for the project and explains that they are looking to establish a system for certification-based access control for their delivery stations.

"What we are considering is a way of offering delivery opportunities across the municipal borders, but with a form of cost-equalization due to the different delivery conditions and structures" Senior Engineer at Oslo REN

With Status Quo being a solution of random spot-checks of the registration numbers on the cars visiting there is great potential in this project. But to be able to accomplish their ambitions, they need political decisions and facilitation, Dalen underlines.

This system is also an example on an innovative public procurement as the system didn't exist in the market to start with (Edquist & Hommen, 2000). It illustrates that regulations and demands in procurements can be significant forces behind innovative ideas and potentially

innovations in the system. It also points to regional public agencies that are aware of innovation through public procurement (Lember, Kalvet and Kattel, 2011).

Another example on innovative demands at Oslo REN was when they in the contracts on waste collection required that the vehicles should run solely on biogas (Oslo Kommune, 2015c). This can be labeled a Green Public Procurement (GPP) or a promotion of purchase of services less environmental damaging. One of the challenging aspects is the risk of *"[…] lack of technical knowledge from procurement officials on how to integrate environmental criteria in the process […]"* (OECD 2013:2). Knowledge has been highlighted as an important instrument for public procurement processes (Menon Business Economics, 2013) and another report presented that the innovation degree was six times as high when public purchasers demanded innovation according to the opposite (Menon Business Economics, 2014b). There are several actors which seem to be aware of GPP, innovation through public procurement and focus on the knowledge aspects of it in the region.

Senior Executive Officer, Håkon Jentoft, explains that Oslo REN has devoted attention to how public procurement can facilitate innovation and today they are looking into several areas to continue to pursue this idea. He underlines that 80 % of the agency's budget is purchase of services. Thus, expertise in procurement has become very important for Oslo REN.

"When we are looking for new services we aim to understand the scope of possibilities and between purchases we try to keep updated in the field" Senior Executive Officer, Oslo REN

However, Jentoft clarifies that it sometimes can be challenging to balance the demands so they stimulate to innovation and at the same time are kept competitively neutral.

After their project stranded, Follo Ren seems to be another actor aware of GPP.

"We will become better purchasers now. We know which environmental requirements we can ask for and what we can expect to get out of our waste. We have learned a lot due to the project" Head of Development, Follo Ren

Another example from the region speaks for more attendance on how public demands also can risk inhibiting development. Requirements on consultants' experience and references can make it difficult to gain entry for younger employees and thus reduce the learning from projects. They can also be limiting for a firm's exploration of new knowledge and new markets. If the firms continue to work on only similar projects it can affect their chances to

acquire and assimilate new knowledge (Zahra and George, 2002). This is important aspects in an industry which already struggles to recruit people to education and jobs (Avfallskonferansen, 2015).

Political ambitions and determination

Although waste management is governed by international and national regulations and targets, there are different ways to relate and react on this. The Oslo Region has through some cases of great political ambitions given an impression of political willingness which has ranged beyond the traditional expected roles and brought new thinking and innovation to the region. Through discussions and concrete projects the government in the triple helix has created several important arenas of interaction. The solutions seemed to be balancing innovation with environmental concerns and thus seem to be examples on environmental cities which manage to govern both environmentalism and entrepreneurialism (While, Jonas & Gibbs, 2004).

Several actors underline this impression. Through IFE's collaboration with Oslo EGE they were perceived as a big motor for development and the industry. Research Scientist at IFE, Meyer, explains the agency as visible beyond its political mandate and that they contribute with a genuine interest. And when OREEC has been visiting other regions around the world they have felt proud of what the Oslo Region has accomplished. Through their international projects on waste, they have experienced the waste industry in the region to be quite forefront. Project Manager, Reime, mentions the city of Oslo as an example of ambitious politicians with ambitious goals, investing a great deal of money on magnificent facilities for waste treatment. The same goes for the inter-municipality companies around Oslo. Also Hjellnes Consult experienced that the innovative in the work in the Oslo region has contributed to give waste a meaning in a larger perspective.

The political ambitions seem to have sped up the processes of development. This doesn't say that all public actors are sharing the same opinion. The region holds examples on different solutions; also areas with little innovation. But the ambitions have triggered discussions between actors and created interaction (Cooke, 2001). This may have increased the region's interactive learning (Asheim & Isaksen, 1997)

It also seems like several of them has been active in searching for new and relevant knowledge. For example Oslo's work with Sweden and Germany illustrated that they were

inspired by others ahead of them to become better. Oslo REN has also been active in networks of different size, purpose and spatial borders. Senior Executive Officer, Jentoft, explains that it is a natural part of Oslo REN to do so.

"We are a large professional community with twelve employees solely working with development. It stands to reason that we want to be active and share knowledge"
Senior Executive Officer, Oslo REN.

ROAF is another one that has been active and showed interests in networks. They have participated even more after they started to work with their new innovative sorting facility, and both the CEO and the Head of Development have experienced that ROAF has big impact regionally.

Although one can discuss if this is a naturally part of the public role, it do illustrate that public agencies and organizations can have a significant role in sharing and learning, which in turn can create more interaction and development in a region through triple helix arrangements (Etzkowitz & Leyersdorff).

Involvement in networks outside the region can also bring relevant knowledge back into the regional system as knowledge spill-overs (Asheim and Gertler, 2005). It doesn't seem like this has been contrary to use of regional networks which may have increased this potential for spill-overs. It has also created openness to the system, which can be a reason for the functioning of the system, in the way it can reduce the chances of lock-ins or path-dependency (Fagerberg, 2005). Several networks can challenge potential ineffective group thinking from networks with strong ties (Granovetter, 1973).

The participation in international networks can also support that non-local relations and regional concentration co-exist (Meyer, Libaers and Park, 2011). In this case, a 'political proximity' seems to be a driver for knowledge exchange. There are shared city contexts and shared international regulations and targets. This openness has indirectly created more regional development, as it has brought back inspirations for new public projects.

Public Investments and Projects

We have seen examples where several different actors have come together in larger projects, getting more familiar with each other and combining different competence and thus are creating room for developing stronger ties with other regional actors (Powell and Grodal,

2005). The examples from the region has also illustrated how larger projects has contributed to several new R&D-projects and further collaboration between different parts – and in that ways creating more intersections between the different helices.

The projects at Follo Ren, ROAF and Oslo also created interaction in the ways they stimulated to academic discussions and political debates on the municipalities' monopoly on treatment of household waste (Norsk Industri, 2015). And not at least, they seem to inspire to see what can be done within waste management.

2) Arenas in the Research and Educational System.

The Role of the Researcher and Research Projects

As presented earlier, different institutes and universities were applauded for their contribution. It also seemed like they have come up with good ideas and getting others on board. In this they are actors, but also arenas for interaction.

For example, in their process of developing a new strategy Follo Ren is searching for new and relevant knowledge and the Head of Development explains that they will continue to turn to regional contributors like Østfoldsforskning and NMBU. They have experienced them to be highly skilled on the area of food waste and also see the benefit of having academia nearby.

"If NMBU has been located somewhere else, it is not certain we had felt the same affiliation as we do" Head of Development at Follo Ren.

In this, the geographical proximity has opened up for more interaction and collaboration, and thus knowledge diffusion in the triple helix (Isaksen, 2005).

Also Østfoldforskning participates in different types of networks. Senior Researcher Hanssen explains how they experience that collaboration and engagement becomes easier when personal contact has been established, and that this is a key factor with networking.

Also the researchers, through national and international relations, may have contributed to the functioning of the innovation system in the way they expand the knowledge base from outside the region and thus creates a larger scope for innovation (Asheim, Coenen & Moodysson, 2015). Since they are respected and recognized in the regional Triple Helix, and are active in networks and projects, new knowledge might be transmitted more easily into the region. This

also strengthens the regions and systems R&D, which again can affect other firms' potential absorptive capacity (Zahra and George, 2002).

The regional R&D is however dependent on the NSI in several ways (Cooke, 2001). For instance, the Research Council of Norway addressing of more research and development in biogas, may have affected the incentives to start new projects in the region.

IFE receives a basic funding from the State of about 10 % of its income, and Research Scientist Julien Meyer points out the necessity for IFE to obtain additional funding from national and international research programs as well as private funding from industrial partners. There is not a lack of innovative ideas at IFE and at other research institutes, but the competition to get funding is tough and the research funding continuity is often challenging. This indicates how the supportive framework also promotes or inhibits the system, by affecting the possibilities of the role of the researchers.

Also the Qualifications Boost is a national priority that reduces the risk of weak universities, asymmetric knowledge, and is thus promote the functioning of the system. (Cooke 2007, in Gausdal, 2008).

The role of the researchers in this system supports the triple helix view on the universities important roles for carry out potential for innovation and economic development (Etzkowitz og Leydesdorff, 1995). But for this to happen, the system is also dependent on framework conditions at different levels.

3) Arenas in the industrial system

The role of the consultancy firms

The examples from the data pointed at these firms as important for the regional development in the way they have contributed with their knowledge in regional projects. In this, they have also represented areas of interaction. In these projects, they have been highlighted as important support and great partners.

The CEO at Mepex Consult explains that it has been important for them to be a company active in knowledge diffusion. They participate through writing articles and lecturing at

different arrangements and they are active in several networks of both formal and informal character.

This builds on the earlier examples which gave impressions of the consultancy firms as conscious of their role as a knowledge exploiter. But these firms are also knowledge explorers. Through their projects they have achieved valuable know-how tacit knowledge (Nonaka et al. 2000). It is visible in the way they have brought new ideas and knowledge into projects and dared to challenge their clients' ideas to find the best possible solutions. In addition, it can also indicate a genuine interest in the field. In several ways, this points to them as "bridges for innovation" in this system (Muller & Zenker's 2001).

Social responsibility among private actors

Another example on arenas of interactions is projects like the one at Norsk Gjenvinning. It created interaction with various businesses and brought attention to circular economy. If one consider the process and outcome it is also an example that indicates potentially and realized absorptive capacity (Zahra and George, 2002). But, most of all, it can stimulate to similar projects. In addition to be good branding for the involved firms, it can spill over on the system as well. The concrete and novel solution on challenging issues presented can inspire to more collaboration and intersections between industries and sectors, and thus more potential for knowledge and learning.

4) Hybrid Arenas

Networks- and cluster organizations' events and projects

Not only were there many networks and clusters relevant for the sector but the actors did also participate in them. This indicates that they have a mediating role in creating more places to meet and collaborate for the actors, and that the events and projects are significant arenas of interaction.

Head of Development explains that Follo Ren has participated in different networks and experienced them as helpful and complementary due to their different strengths. Through OREEC they can broaden their horizon because of an interesting mix of members, Avfall Norge offers expertise on waste issues and discussions on what is possible in the industry and KS Bedrift has been supportive with competence in laws and regulations.

For ROAF there have been several networks of importance in terms of creating good ideas and share experience – for instance Avfall Norge, Avfallsforsk and OREEC. The latter has been interesting to be a part of because of the span of members and industries represented. The CEO explains that this has given ROAF the opportunity to learn from others as well.

Research Scientist at IFE Julien Meyer explains that OREEC has been a valuable arena where IFE can present its research and exchange with others actors in view of possible collaborations. Further, IFE has experienced how information and networking events organized by OREEC create more dialogue between actors and open the door for further research and development, and innovation.

These experiences can indicate how these arenas also can promote development. They create crossings between actors, sectors, industries and the examples highlight how the potential of recognizing new knowledge and new projects has increased from this (Powell et al., 1996). This can also increase the innovation ability as they meet actors with complementary assets and combine prior knowledge with external. These events become an external factor promoting the members AC (Zahra & George, 2002). And the involvement in such networks and events can indicate an already high AC (Cohen and Levinthal, 2001). It is also possible that these arenas have made the search for new knowledge less time consuming and expensive for those participating (Laursen and Salter, 2006).

However, several of the private actors mentioned cost-benefit considerations and fear of spill-overs to competitors as reasons for not always participating. From a systems point of view, it brings up a potentially system bottleneck if only two of the helices meet up and interact (Fagerberg, 2005).

Key Persons

In all the subsystems there are examples of key persons, in the way they sometimes operate outside their traditionally role and expectations; having great ambitions in their jobs and the waste sector in general. They appear particular engaged, both inside and outside the system, and they create a lot of interaction, directly and indirectly. Their' strong values and motivation may have contributed to successful clustering in the region (Porter, 1998).

Through the study it was also brought up that several persons in higher positions had switched jobs inside the system. This is quite normal in a region and industry, but it also indicates

potentially strong person-to-person ties, familiarity with other actors and can promote the chances of more interaction and collaboration. Such familiarity can also have been useful for the diffusion of tacit knowledge (Nonaka et al., 2000). And in that case it the job mobility may have contributed positively to the regional innovation system (Cooper, 2001). It also becomes relevant as waste management seem to be a quite transparent sector in the Oslo Region.

5 Conclusion

The chapter summarizes the findings from chapter 4 in a concluding discussion and also presents some implications and ideas for further research.

5.1 Discussion and Concluding Remarks

The thesis set out to discover what made an emergent regional innovation system in waste management in the Oslo Region, and most importantly, what characterized such a system. This was split into three sub-questions that aimed to explore the main actors and characteristics of the system, what characterized the arenas of interaction between the parts and what factors that seemed to promote or inhibit the functioning of the system. A case study containing a selection of main actors was interviewed and complemented by a document study. Additionally a participation of two regional events relevant for the waste sector in the Oslo Region led to some exiting data. This material has been analyzed with the help of different concepts from and literature on Regional Innovation Systems, The Triple Helix, Cluster Theory and Absorptive Capacity. It remains to summarize the findings and bring some concluding remarks. This will be done in the following.

The research question was

What characterizes the Emergent RIS in Waste Management in the Oslo Region?

One of the main characteristic of this system is the political system; with its actors, laws and regulations that has played an important role for this emergent innovation system. It is partly because waste management is a political matter, but also in the way the government and public actors in this region have showed great political ambitions and engagement, alike been risk-taking and gathered relevant and regional based competence to contribute to some remarkable developments. The public actors have sometimes been operated in an intersection between political instruments and more commercialized activities and large public agencies, like REN and EGE in Oslo, and interactions between local governments in inter-municipal waste organizations, like ROAF, has played a significant role in several successful implementations.

The region is neither the first nor the only region to have considerable waste management developments and solutions, but it seems like when the decision makers first decided on it; they dared to go large. Not only large in technological investments and facilities, but also in how they have developed new thinking, systems and examples towards a circular economy. It brings examples on successful sustainable development in an urban area, where the public sector has fostered and encourages local growth (Hall & Hubbard, 1996). This also illustrates how the role of the government can take a prominent role in the triple helix (Etzkowitz & Leydersdorff, 2000).

This work has been promoted by public actors that are active in searching for possibilities and relevant knowledge also outside the region. Their work has clearly lifted the potential for further innovation and development in the region, which academia and private industries can continue to harvest from and in turn can strengthen the regional innovation system further. This paper holds examples of regional conditions which has stimulated to production and circulation of knowledge, but also that several non-local interactions that has been of relevance. All parts of the system show examples of RIS openness (Asheim et al, 2011).

This search for inspiration outside the region and national borders can indicate not enough competence and knowledge in the two other regional subsystems to fulfill the political ambitions. On the other hand, both regional research institutes and private firms have been acknowledged as important partners and contributed with knowledge, consultancy and specific technology developments. From this, it's more likely that the explanation lies in the fact that waste management is linked to global challenges of our time, which might need more global interaction to ensure sustainable urban developments.

The public has clearly been accompanied by a strong research and educational system and also a competent industrial system. Research institutes and universities ware engaged actors that were taking initiative to share knowledge and collaborate, which indicates that they fill an important role in this innovation system (Etzkowitz & Leydersdorff, 2000). Their expertise in different areas of waste management and in extractions of waste value chains is visible in the region and elsewhere. The ongoing competence lift can bring more possibilities for this system to emerge; having strong universities in it.

In the private sector there were examples of engaged and acknowledged consultancy firms which contributed with knowledge and professional interest to both sustainable and

innovative developments. Also large private waste management companies have joined in on the circular approach and created positive spill-over effects in the region. And not least, several of the large investments projects used technology from regional companies.

The system was also characterizes by having actors in all of the triple helices pulling in the same direction; having shared beliefs and values regarding the environmental concerns. It is not only in the political system ambitions exist, but it seems to have been a regional mindset which has contributed to this innovation system. In addition, there is solid knowledge among all subsystems. This can be a result of having different networks, clusters, events and research projects in the region together with the regional tendency in participating and sharing. The existence of networks and cluster organizations has given several arenas which seem to affect the actors in the region and the potential for further development. This also indicates a strong absorptive capacity among the regions actors; which in turn, might have been affected by the regional conditions.

5.2 Implications and Further Research

Some policy implications can be suggested. For instance, it seems important to develop and evaluate policies; which in this case promoted innovation, collaboration and regional development. There is need for more guidance in how to use public procurement in order to stimulate sustainable innovation. Since events and common projects were experienced as useful, this speaks for a good supportive framework to continue to harvest from this. The findings indicated that proximity matters, but also how collaboration across spatial borders can bring innovative solutions and new knowledge into the region and nation. This gives implications for facilitating more collaboration across subsystems, between municipalities, regions and international; which also will be relevant for the movement towards a circular economy. In addition, for the potential of further development and creating a regional and national export-industry it will be necessary to develop good support systems, supporting incubators and spin-offs, as well as helping firms reach a bigger market international.

Since this thesis only focused at a small selection from the system it would be interesting to continue the research on this. It can be done through surveys, building hypotheses from this study, or smaller case studies of regional projects or specific events. It can also be interesting to look deeper into only one part of the triple helix to understand more of the different roles in

the system. This was a limitation with this thesis. In addition, other concepts and theories can be used to understand the case; Sectorial innovation system-approach is one way to complement this study, or maybe through transition theories and multi-level perspectives to capture the larger changes and challenges. Further research can also evaluate the effects of different policy tools, regulations, and public procurement on innovation.

References

AFI, (2015) Arbeidsforskningsinstituttet homepage http://www.hioa.no/Om-HiOA/Senter-for-velferds-og-arbeidslivsforskning/AFI

Aschoff, B & Sofka,W (2008). Innovation on demand – can public procurement drive market success of innovation. Zentrum für Europäische Wirtschaftsforschung GmbH (ZEW) Discussion Paper 08-052.

Asheim, T. B. & Isaksen, A. (1997) *Location, agglomeration and innovation: Towards regional innovation systems in Norway?,* European Planning Studies, 5:3, 299-330,

Asheim & Coenen (2005) *"knowledge baes and regional innovation systems: Comparing Nordic clusters»* research Policy 34 8 pages 1173-1190 Regionalization of Innovation Policy

Asheim, B.T., Gertler, M. (2005): "The geography of innovation: Regional innovation systems", in Fagerberg, J., Mowery, D. and Nelson, R. (Eds.): *The Oxford Handbook of Innovation*.

Asheim, Coenen, Moodysson (2006) *Explaining spatial patterns of innovation: analytical and synthetic modes of knowledge creation in the Medicon Valley life-science cluster* Environment and Planning A 2008, volume 40, pages 1040- 1056 http://epn.sagepub.com/content/40/5/1040.abstract?id=a39110

Asheim, T.B., Smith, L. H, Oughton, C. (2011) Regional Innovation Systems: Theory, Empirics and Policy p 875-891 Regional Studies Vol 45 (7) Special issue 2011

Asheim, Coenen and Moodysson (2015) *Methods and applications of regional innovation systems analysis* chapter 13 in Handbook of Research Methods and Applications in Economic Geography, 2015,

Avfallskonferansen (2015) *Program 2015* internet: http://www.avfallskonferansen.no/program2015.cfm [09.06.2015]

Avfall Norge, (2014a) *Historiske hendelser i avfallsbransjens historie* Internet: http://avfallnorge.no/avfallsbransjenshistorie.cfm [02.05.2015]

Avfall Norge (2014b) *avfallsbransjen i Norge* internet: http://avfallnorge.no/ombransjen1.cfm [03.05.2015]

Avfall Norge (2014c) *Avfallsbransjen vil bli mer synlig - skal inn på universitetene av Jens Måge, Avfall Norge.no Internet:* http://avfallnorge.no/Nyheter.cfm?pArticleId=40233&pArticleCollectionId=2556) [02.08.2015]

Avfall Norge (2015a) *Norsk avfallspolitikk – veien fra deponi til ressurs* Avfall Norge Fagrapportnr:8/2015 Available from:

http://www.avfallnorge.no/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=63382 [31.08.2015]

Braczyk, P. Cooke, M. Heidenreich (1998.), *Regional Innovation Systems: The Role of Governance in a Globalised World, UCL Press, London ,*

Bergek, Anna, et al. (2008): 'Analyzing the functional dynamics of technological innovation systems: A scheme of analysis', *Research Policy*, 37 (3),pp 407-29.

Cambi (2015) *CambiTHP* Internet http://www.cambi.com/Products/CambiTHP [27.08.2015]

Cohen, W.M. and Levinthal D.A. (1990) *Absorptive capacity: a new perspective on learning and innovation* Administrative Science Quarterly, 35 (1990), pp. 128–152

Cooke, P. (1998) *Introduction: origins of the concept* H.-J. Braczyk, P. Cooke, M. Heidenreich (Eds.), Regional Innovation Systems: The Role of Governance in a Globalised World, UCL Press, London (1998), pp. 2–27

Cooke (2001) *Regional Innovation Systems, Clusters and the Knowledge Economy oxford Journals Social Sciences Industrial and Corporate change* 10(4) pp 945-974

Cooper, P.,D. (2001) *Innovation and reciprocal externalities: information transmission via job mobility* Journal of Economic Behaviour and Organization vol 45 is 4 2001 403-425

Coolsweep (2014) *COOLSWEEP: Joint Action Plan* Coolsweep, 2013-2015 Available from: *http://www.oreec.no/userfiles/files/Joint%20Action%20Plan_low%20resolution%20file.pdf [21.06.2015]*

Coolsweep (2015) *About Coolsweep* Internet: http://coolsweep.org/about-coolsweep/

Delaplace M., Kabouya, H. (2001*),"Some considerations about interactions between regulation and technological innovation: the case of a sustainable technology, biodegradable materials in Germany"*, European Journal of Innovation Management, Vol. 4 Iss 4 pp. 179 - 185

Edquist C., (1997) *Systems of Innovation Approaches – their emergence and characteristics"* in Edquist (eds). 1997 systems of innovation technologies, institutions and organizations London, Pinter/cassell.

Edquist and Johnson 1997 *Institutions and Organizations in Systems of Innovation* in Edquist (ed. 1997 Systems of Innovation, Londong & Washinghton. Pinter/cassell academic

Edquist, C., Hommen, L., Tsipouri, L,. (2000) *Public Technology Procurement and Innovation* Klower academic Boston/London

Edquist, C. (2001) *The Systems of Innovation Approach and Innovation Policy: An account of the state of the art* By Charles Edquist Lead paper presented at the DRUID Conference, Aalborg, June 12-15, 2001, under theme F: 'National Systems of Innovation, Institutions and Public Policies' Draft of 2001-06-01 http://www.druid.dk/uploads/tx_picturedb/ds2001-178

Edquist, C.,(2005) *Systems of Innovation: Perspectives and Challenges*, chapter 7 in Fagerberg et al. 2005 The Oxford Handbook of Innovation Oxford University press

EU, European Commission, (2011a) *A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy* Brussels, 26.1.2011 COM(2011) 21 Available from: http://ec.europa.eu/resource-efficient-europe/pdf/resource_efficient_europe_en.pdf [30.07.2015]

EU, European Comission (2011b) *Horizon 2020 - The Framework Programme for Research and Innovation* Brussels, Brussels, 30.11.2011 COM(2011) 808 final Available from: http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52011DC0808 [30.07.2015]

EU, European Commission (2015) *What is the Bioeconomy* Available from: *http://ec.europa.eu/research/bioeconomy/index.cfm?pg=home* [12.08.2015]

EU, European Commission (2014) *Towards a circular economy: A zero waste programme for Europe* Brussels, 2.7.2014 COM(2014) 398 final Avaiable from: http://eur-lex.europa.eu/resource.html?uri=cellar:50edd1fd-01ec-11e4-831f-01aa75ed71a1.0001.01/DOC_1&format=PDF [05.07.2015]

EU, European Commission (2008) DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 *on waste and repealing certain Directives*, Official Journal of the European Union, 22.11. 2008. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN [07.07.2015]

Europalov, (2014) *EU-strategi om en ressurseffektiv sirkulær økonom. Høring om innspill til en EU-strategi for en sirkulær økonom* Internet: http://europalov.no/politikkdokument/eu-strategi-om-en-ressurseffektiv-sirkulaer-okonomi/id-8398 [02.09.2015]

European Commission, (2014) *Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment* Brussels, 2.7.2014 COM(2014) 397 final 2014/0201 (COD) Available from: http://eur-lex.europa.eu/resource.html?uri=cellar:e669092f-01e1-11e4-831f-01aa75ed71a1.0001.01/DOC_1&format=PDF [05.08.2015]

EC, 2015 European Commission, *ROADMAP on Cicular Economy Strategy 04/2015 ENV (A1,A2,A3 GROW).* Available from: http://ec.europa.eu/smart-regulation/impact/planned_ia/docs/2015_env_065_env+_032_circular_economy_en.pdf [05.10.2015]

Etzkowitz, H., & Leydesdorff, L. (1995). The Triple Helix---University-IndustryGovernment Relations: A Laboratory for Knowledge-Based Economic Development. EASST Review 14, 14-19.

Etzkowitz, H., & Leydesdorff, L. (1998). The Endless Transition: A "Triple Helix" of University-Industry-Government Relations, Introduction to a Theme Issue. Minerva, 36, 203-208.

Etzkowitz, H. & Loet Leydesdorff (2000), *The dynamics of innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government relations,*Research Policy, 29:109-123.

Fagerberg, J. (2005) *Innovation: A Guide to the Literature:* Fagerberg, J., Mowery, D.C., Nelson, R.R. (red.). The Oxford Handbook of Innovation. (p.115-147). Oxford: Oxford university Press

Freeman (1987) *Technology policy and economic performance: lessons from Japan.* London. Pinter.

Follo Ren (2014) *Fakta om Kretsløp Follo* Available from: http://www.folloren.no/hva-er-kretsloep-follo.296605.no.html [12.06.2015]

Forurensningsloven (1981) *Lov om vern mot forurensninger og om avfall* LOV-1981-03-13-6 Available from https://lovdata.no/dokument/NL/lov/1981-03-13-6/KAPITTEL_5?q=avfall+definisjon#KAPITTEL_5 [30.06.2015]

Forskningsrådet (2015) homepage http://www.forskningsradet.no/no/Forsiden/1173185591033

Flick, U. (2006) An Introduction to Qualitative Research. Third Edition. London: Sage Publications

Gausdal, A. H. (2008) *'Hvordan Skape Innovative Nettverk?' Magma,* 11, 5, 53-63.

Granovetter M.,S. (1973) The strength of weak ties American journal of Sociology 78 (6) 1360-1380

Greengas, (2015) Internet: http://greengas.no/

Grabher, 2006 http://phg.sagepub.com/content/30/2/163.abstract

Hall, T., Hubbard, P. (1996) The entrepreneurial city: new urban politics, new urban geogrpahies? Progress in Human Geography 20: 153-174

Hartley, J (2005) Innovation in Governance and Public Services: Past and Present, *Public Money & Management*, 25:1, 27-34

Hess (2004) 'Spatial' relationships? Towards a reconceptualization of embedded ness Progress in Human Geography April 200428: 165-186,

Hay, I. (2010) Qualitative Research Methods in Human Geogrpahy Oxford 3. Ed. Oxford university press.

Hjellnes Consult, (2015) Sammen designer vi fremtiden Internet *www.hjellnesconsult.no* [09.06.2015]

Hynor Lillestrøm, 2015 internet; http://hynor-lillestrom.no/om_oss/

Innovasjon Norge, (2015) *Financial Services* Internet: http://www.innovasjonnorge.no/en/start-page/our-services/financial-services/ [16.08.2015]

IFE (2014) *Årsrapport 2013* Available from http://www.ife.no/no/ife/filer/ife_arsrapporter/ife-arsberetning-2013 [06.08.2015]

IFE (2015) *Årsrapport 2014* Available from http://www.ife.no/no/ife/filer/ife_arsrapporter/ife-arsberetning-2014 [06.08.2015]

Interreg 2015 *Interreg homepage* internet http://www.interreg4c.eu/programme/

Isaksen, A., 2005, 'Regional Clusters Building on Local and Non-Local Relations: A European Comparison,' in A. Lagendijk and P. Oinas (eds.), Proximity, Distance and Diversity: Issues on Economic Interaction and Local Development, Aldershot: Ashgate, pp. 129–152.

Jacobsen, D.I. (2005) *Hvordan gjennomføre undersøkelser? – Innføring i samfunnsvitenskapelig metode*. 2. utg, Kristiansand, Høyskoleforlaget

Klima- og Miljødepartementet, (2014) *Avfall* 26.11.2014 Internet: https://www.regjeringen.no/no/tema/klima-og-miljo/forurensning/innsiktsartikler-forurensning/avfall/id2076495/ [30.05.2015]

Klima- og Miljødepartementet (2013) *Strategi Fra avfall til ressurs Avfallsstrategi* Miljøverndepartementet 06/2013 Available from: https://www.regjeringen.no/contentassets/27128ced39e74b0ba1213a09522de084/t-1531_web.pdf [30.05.2015]

Kommunal- og moderniseringsdepartementet (2006) *Åpen, trygg og skapende hovedstadsregion – Hovedstadsmeldingen* st.meld. nr. 31 (2006/2007) Oslo, Kommunal- og moderniseringsdepartementet. Available from: https://www.regjeringen.no/no/dokumenter/stmeld-nr-31-2006-2007-/id469140/?ch=1&q= [Read 28.06.15].

KS Bedrift (2015) *homepage about* Internet*:* http://www.ksbedrift.no/bransjer/avfall/

Lam, A. (2005) Organizational Innovation. I: Fagerberg, J., Mowery, D.C., Nelson, R.R. (red.). The Oxford Handbook of Innovation. (p.115-147). Oxford: Oxford university Press

Laursen and Salter (2006) available from [30.08.15] (http://www.druid.dk/laursen/papers/laursen_salter2006smj.pdf)

Leydesdorff (2012) '*the triple helix, Quadruple Helix,…, and N-tuple of Helices: Explanatory Models for Analyzing the Knowledge-based Economy* Journal of the Knowledge Economu 3(1) 2012 p.25-35

Lundvall (1992) Lundvall, B.-Å. (Ed.), 1992. National System of Innovation. Towards a Theory of Innovation and Interactive Learning. Pinter Publishers, London.) Lundvall, B.-Å. (1992) Introduction, in B.-Å. LUNDVALL (Ed.) *National Systems of Innovation,* pp. 1-19.

Lundvall, B. Å. and Johnson, B. (1992) National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Pinter Publishers

Lember, V., Kalvet, T. & Kattel, R. (2011). *"Urban Competitiveness and Public Procurement for Innovation."* Urban Studies, in press

Malerba 2002 Research Policy 31 (2002) 247–264 Sectoral systems of innovation and production Franco Malerba∗ CESPRI, Bocconi University, Via Sarfatti 25, 20136 Milan, Italy

Muller, E./Zenker, A. (2001): Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems, Research Policy, 30, 1501-1516.

McDougall, F. R., White, P.R., Franke, M., Hindle, P. (2001) *Integrated Solid Waste Management: a Life Cycle Inventory* second edition, Blackwell Science LTD, Blackwell Publishing Company, Cornwall Available from: [http://onlinelibrary.wiley.com/doi/10.1002/9780470999677.fmatter/pdf] [07.07.2015]

Menon Business Economics (2014) *Rapport: Fornybar energi og miljøteknologi i Norge Status og utvikling 2004-2013,* av A. Espelien & Ø.S.Sørvig, Menon-Publikasjon nr.34/2014 Desember 2014. Available from: http://oreec.no/userfiles/files/OREEC%20Foresight%20Nov14/Menon%2034-2014%20-%20Fornybar%20energi%20og%20milj%C3%B8teknologi.pdf [30.04.2015]

Menon Business Economics (2014b) *Innovative offentlige innkjøp – mer produktivitet og bedre tjenester* Menon-publikasjon nr.11/2014 av Sveinung Fjose, Leo Grünfeld, Erland Skogli og Øystein S. Sørvig. Avaiable from: https://www.nho.no/siteassets/nhos-filer-og-bilder/filer-og-dokumenter/offentlige-anskaffelser/menon-publikasjon-11-2014--offentlige-innkjop---mer-innovasjon-og-bedre-tjenester.pdf [05.09.15]

Menon Business Economics (2013) *Rapport: Kunnskap som virkemiddel i offentlige innkjøpsprosesser* Av Sveinung Fjose, Torstein Fjeldet Lunde og Kristina Wifstad Menon-Publikasjon nr.17/2013 available from http://menon.no/upload/2013/05/06/menon-rapport-17-2013-kunnskap-som-virkemiddel-i-offentlige-innkjopsprosesser-2.pdf [08.09.2015]

Meyer, M. Libaers, D. Park, J-H (2011) *The Emergence of Novel Science-related Fields: Regional or Technological Patterns? Exploration and Exploitation in United Kingdom*

Nanotechnology special Issue: Regional Innovation Systems: Theory, Empirics and Policy 2011 Pages 935-959

Nonaka et al. (2000) Krogh, Ichijo, Nonaka: *How to unlock the mystery of tacit knwoledge and release the power of innovation* Oxford University Press 2000

Norsk Industri 2015: *posisjonsnotat* http://www.norskindustri.no/siteassets/dokumenter/gjenvinning-posisjonsnotat-2015.pdf

Norsk Samfunnsvitenskapelig Datatjeneste (2015). Norsk Samfunnsvitenskapelig Datatjeneste Hjemmeside. [http://www.nsd.uib.no]

Nelson, R.R.(1993) National Innovation System: a comparative study Oxford Oxford Universty Press.

NGgroup, (2014) *Gjenvinning av Nespresso kaffekapsler* NORSK GJENVINNING Norge AS Internet: http://www.nggroup.no/baerekraft/sirkeloekonomi/gjenvinning-av-nespresso-kaffekapsler/ [12.08.2015]

Norsk Industri (2015) *homepage about* internet: http://www.norskindustri.no/Bransjer/Gjenvinning/

OECD (2013) Organisation for Economic Co-operation and Development: Mapping out good practices for promoting green public procurement OECD meeting of Leading Practitioners on public procurement Public Governance and Territorial development directorate public governance committee 11-12 February 2013 Paris, Conference Centre, Paris February 2013 Internet: http://www.oecd.org/gov/ethics/Mapping%20out%20good%20practices%20for%20promoting%20green%20public%20procurement%20GOV_PGC_ETH_2013_3.pdf [20.09.2015]

OECD (2005) Oslo Manual: guidelines for collecting and interpreting innovation data, 3rd edition. The Measurement of Scientific and Technological Activities

Oslo kommune (2015a) Klima og Energi Programmet, *Det grønne skiftet Utkast til Klima- og energistrategi for Oslo* Januar 2015 Available from: https://www.staging.oslo.kommune.no/getfile.php/Innhold/Politikk%20og%20administrasjon/Milj%C3%B8/Dokumenter/Det%20gr%C3%B8nne%20skiftet%20-%20utkast%20til%20Klima-%20og%20energistrategi%20for%20Oslo%20140115_endelig.pdf [12.07.2015]

Oslo kommune (2015b) *Om ENERGIGJENVINNINGSETATEN* Internet: https://www.oslo.kommune.no/politikk-og-administrasjon/etater-og-foretak/energigjenvinningsetaten/ [30.05.2015]

Oslo kommune (2015c) Oslo kommune Renovasjonsetaten Årsberetning 2014 [avilable from] https://www.oslo.kommune.no/getfile.php/Innhold/Politikk%20og%20administrasjon/Etater

%20og%20foretak/Renovasjonsetaten/Dokumenter%20Renovasjonsetaten/%C3%85rsberetning%202014%20Renovasjonsetaten.pdf [07.07.2015]

Oslo kommune, 2013, Oslo Kommune Energigjenvinningsetaten av Pål Mikkelsen under avfallskonferansen 2013 *Fra nasjonalt til internasjonalt avfallsmarked; hvordan påvirker dette aktørene?* Internet: http://www.avfallnorge.no/avfallskonferansen2013/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=47624 [31.07.2015]

OREEC (2015) homepage http://oreec.no/

Patton, M,Q,.(2002) chp 7: qualitative interviewing" in Qualitative Rsearch and evalutatio methods 2002: 339-427

Porter, M. E., (1998) *clusters and the new economics of competition*, Harvard Business Review, 76(6) 77-90.

Powell, W. W., Koput, K. and Smith-Doerr, L.. (1996) *Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology.* Administrative Science Quarterly 41 (1): 116–45

ROAF (2015) *ROAF Årsrapport 2014 – MILJØR*APPORT Available from: http://www.roaf.no/index.php?cat=261766&id=5757638&pf=122756&folder=122760 [30.08.2015]

Rolfstam, M.(2009) *Public procurement as an innovation policy tool: the role of institutions,* Science and Public Policy, 36(5), June 2009, pages 349–360 http://www.ingentaconnect.com/content/beech/spp

ROAF, (2014) *ROAFs sorteringsanlegg er unikt og innovativt* Available from: http://www.roaf.no/getfile.php/3088228.1919.derxufypxp/Sorteringsanlegget.pdf [28.07.2015]

ROAF, (2010) Strategi 2010-2016 Ansvarlig avfallshåndtering for klima, kretsløp og miljø Available from: http://www.roaf.no/getfile.php/1986593.1919.aycafyvrae/Strategi2010-2016.pdf [28.06.2015]

The Great Project, 2015 *the great project* internet: http://www.great-project.eu/

Tidd & Bessant (2013) Managing Innovation: Integrating Technological, Market and Organizational Change, 5th Edition. (2-3,5-6,9,11)

Tomra (2015) *homepage* Internet: https://www.tomra.com/en/

Tjora, A. (2010) *Kvalitative forskningsmetoder i praksis*. Trondheim, Gyldendal Akademisk

Ter wal A,. & Boschma, T., (2011) *Co-evolution of Firms, Industries and Networks in Space*.

Regional Studies (45)7 special Issue: Regional Innovation Systems: Theory, Empirics and Policy 2011 Pages 919-933.

Utenriksdepartmentet, (2014) *Bredere satsing mot en «sirkulær økonomi» Rapport fra miljøråd Ulla Hegg* Internet: https://www.regjeringen.no/no/aktuelt/Bredere-satsing-mot-en-sirkular-okonomi/id765158/ [30.06.2015]

While A, Jonas AEG and Gibbs D. (2004) *The environment and the entrepreneurial city: searching for the urban 'sustainability;fix' in Manchester and Leeds.* International Journal of Urban and Regional
Research 28: 549-569.

Yin, R. K. (2009). *Case study research: Design and methods* (2nd ed. ed. Vol. vol. 5). Thousand Oaks, Calif: Sage.

Zhan, G, Xu, Q, Lie, X. (2011) *Knowledge diffusion within the dating sock-manufacturing cluster in china* Regional Studies (45)7 special Issue: Regional Innovation Systems: Theory, Empirics and Policy 2011p 977-996

Zahra, A.S., & G. George. (2002) *Absorptive Capacity: A Review, Reconceptualization and Extension* Academy of Management Review **27**(2):185–203.

Østfoldforskning, (2015) *om Østfoldforskning*
Internet: http://ostfoldforskning.no/om-ostfoldforskning.aspx [30.05.2015]

Appendix A: Interview guide

INTERVJUGUIDE INTERKOMMUNALE SELSKAP

Dato og sted:

Deltakere:

Husk opptaker + flight mode

Introduksjon: Om aktøren

1) Vil du kort beskrive din stilling og hva den går ut på?
2) Vil du kort beskrive hva X gjør og leverer: «hva er X»:
   i) Visjon
   ii) Kjernekompetanse / hovedoppgaver og ansvarsområder
   iii) Direkte samarbeidspartnere og eiere, samt retningslinjer/rammeverk.
   iv) Marked (Hvilke produkt og tjenester leveres til hvem)
   v) Finansiering
3) Vi er interessert i regionen som et innovasjonssystem hvor aktører…
   På bakgrunn av spm 2) kan du gi en kort introduksjon om X **som aktør innen avfallsforedling i regionen:** Hvilken rolle har dere hatt og har dere i dag?

Innovasjon og utvikling

1) Hva betyr **innovasjon** for X?
   i) Hva legger du/dere i dette?
   ii) Hvordan arbeides det til daglig med dette (innovasjon)?
   Eksempel: gjennom interne aktiviteter, FoU, samarbeid eksternt, deltakelse i nettverk, krav fra eierkommuner m.m. krav fra nasjonale/ internasjonale hold? Egendriv internt?
   iii) Hvor ser dere til for ny kunnskap og inspirasjon?
   (til ny teknologi, produkt, prosess, struktur, prosjekt m.m.) internt og eksternt.
2) Innovasjon i X – **tilbakeblikk:**
   Hvilke innovasjoner vil dere trekke frem som har vært viktige, større milepæler innen X?
   Eksempelvis kan dette være nye løsninger, prosesser, nye produkt, nye tjenester / det kan være større innovasjoner som typisk førte til flere følgende inkrementelle (mindre) innovasjoner / løsninger

i) Hvilke type innovasjoner er/var dette? Radikal/inkrementell

Produkt/tjeneste/prosess/organisatorisk/markedsmessig

ii) Hvor kom de fra? Hovedkilden?

Eks. Forskning / Erfaring / Internt / Eiere

iii) Årsaker til suksess?

Eksempelvis: Noen fremtredende aktører / lokale ildsjeler / Nøkkelpersoner Lokal kompetanse/kunnskap, / Rammevilkår / Finansiering / Spesiell type samarbeid? m.m.

iv) Noen fallgruver underveis: Utfordringer, motstand m.m.?

Innovasjon og samarbeid

1) Fortell mer om hvilke **arena** deltar X i **samarbeid og kunnskapsdeling**? (Uformelle og formelle)

i) Ranger gjerne viktigheten av disse ift hva dere opplever at

a) knytter ulike aktører sammen

og hvorvidt det

b) har skapt/ skaper nye muligheter/prosjekt/ideer på tvers?

2) X sin rolle som kunnskapsspreder: Hvordan deler dere kunnskap (i regionen)? (Jamfør X rolle i regionen, tidligere..)

3) Hvilke relasjoner har vært og er **særlig viktig for** X **(**mtp kunnskap, innovasjon og utvikling)? Hvem ser dere som viktige aktører innen samarbeid?

i) Hva har X *(konkrete eksempler helst)* fått ut av deltakelsen de nevner?

ii) Mer om samarbeid med andre aktører:

a) Kommunesamarbeid / andre IKS: Eksempler?

b) Private aktører (store selskap, SME, spinoffs?) Eksempler?

c) Forskningsmiljøer og utdanningsinstitusjoner? Eksempler her?

Avslutningsvis / fremover

1) Hvis du skulle skrellet det hele ned til kjernen: Hva har særlig preget utviklingen innen avfallstankegang og løsninger i X / hva har særlig drevet dette fremover? Eks: *Er det noen tydelige pågangsdrivere/kunnskapsbesittere av aktørene i regionen? Noen*

som spiller en større rolle enn andre/ som særlig lykkes med å få ting til å skje? Hvorfor/hvordan?

2) Dette henger litt sammen med: Hva tror du er typisk for *Regionen*? Hva kan vi lære/ ta videre (synsing)?
   i) Finnes det eksempler på felles løft eller felles plattformer for innovasjon i avfallsverdikjeden?

ii) Er det f.eks. noe særegent over måten f. eks X jobber med andre avfallsselskap i regionen? Eller de andre aktørene for øvrig?

3) Fremover:

i) Hva tror du vil skje fremover og hva vil være viktig i tiden fremover mtp fortsatt innovative løsninger og utvikling?

ii)Hvilke/ foreligger det noen særlige utfordringer og hinder?
(Eks. finansiering, menneskelige ressurser, rammeverk, myndigheter regionalt/nasjonalt/internasjonalt, nok kunnskap/kompetanse/forskning?, holdninger, arbeidskraft, motstand m.m.).
Både for
A) X og B) for avfallsbransjen/verdikjeden i Oslo-regionen (og nasjonalt) i det store bildet

- Igjen takke for deltakelse
- Ønske om anonymisering? / Kan X nevnes?
- Sender over sitater for sjekk via e-post august/september.

Appendix Workshop

Invitasjon fra OREEC til kommunale politikere, avdelingsledere, seksjonsledere, saksbehandlere, miljørådgivere og andre fagpersoner involvert i planlegging og tjenesteutvikling innen husholdningsavfall.

Velkommen til en spennende formiddag!

Gjennom å lede et stort EU-prosjekt på avfall og energigjenvinning har OREEC hevet sin internasjonale kompetanse og kommet i tett kontakt med Europa. Norge, og Oslo/Akershus-regionen, ligger svært langt fremme på avfallsbehandling i forhold til brorparten av de 28 EU-landene og i dette perspektivet er det lett å bli stolt av å være norsk. Men i det lokale perspektivet har vi utfordrende målsetninger å forholde oss til i toppen av avfallshierarkiet; økt materialgjenvinning, større forventninger til ombruk og et økende fokus på avfallsreduksjon. Det er også en kjent utfordring å få til regionale synergier mellom de kommunale systemene, da vi allerede har en rekke ulike infrastrukturer som helst skal fungere optimalt side om side, men også sammen.

Bli med på en annerledes workshop der det regionale ses fra et europeisk perspektiv og stiller spørsmålet:

Hvordan kan avfallssektoren i regionen bli (enda) mer innovativ?

Tid og sted: Fredag 5.juni kl 09:00-11:30,

Kunnskapsbyen konferansesenter (Gunnar Randers vei 24, 2.etg)

Vi serverer frokost fra kl 08:30

Agenda: Marianne Reime fra OREEC ønsker velkommen, og videre vil en interaktive prosess bli ledet av Berit Gullbransson og Anna Sager fra SP Tekniske Forskningsinstitutt i Sverige. SP har utviklet en enkelt anvendbar metodikk der målet er å identifisere hvordan man kan få til forandring.

Detaljene for workshopen blir utarbeidet på bakgrunn av hvem som melder seg på.

Formål: Å samle sentrale, kommunale aktører i en uformell setting for å mene noe om hvordan regionen kan videreutvikles og bli mer innovativ innen avfallsbehandling. Invitasjonen sendes til kommunene i regionen; både OREEC-partnere og andre.

Resultat: Innspillene vi får i løpet av denne formiddagen vil danne hovedgrunnlaget for et policy paper; et dokument som skal leveres til EU-kommisjonen innen utgangen av juni. Deltagerne får herved forme innspillet, der vi både kan fremheve våre regionale kompetanser og hva som fungerer vel, og samtidig peke ut hvor vi har størst behov for endring og innovasjon. Dokumentet skal også leveres til våre egne kommunalpolitikere. Hva mener du er våre forbedringspunkter på et regionalt nivå?

***Bakgrunn*:** OREEC har ledet EU-prosjektet Coolsweep som startet opp i 2013 og siden da har avfall og ressursutnyttelse blitt et stort fokus i organisasjonen. Gjennom COOLSWEEP har vi identifisert synergier med et nærliggende prosjekt som er finansiert via samme EU-program. Til sammen representeres 13 europeiske land i prosjektene. WASTECOSMART er ledet av svenske SP, og prosjektlederne har fått en god dialog. Gjennom workshopen den 5.juni får vi anledning til å ta ut konkrete synergier av disse to store EU-prosjektene, gjennom å knytte SP's metodikk med OREECs politiske prosjektleveranse.

Mer om:

OREEC – www.oreec.no

COOLSWEEP-prosjektet – www.coolsweep.org

SP Tekniske forskningsinstitutt – www.sp.se

WASTECOSMART-prosjektet – www.wastecosmart.eu

Påmelding ved å trykke på den grønne knappen "Register" eller her.

Transport/parkeringsmuligheter:

Bil: Q-park Parkering på stedet mot betaling

Kollektivt: Buss 401 eller 842 fra Lillestrøm togstasjon til Forskningsparken

(OREEC, 2015)

Appendix Avfallskonferansen 2015

Program 10. Juni

- **- Årets tema: Samfunnansvar og industriell lønnsomhet**
  Med forbehold om mindre programendringer i tiden frem mot konferansestart.
- **- Miljø- og sikkerhet**
  Deltakere får informasjon om miljø- og sikkerhetstiltak via voicover før konferansen starter.
- **- Konferansier og debattleder: Erik Wold**

- **09:00 - Åpning i PLENUM (Luftrommet)**
  Anette M. Solli, fylkesordfører Akershus
  Kjell Øyvind Pedersen, styreleder Avfall Norge
- **09:30 - Innovasjonsprisen 2015**

- **09:40 - 11:00 Paneldebatt i PLENUM (Luftrommet)**
  Victor Norman, professor Handelshøyskolen BI innleder debatten

  Debattdeltakerne er:
  -Lars Andreas Lunde, statssekretær Klima- og miljødepartementet
  -Nancy Strand, direktør Avfall Norge
  -Pål A. Sommernes, direktør Renovasjonsetaten Oslo kommune
  -Heikki Holmås, stortingsrepresentant (SV)
  -Marianne Marthinsen, stortingsrepresentant (AP)
  -Ola Elvestuen, stortingsrepresentant (V)
  -Erik Osmundsen, konserndirektør Norsk Gjenvinning

- **11:00 - 12:30 LUNSJ OG UTSTILLINGSVANDRING (the Qube)**
  Lunsj og utstillingsvandring. Lunsjen serveres i utstillerhallen.
- **12:30 - 13:30 PARALLELL 1 (Sal Q3) - tema 1: KPI - Styringsverktøy som gjør både offentlige og private virksomheter bedre**
  Møteleder: Roger Stigum, avdelingsdirektør økonomi og administrasjon Roaf

  - KPI som styringsverktøy
  Ole Greger Terjesen, seniorkonsulent EGE, Oslo kommune

  - Praktiske tips til hvordan renovasjonsselskaper kan utarbeide egne nøkkeltall
  Espen Starheim, daglig leder Momentum Selvkost AS

  Spørsmål fra salen.

- **12:30 - 13:30 PARALLELL 1 (Sal Luftrommet) - tema 2: Om å ta vare på fremtidens råvarer**
  Møteleder: Erik Wold

- Fosfor som begrenset ressurs – gjenvinningspotensialet i norsk organisk avfall
Ola Hanserud, forsker Bioforsk Jord og Milj

- Forskning for en mer effektiv produksjon av biogass
Svein Jarle Horn, professor NMBU

- Strengere resirkuleringskrav fra EU – en kostbar plage eller en stor mulighet?
Thomas Mørch, Sjef Forretningsutvikling - Strategi & Bærekraft Norsk Gjenvinning

Spørsmål fra salen

- **12:30 - 13:30 Nyhetstorget - innlegg i utstillingsområdet (se kart)**
1230-1240 Cambi: Cambi in brie

1245-1255 Reknes AS: Ny veie- og betalingsløsning for gjenvinningsstasjone

1300-1310 Enova: Gjør gode energi- og klimatiltak – få støtte fra Enov

1315-1325 Syklus: Handle with care
- **13:30 - 14:00 PAUSE**

- **14:00 - 15:00 PARALLELL 2 (Sal Luftrommet) - tema 3: På vei mot sirkulær økonomi**
Møteleder: Henrik Lystad, fagsjef Avfall Norge

-Scenarier for avfallsmengder og gjenvinning fram mot 2030
Frode Syversen, daglig leder Mepex Consult

-Fremtidens avfallshåndtering i Oslo
Ingunn Dale Samset, overingeniør Utviklingsavd., Renovasjonsetaten

-Returlogistikk – KING den grønne løsningen for NorgesGruppen
Bjarte E. Grostøl, logistikksjef konsern ASKO Norge AS

Spørsmål fra salen
- **14:00 - 15:00 PARALLELL 2 (Sal Q3) - tema 4: Den gode dialogen mellom offentlige innkjøpere og leverandører**
Møteleder: Johnny Stuen, teknisk direktør Energigjenvinningsetaten (EGE)

- Gevinstrealisering gjennom smartere innkjøp
Nina Ellingsen Nasjonalt program for leverandørutvikling NHO

-Hvordan vinne flere konkurranser?
Tanja Huse-Fagerlie, seniorrådgiver, Avd. for offentlige anskaffelser Difi

Spørsmål fra salen.

- **15:00 - 16:00 PAUSE OG UTSTILLINGSVANDRING (the Qube)**
  Servering av kake og frukt i utstillerhallen.
- **16:00 - 17:00 Om bærekraftig økonomisk utvikling i PLENUM (Luftrommet)**
  -Vi behöver en ny ekonomisk logik
  Anders Wijkman, forfatter, samfunnsdebattant, talsperson for *återvinningsindustrierna" i Sverige

  -Svevende avfallssortering - om forbrukertrender og hvordan de vil påvirke fremtide
  Ida Hult, konsumentspesialist

Program 11. Juni

- **- Årets tema: Samfunnsansvar og industriell lønnsomhet**
  Med forbehold om mindre programendringer i tiden frem mot konferansestart.
- **0905 - 0925 Innovasjon på agendaen i PLENUM (Luftrommet)**
  - Hvorfor vi trenger et 'drømmeløft' for å øke norsk innovasjonsevne og hvorfor bærekraft er kjernen!
  Anita Krohn Traaseth, adm. dir. Innovasjon Norge
- **09:25 - 10:30 Om EU, kretsløpsøkonomien og konsekvenser i PLENUM (Luftrommet)**
  Møteleder og moderator Kristin Bergersen, kommunikasjonsdirektør Renovasjonsetaten, Oslo kommune

  -How municipal waste management organizations are preparing for the circular economy
  Philip Heylen, Vice-mayor of the city of Antwerp, responsible for waste management

  -Key role of the private waste management sector in the transition from a linear to the a circular economy in view of the new EC proposal
  Milda Basiulyte, Legal and Communications Officer FEAD

- **10:30 - 11:00 PAUSE**

- **11:00 - 12:00 PARALLELL 3 (Sal Luftrommet) - tema 5: Kriminalitet og samfunnsansvar i avfallsbransjen**
  Møteleder: Per Elvestuen, kommunikasjonssjef Avfall Norge

  -Global perspective to the magnitude of waste crime
  Ieva Rucevska, Norwegian Project Manager GRID-Arendal
  Runa Opdal Kerr, juridisk direktør Norsk Gjenvinning AS

  -Økonomiske misligheter – forebygging og avdekking
  Are Meisler Storvik, Senior Manager KPMG AS

  Spørsmål fra salen
- **11:00 - 12:00 PARALLELL 3 (Sal Q3) - tema 6: Hvordan tiltrekke seg og holde på verdifulle arbeidstakere?**
  Møteleder: Kirsten Lundem, kommunikasjonsrådgiver Øras

- Å være lærling i Energigjenvinningsetaten - erfaringer og refleksjoner
Karina Vikbakk Johnsen, lærling i kjemiprosessfaget
Sebastian Hov, lærling i industrimekanikerfaget

- Kampen om kompetansen. Rekrutteringsutfordringer i avfallsbransjen
Anna Hagen Tønder, forsker Fafo

- Tiltak for å møte fremtidige kompetansekrav - lærlingeordning i Härnösand, Sverige
Linda Johansson, administrasjonssjef Härnösand Energi & Miljö AB

Spørsmål fra salen

- **12:00 - 13:00 LUNSJ OG UTSTILLINGSVANDRING (the Qube)**

- **13:00 - 14:00 Om Russland, økologi og neste års konferanse i Tromsø i PLENUM (Luftrommet)**
Møteleder: Nancy Strand, direktør Avfall Norge

- Presentasjon av Avfallskonferansen 2016 i Tromsø

- Økologibomben truer Russland mer enn atombombe
Hans-Wilhelm Steinfeld, journalist, historiker, forfatter og programleder

- **14:00 - Takk for nå og god reise hjem!**

(Avfallskonferansen, 2015)