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Master Thesis

Exploration and Exploitation in Public Procurement

A case study on ICT public procurements in Norway

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Abstract

Public procurement for innovation is known as a powerful demand-side instrument to be employed in addressing pertinent challenges. The Traditional procurement process is outdated and insufficient to stimulate the production of innovative results. However, while the Public Procurement of Innovation (PPI) approach addresses barriers of the Traditional procurement procedures regarding innovation, it also presents several barriers of its own.

This thesis focuses on the particular case of PPI in Norway, where the account of the current state and usage of the PPI approach are described. Findings indicate a dominance of the traditional approaches in the current state of public procurement practices in Norway, with tendency towards exploitation rather than exploration, despite the country's political ambitions. Several causes, other than the nature of "*normal*" routine purchases, seek to influence the procurer's avoidance of more complex innovation-oriented tendering procedures. This study aims to explain this, and concludes with a discussion of potential improvements to stimulate the procurement of innovative products and services in Norway, based on the practical case of ICT procurements.

Keywords: Public Procurement for Innovation; PPI; innovation policy; innovation elements; interactive learning; cooperation; competition.

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Last, but by no means least, I thank my mentor and friend Ronny Dragnes for his kindness and encouragement throughout my Master's program, and for his personal commitment and active guidance which helped me define my interests, career priorities, and the upcoming stages in my personal development.

For any mistakes or inadequacies that may persist in this study, the responsibility is, of course, entirely my own.

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Acronyms

DIFI - Direktoratet for Forvaltning Og Ikt

EU / EC – European Union / Community

GDP - Gross Domestic Product

IAOP - International Association of Outsourcing Professionals

ICT – Information and Communication technology

LCC – Life Cycle Costs

ME – Ministry of the Environment

MEAT – Most Economically Advantageous Tender

MGARCA – Ministry of Government Administration, Reform and Church affairs

MTI – Ministry of Trade and Industry

PPI – Public procurement of Innovation

RFI – Request for Information

RFP – Request for Proposal

SI – Systems of Innovation

R&D – Research and Development

RFT – Request for Tender

SBIR / SBIR - Small Business Research Initiative

SBU - strategic business unit

SME – Small and Medium sized Enterprises

SOW - Statement of work

TCO – Total Cost of Ownership

Ted – Tenders Electronic Daily

I - Introduction

1. Introduction

Demand is a powerful source of innovation, yet the role of demand as a key driver of innovation still falls short from being fully recognized in government policy. According to Edler and Georghiou (2007), when oriented towards innovative solutions and products, public demand has the potential to improve the delivery of public policy and services, often generating improved innovative dynamics and benefits from associated spillovers. However, public procurement as an innovation policy instrument has been neglected or understated for many years. A recent EU exploratory study concerning public procurement regards as a major problem that very few European countries, such as the UK and the Netherlands, have specific programmes focusing on the use of public procurement for the promotion of innovation (Nyiri, et al. 2007).

Pursuing innovative outcome through optimizing procurement processes gave birth to the theoretical approach of Public Procurement of Innovation (PPI). Several authors regard the topic of innovation in public procurement practices through the lens of Systems of Innovation, looking for the barriers and key drivers of innovation in procurement processes, and developing an innovation-oriented analytical framework (Edquist and Hommen 1999, Edler and Georghiou 2007, Rolfstam 2009, Hommen and Rolfstam 2009, Aschhoff and Sofka 2009, Nemet 2009). In addition to researching the effects that hinder innovation in public procurement, these authors express a desire for an integrated approach that inherently stimulates innovation. Conversely to the current state of disregarding the innovation potential of several "normal" or routine purchases, these authors argue towards an approach where every purchase should be considered and analyzed regarding its strategic potential.

In Norway, public procurement accounts for about one third of the total consumption, corresponding to an expenditure of NOK 380 billion in 2010 (SSB 2012). According to the Ministry of Governmental Administration Reforms and Church Affairs, this is the rough "equivalent of

sixty new Opera houses per year" (MGARCA 2012). Such force is a highly useful policy instrument for realizing positive changes in the economy. With this in mind, the Norwegian government has included several policy goals that affect public procurement in its latest reforms towards strengthening the innovative capabilities of the Norwegian economy (MTI 2008, MGARCA 2012). Considering the implemented innovation instruments in public procurement, and the expressed intentions of the Norwegian Innovation policy, this leads to the following research goal of this Master's Thesis: *To review the existing Innovation-oriented procurement instruments in Norway, in order to stimulate the purchase of innovative products and services.*

1.1. Problem statement

The main problem in public procurements is achieving a balance between engaging in safe, stable and low risk purchases (with a low potential for innovative outcome), or in riskier, costly and uncertain innovation-oriented purchases. This problematic of avoiding extremes is best put in March's (1991) formulation on the firm level between balancing Exploitation (defined as activities towards incremental efficiency in existing operations) and Exploration operations (the pursuit of revenues from new, unexplored possibilities). The same concepts can be extrapolated into the public procurement dimension, with Exploitation being reflected in more conservative purchases, and Exploration in innovation-oriented purchases.

It is therefore of interest to analyze the current state of this practice in Norway to realize whether it has an Exploration or Exploitation focus and understand the types of incentives built into the procurement process. This thesis will analyze this with aim to reveal potential areas of improvement and discuss which recommendations from the literature are most promising to stimulate the focus on innovation in Norwegian public procurements. I will promote these improvements by addressing the barriers found in the Norwegian context with suggestions extracted from Innovation theory.

1.2. Research Questions

To understand if there is the necessity to review the existing procurement instruments in order to stimulate the procurement of innovative products, four research questions are proposed:

1) *What is the current state of procurement practices in Norway?*
2) *How has the PPI approach been used?*
3) *What are the current major barriers to PPI in Norway?*
4) *How can these barriers be mitigated?*

To address these questions, I have structured this thesis as illustrated bellow in Figure 1.

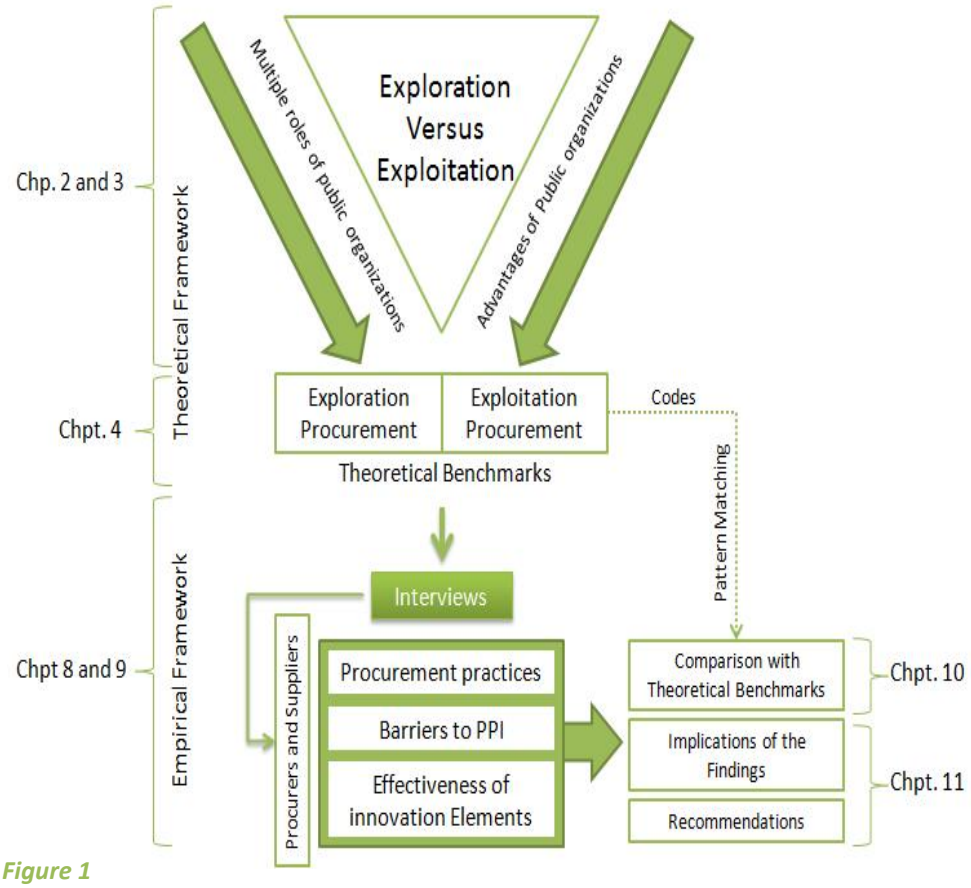

Figure 1
Research Process

Chapters 2 and 3 will explain the problematic of Exploration versus Exploitation, and introduce the development of public procurement as an important policy tool. Derived from these chapters, the distinction between procurement practices with tendency for Exploration and procurement practices for Exploitation will be discussed and introduced as Theoretical

Benchmarks in Chapter 4. The bridging Chapters 5 and 6 present the political context of public procurement in Norway, and introduce a brief overview of important drivers for innovation in the ICT sector, followed by the methodology section in Chapter 7. Lastly, Chapters 8 and 9 concern the presentation of this study's empirical findings with a further analysis on Chapter 10, where I compare these findings with the theoretical benchmarks explained in Chapter 4. The implications of the findings and derived recommendations are discussed in Chapter 11.

II – Theoretical framework

2. Exploration versus Exploitation

I will begin with introducing the relation between the concepts of exploration of new possibilities and the exploitation of certainties in organizational learning. The concept of Exploration relates to search, variation, risk-taking, experimentation and innovation, while Exploitation concerns terms as refinement, efficiency, implementation and execution (March 1991).

2.1. The dilemma

The problematic of achieving a balance and avoiding extremes is best put in March's formulation on the firm level: "*Firms that engage in Exploitation to the exclusion of Exploration are likely to find themselves trapped in suboptimal stable equilibrium, while conversely, firms that engage in Exploration to the exclusion of Exploitation are likely to find that they suffer the costs of experimentation without gaining many of its benefits*" (March 1991, 71).

The higher degree of uncertainty related to Exploration activities results in an (unpredictable) dispersion of consequences across time and space, which affects organizational learning. At the same time, the certainty, clarity and proximity of results from engaging in Exploitation activities allow firms to link these to their consequences faster and more precisely. Therefore, firms have the tendency to engage in Exploitation, further accumulating these operations' advantages: each increase in competence at an activity increases the likelihood of rewards for engaging in that activity (Argyris and Schön 1978, as cited in March 1991, 73). Through network externalities, these effects extend to other organizations. Ultimately, learning and imitation obstructs experimentation and innovation.

These positive local feedbacks from Exploitation result in strong path dependences, leading to suboptimal equilibrium (David 1999, as cited in March 1991, 73). A firm risks excluding superior activities with which it has little experience, by focusing its competence on inferior activities (Herriott, Levinthal and March 1985, as cited in March 1991, 73). This

tendency towards exploitation can potentially engage the firm in a vicious cycle, as illustrated in Figure 2 bellow.

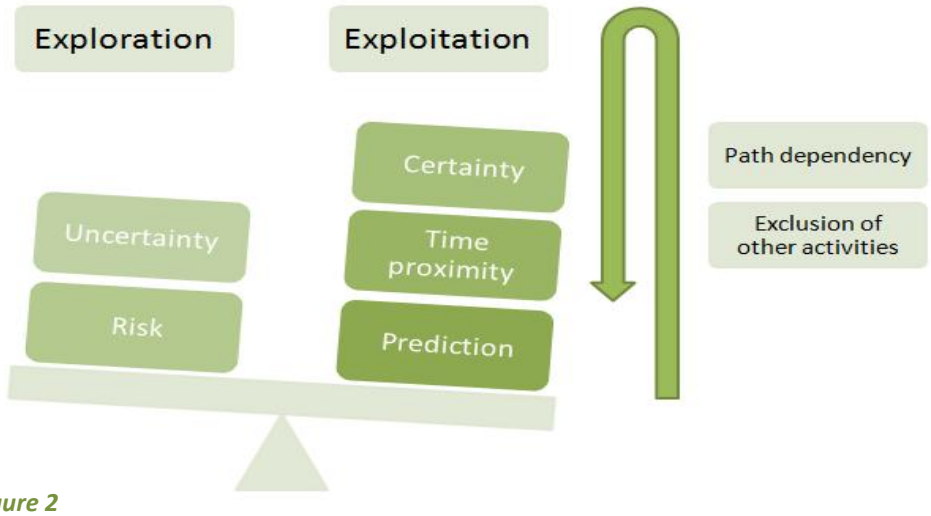

Figure 2
Tendency towards exploitation (Source: adapted from March 1991)

2.2. The compromise

According to Nooteboom (1999), as cited in Ørjasæter (2005, 5), the balance between Exploitation and Exploration changes along the business' lifecycle: the more mature and established a company becomes, the more resources it can allocate to riskier Exploration activities. However, Burns (2005) found that the larger companies in his study (including publicly enlisted organizations) tend to focus on Exploitation-related activities, while small-medium enterprises (SME's) tend to be more Exploration oriented.

This is explained by impatient shareholders and top management's emphasis on Exploitation as a result of companies' short-term valuation. Leaders are required to focus on effectiveness, productivity and short-term profits. Radical changes that diverge from existing practices tend to be ignored unless the firm's market position is vulnerable. However, this path-dependency becomes destructive for the company, especially with decreasing product life cycles and increasingly aggressive competition. Such was the case of IBM, who almost went bankrupt from solely focusing on their Mainframe core business before being able to include desktops and laptops (Ørjasæter 2005). In Norway, Norwegian Data and Tandberg collapsed, unable to adapt quickly enough to the changing industry (Ørjasæter 2005).

How, then, can firms balance between safe and predictable growth and new, unpredictable ventures? Clayton Christensen (1997), argues that the more disruptive the technology is, the more reason there is to outsource it or create an independent business unit working solely with the specific innovation, as illustrated in Figure 3.

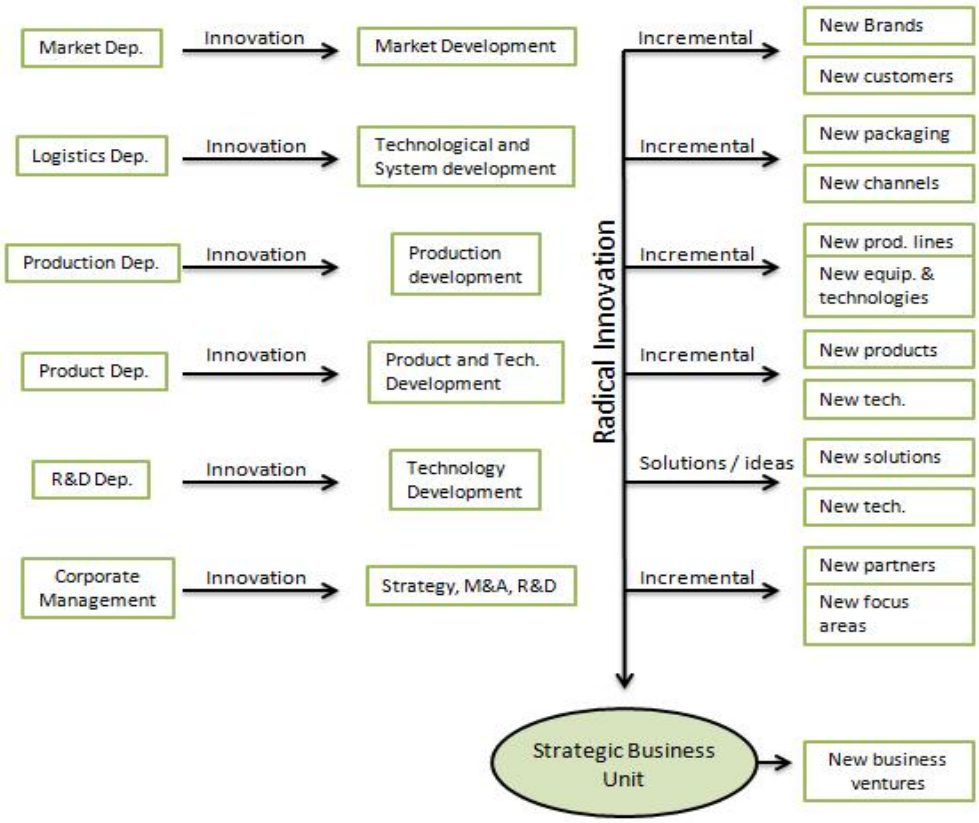

Figure 3
Strategic business unit (Source: adapted from Ørjasæter 2005)

While this Strategic Business Unit (SBU) should prioritize the exploration of new innovations, it should also be involved in the firm's core strategy in order to actively participate in the innovation processes (Ørjasæter 2005).

The compromise between engaging in both Exploitation and Exploration is then the implementation of such a unit that can engage in exploration activities, with the responsibility of actively assisting top management; generating, identifying and evaluating new business ideas; and commercialize innovation projects, while the core company focuses on Exploitation (Ørjasæter 2005). Competitive advantage, this way, comes not from separating the two, but rather actively implementing the learnings from one side into the other.

3. Public Procurement

In this section, we will see how this is reflected in the public sector. The topic of Public Procurement has received much attention especially in the latter half of the 20th century, following the shift from the classical Keynesian view of the Bretton-Woods order, towards the *Market-focused* economy inspired by Milton Friedman (Callender and Matthews 2009). This switch was accompanied, among other factors, by a transition from manufacturing to service-based economies and a rapid enhancement of electronic technology. At this point, governments adopted the same approach to balancing Exploration and Exploitation introduced in the last section. This epoch was marked by large sales of public organizations; an increasing trend of resorting to an external firm's expertise in certain phases of the value-chain through contracting non-core activities, and a spreading culture of "*doing more with less*", which highly impacted Public Procurement (V. Thai 2009). Public organizations decide what can be better done through outsourcing and what kinds of services can they purchase to better address their users and citizens. By fully taking advantage of its buyer power, the public organization can demand higher requirements from the market and induce innovation. Although not as directly as with private firms, public organizations can this way engage in Exploration activities through targeted procurements.

3.1. Public Procurement as a policy instrument

Governments thus began to consider the power of its purchase function, admitting it as an attractive policy instrument with at least four functions. According to Edquist and Hommen (2000), it has been used to:

- Increase global demand and stimulating economic activity, thus creating employment (Keyzer 1968, McCrudden 1994);
- Protect national industry against foreign competition (Goodman and Saunders 1958, McLachlan 1985);
- Improve the competitiveness of certain industrial sectors, by linking secure access of public markets to commitments on the part of national champions to invest in R&D (Jeanrenaud 1984); and,

- Remedy regional disparities, so as to reach redistribution objectives (Jeanrenaud 1984).

As such, the use of public procurement as a policy instrument is of interest to several different domains. The domain of economic and industrial policy aims at economic growth and the support of certain strategic sectors, where the induction of "*sophisticated markets*" (such as Lead Market initiatives) is one of the pillars behind the interest in demand-led policies. There is also the domain of science, technology and innovation policy, with the objective to stimulate public and private investments in R&D. Finally, there are a large number of specific policy domains (such as health-care and environment) that need solutions to societal problems that could potentially be provided by technology and innovation.

3.2. Public procurement versus for-profit procurement

The rationale for public intervention through procurement can be made on the grounds that strong social needs or demands often correspond to normally weak rates of private return on investments in innovation (Mansfield and Rapoport 1971). At the same time, the most frequently cited arguments in favor of public procurement refer primarily to certain special characteristics of demand: strategic importance, largeness of scale, high risks, and high costs (Rothwell and Zegveld 1982).

According to Stiglitz and Wallsten (1999), the private sector's investment in R&D is constrained by several barriers relating to firms' incentives for engaging in activities towards society-wide benefits, especially when these do not translate into direct financial rewards (such as the adoption of sustainable and innovative products). Combined with the short-term shareholder evaluation of private companies, these companies tend to ignore new technologies because it initially provides neither a better product nor acceptable margins. Despite their understanding that noteworthy and sustainable growth comes from creating new markets and ways of competing, few are willing to make such investments especially when times are good (Christensen 1997).

Conversely, as seen in the previous section, there is an intrinsic interest in public procurement from the part of the government - as the

provider of services and products such as infrastructure, information, defense and so on - making the public sector better positioned for this kind of activities. The provision of better (more efficient or new) public services is a powerful driver for governments to engage into procurements of sustainable innovations.

Nonetheless, public procurement has several hindering characteristics that distinguish from commercial procurement. These are summarized and gathered from various sources by Telgen et al. (2007), and seen in Table 1.

Characteristics	Explanation
External demands: Transparency, Integrity, Accountability, and Exemplar behavior	• Transparency - openness and equal opportunities for all interested bidders. • Integrity - refers to avoiding improper, wasteful or corrupt and fraud practices. • Accountability - public procurement authorities are responsible for effective, legal, and ethical procedures. • Exemplary behavior - the government is expected to set an example, not only in terms of ethical standards but also in terms of efficiency and effectiveness.
Internal demands: Simultaneously serving multiple political goals	This complicates public procurement, because it is hard to fully recognize the impact of purchases across different political goals. The public agency is in fact serving a large amount of stakeholders with different objectives (per example, citizens, taxpayers, and electorate).
External pressure: Budget structure	As a result, the budget partly determines the outcome of what is procured. The budget is known to the general public and the suppliers, which highly influences the relation between the buyer and the supplier, and furthermore makes the procurer publicly visible and accountable for its decisions. In addition, budgets are often divided into different allocations, causing difficulties in optimizing purchasing and operating costs.
Regulatory demands on the procurement process	These are: demands on the process from legal regulations; restriction from engaging into long-term relationships with suppliers; and complex cooperation opportunities between public organizations lost due to the absence of competition between them.
Adoption of multiple roles	This means that public purchasers buy products for their own organization predominantly for improving its service offer for the citizens they are expected to serve.

Table 1
Characteristics of Public Procurement (adapted from Telgen et al. 2007)

These multiple responsibilities are illustrated in Figure 4.

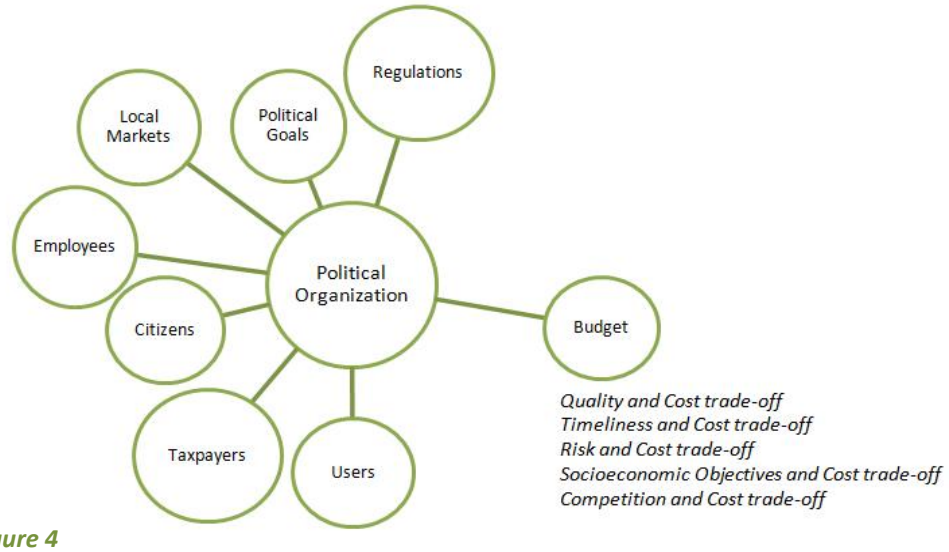

Figure 4
Multiple stakeholders in the public institution (Source: adapted from Khi V. Thai 2009)

3.3. The development of public organizations

The priority of these different goals changes over time, throughout to the maturity of the purchasing organization. According to Crawford (2006), the goals in the different phases of the procurement agency's development are: serving the organization, appropriate use of public funding, efficient use of public funding, accountability, value for money, and overall policy delivery (such as integrating a sustainability and innovation focus). Figure 5 illustrates the described development of public procurement, using the Project Management Maturity model as basis.

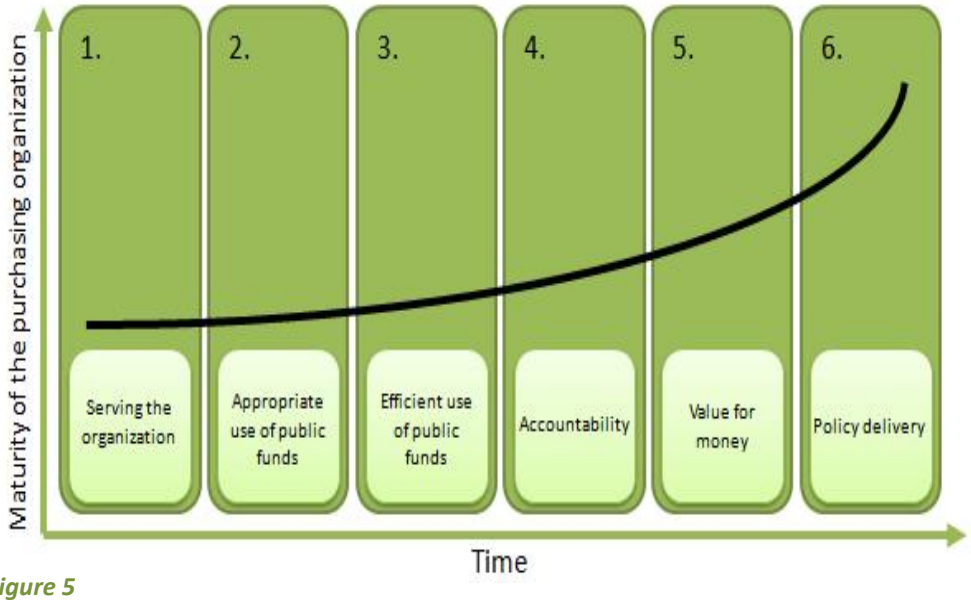

Figure 5
Areas of influence of the purchasing organization (Source: adapted from Crawford, 2006)

In its initial stages, while the organizational structure is more chaotic and inconsistent, the public organization focuses its efforts on building itself to serve its purpose. In the following stages, the organization is emerging, better managed, and adopting standardized, documented procedures. It then evolves to an integrated, well-defined, competent institution, which illustrates the development from appropriate to efficient use of public funding.

Next, it evolves to a strategic stage, where the institution is disciplined, predictable and with quantitatively managed aligned objectives. The following two stages represent an evolution towards optimization, where the company is adaptive, opportunistic, agile and proactive. At this maturity level, the institutions can not only deliver good value for money, but also strongly contribute for policy delivery and achieving political ambitions.

The amount of capital involved in the institution's operations (which also grows along its maturity), attracts political interest in public procurement as an influential policy instrument. Suggested policy areas related to public procurement are: job creation and employment, strengthening of industries, stimulating small and medium size enterprises (SMEs), local industries, diversity, innovation, sustainability and environment, and development aid (Telgen, et al. 2007). These policy areas therefore grow to become the focus of the purchasing organization.

4. Traditional procurement and PPI

As we have seen in the previous sections, the public sector is best positioned to engage in riskier Exploration activities. However, public organizations must decide which objectives to prioritize, a problematic particularly evident in the case of mature organizations. The institution is constrained with a public funding budget, and a high public visibility of management's resource-allocation decisions, among other external pressures introduced in Table 1. Again, we can see a friction between engaging in Exploitation or Exploration. The public institution, acting as a purchaser, needs to decide what to buy and how to do it. It can have an Exploitation

focus by procuring cheaper, ready-made solutions from the market, or conversely, have an Exploration focus by demanding more from the market than what it has to offer, i.e. procuring solutions that address the institution's current need as well as future ambitions and policy objectives.

4.1. Exploitation procurement in the Traditional process

In this section, I will describe the characteristics of an Exploitation focus in public procurement. These are present in the Traditional approach to public procurements, as this process typically involves no innovation. Only the price and quality of the (existing) product are considered. I will now discuss its most relevant phases, present their characteristics, and most common practices.

In Supply-Chain literature, Van Weele's (2005) purchasing model is widely accepted to describe this process, involving every step from the initial specifications to the final evaluation of the procured goods or services. This model is organized in six stages: Specification, Selection, Contracting, Ordering, Monitoring, and After-care. This study focuses on the phases that are most influential on the final product outcome and therefore the left-end of the model was expanded to include the Preparation phase. The most influential phases, therefore, are the Preparation phase - defined as the *strategic* stage - and the Specification, Selection, and Contracting phases - defined as *tactical* stages (Harink 1999). The remaining three phases (Ordering, Monitoring, and After-care) are operational phases of the purchasing process, and escape the focus of this thesis.

Figure 6
Areas of influence on product specifications (Source: adapted from Crawford, 2006)

Figure 6 above illustrates how these initial phases have the most influence on the project's outcome, as the influence each phase can have on the result declines along the process. The innovation potential of the project must then be carefully understood early on during the initial procurement phases.

In the next Subsections I will present the characteristics of the Preparation and Specification phases (the two most influential phases). I will introduce basic principles regarding Tenderer and Tender criteria, supplier selection based on multiple criteria, and the definition of different tendering procedures.

4.1.1. Preparation phase

This stage addresses what will be procured and how. Being able to choose an appropriate tendering procedure, with suitable selection criteria, requires good knowledge of the market and technical capabilities. A good preparation produces important insights regarding key characteristics of the procured products, affecting the choice for tendering procedures and criteria used, and consequently affecting the innovativeness potential of the procurement. As we will see when regarding the tendering procedures allowed by the regulations, this phase and its relevance are not prioritized in the Traditional procurement approach.

4.1.2. Specification phase

In this phase the public agency specifies the requirements for both the tenderer (vendor) and the tender (offer), through a formulation of the information gathered in the previous stage, with aim to guarantee that the objectives are met. The regulations for public procurement require that procurers describe in a high level of detail what they are looking to buy (EC 2004). This level of detail required brings several advantages in terms of comparing tenders, thus easing the selection process, and gives the procedure a high level of transparency. On the other hand, as we will see, it does not give suppliers enough room to propose alternative solutions. Finally, also in this phase, the procurer chooses the most suitable tendering procedure, regarding selection and award criteria for the tender and the

tenderer, as well as the type of tender contract. These are described in the following paragraphs.

4.1.2.1. Tenderer and tender criteria

There are two main methodologies when choosing the most appropriate offer: to use criteria focusing on the supplier's performance (defined as tenderer criteria), or to select suppliers based on their offer (defined as tender criteria). Within these tenderer and tender criteria, there are three types to choose from: knockout criteria (per example, exclusion from non-compliance), scoring criteria (for ranking the tenders), and semi-knockout criteria (where scores on a certain criteria bellow a given level cannot be compensated from other criteria).

There are three sets of tenderer criteria. Exclusion criteria intend to define situations where the public purchaser will not conduct business with the supplier. The second set of criteria relates to technical capacity. Finally, selection criteria that are not included in the previous two sets are to be used in Competitive Dialogues, Restricted procedures and in Design contests.

Regarding tender selection, there are two sets of criteria: technical specification (usually in terms of minimum requirements), and award methods (price only, or a constellation of characteristics including per example, quality, sustainability and innovation, through the use of a mathematical formula accompanied by an (intended) comprehensive description).

4.1.2.2. Supplier selection based on multiple criteria

Norway follows the EU procurement directives stating the possibilities to include further criteria than price. The problem is that no specific method is presented regarding how to include these criteria.

According to Telgen et al. (2007), five steps are necessary to award the right supplier with the best product when selecting based on multiple criteria, as summarized bellow in Figure 7.

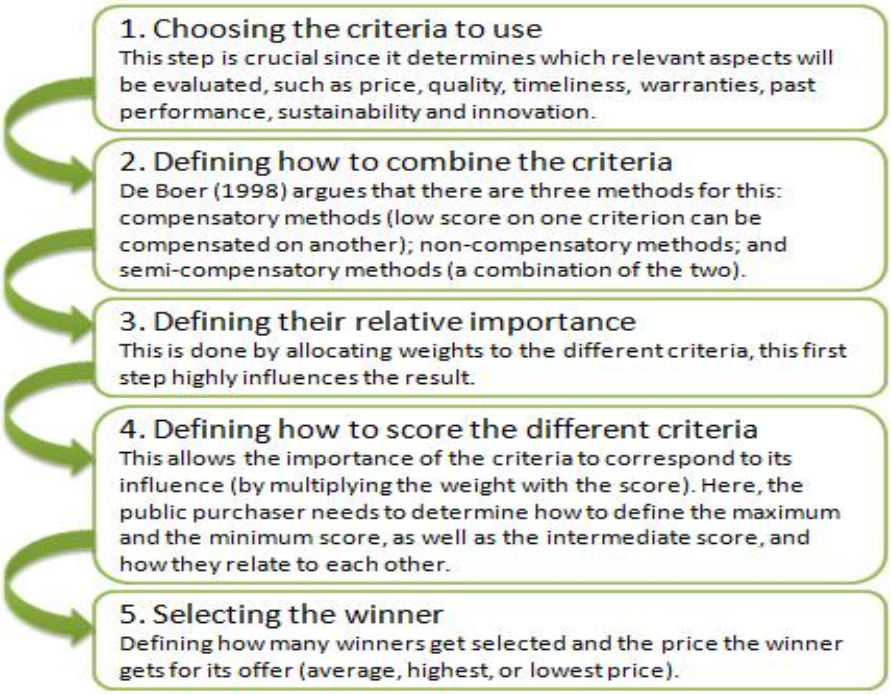

Figure 7
Supplier selection based on multiple criteria (adapted from Telgen et al. 2007)

4.1.2.3. Tendering procedures

Depending on the size and characteristics of the procurement, different tendering procedures can be selected (EC 2004). These are presented in Table 2.

Procedure Type	Characteristics
Open procedure	• This procedure is performed in a single round when the tender is made public and all interested can submit offers, which are chosen under predefined criteria. • No negotiation with suppliers is allowed.
Restricted procedure	• This procedure consists of two rounds: when the tender is made public and a predefined number of suppliers is selected; and when the purchasing organization awards the actual winning tender. • As in the Open procedure, negotiations with the selected suppliers are forbidden.
Negotiated procedure with prior publication of a contract notice	• When the previous procedures are not appropriate, this procedure allows negotiating the offers with the suppliers. • In order to assure non-discrimination, the same information must be given to all suppliers.
Negotiated procedure without prior publication of a contract notice	• This procedure is the same as the above, other that no prior contract notice is required.
The Competitive dialogue	• This procedure is meant for extraordinary tenders, where the previous procedures are unsuited. • The MEAT is the appropriate awarding method.

	• In its first phase, the purchasing agency describes the problem to all interested suppliers, and in cooperation with a selected part of them it defines the requirements necessary to meet the described objective, after which suppliers submit their offer.
Design Contest	• This procedure selects offers based on design, through a neutral jury (IPR plays an important role in this procedure).

Table 2
Different procurement procedures (Source: adapted EC 2004, article 28)

4.1.2.4. Types of tendering contracts

Procurement agencies select a contract type between the extremes of a Fixed-price and Cost-plus contracts (with a middle-ground of an Incentive contract), giving the agency the tradeoff between limiting its costs against stimulating bidding competition and sharing risks (McAfee and McMillan 1986). Figure 8 illustrates this.

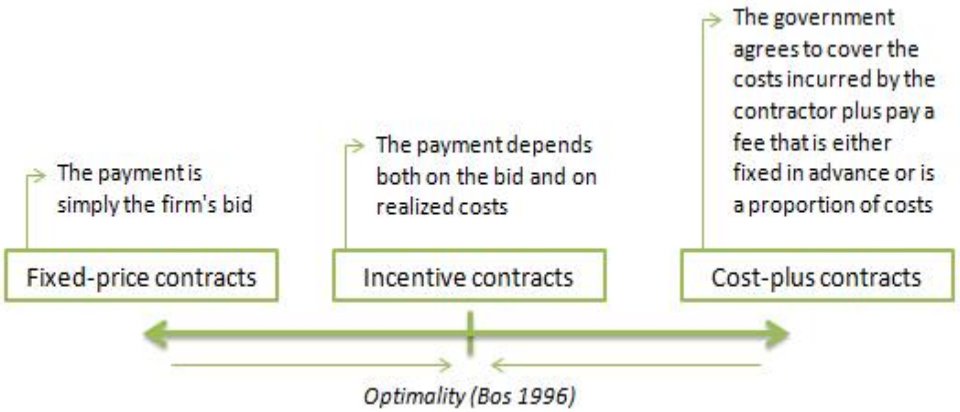

Figure 8
Types of Procurement contracts (Source: adapted from McAfee and McMillan 1986)

Each has different efficiency incentives, rent and equity properties, and each brings different opportunities for strategic behavior in contract negotiations (Hartley 2007). Fixed-price contracts are regarded by Hartley (2007) as providing higher incentives than Cost-plus contracts, since the supplier has the incentive to use the price paid by the buyer into delivering the product and keeping his costs beneath that level. However, it also gives the firm incentives to deliver as cheaply as possible, to save a premium margin. Hartley (2007) gives the example of the UK's experience in the purchase of the Nimrod MR4 maritime reconnaissance and attack aircraft, confirming the risks of Fixed-price contracts for combined development and production work.

In most purchases, the type of contract typically used is the Fixed-price contract: its simplicity and transparency allow the procurer to easily compare among tenders. In a negotiated procedure, the most typical type of contract used is the Cost-plus-fixed-fee contract, or simply Cost-plus (Hartley 2007). In these types of contract, the government pays the contractor his realized costs and sets a fixed fee independent of the actual performance, but implicitly related to the size of the project. Cost-plus contracts are also not considered appropriate for innovation, since these allow firms to allocate costs from other areas into the project (low transparency from firm's accountancy) and therefore easily allow the costs to escalate (Hartley 2007).

Bös (1996) shows that target cost pricing (or Incentive contracts) can achieve a first best when both fixed price and cost reimbursement contracts fail: if realized costs exceed the firm's bid, the firm is responsible for a fraction of the cost overrun; if the firm succeeds in holding its costs below its bid, it is rewarded by being allowed to keep part of the cost under-run (McAfee and McMillan 1986). This type of contract is the most suited for procurements of development and production, such as innovation-oriented purchases, whose procurement procedures I will introduce in the next section.

4.2. Public procurement for Exploration - PPI

Contrasting with the traditional procedures presented in the last section, the Public Procurement for Innovation approach (PPI) has more of an Exploration focus, as we will see in the following chapters. I start with a brief literature review on Theories of Innovation, after which I will present a literature review on the concept of PPI.

4.2.1. Theories of Innovation

According to the Merriam Webster dictionary, the definition of innovation is "*the introduction of something new, a new idea, method or device*" (Webster 2012). In Innovation literature, a broadly accepted definition of innovation is "*The introduction of new goods (…), new methods of production (…), the opening of new markets (…), the conquest of*

new sources of supply (…) and the carrying out of a new organization of any industry" (Schumpeter 1943). From his definition, Schumpeter introduces five types of innovation: Product, Process, Business Model, Source of Supply, and Merger & Divestments (as new forms of organization). For something to be considered an innovation there must be some kind of market acceptance, which follows a specific diffusion curve according to Rogers (1962), otherwise the new concept would solely fall under the definition of invention.

Innovations fall under two categories: Incremental and Radical innovations (Christensen and Raynor 2003). It is crucial for a purchasing organization to not only know the type of innovation it is aiming for, but also at which stage it is in its diffusion curve (from invention to full market acceptance and adoption). These considerations deeply relate to the surrounding risks for the buyer since risks decrease as the innovation goes through its diffusion stages and the technology becomes common and well understood.

Innovation processes occur over time and are influenced by many factors such as input and market factors, the latter being accountable for nearly 80% of innovations (Narayanan 2001). Due to the complexity of the innovation process, firms rarely innovate by themselves: instead, firms interact with other players (sometimes operating in different institutional contexts) to gain, develop, and exchange knowledge, information and other resources (Edquist and Zabala 2012). Such interaction is seen in Systems of Innovation literature as crucial for the innovation process and determinant of the development and diffusion of innovations.

4.2.1.1. The Linear Model of the innovation process

Different models of the innovation process have been developed aiming to introduce some conceptual order on this process, with the purpose of providing a more secure foundation for policy formulation (Kline and Rosenberg 1986). The early innovation model, called the "Linear Model", attempts to describe this process as a one-way flow from research, to development, to production and finally to marketing, as represented in

Figure 9 bellow. This model has several criticisms, mainly due to the lack of feedback paths within the ongoing process (Kline and Rosenberg 1986).

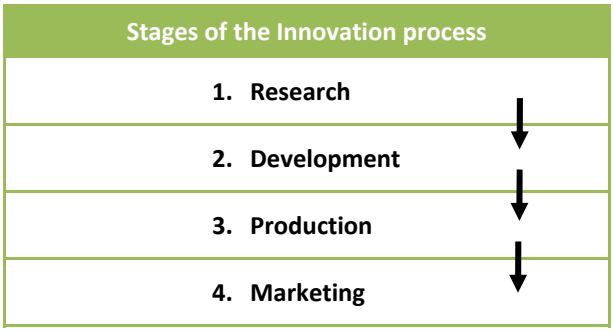

Figure 9
The Linear Model of the innovation process (Source: adapted from Kline and Rosenberg 1986)

As put by Kline and Rosenberg (1986, 286), "*in an ideal world of omniscient technical people, the design of the innovation would be workable and optimized at first try, and therefore could proceed flawlessly to the sequent stages (…)*". Conversely, in the real world, several aspects prevent this: inadequate information, high uncertainty, fallible people, increasing complexity, increasing role of experimentation, and the cumulative character of innovative activity (Carlsson and Stankiewicz 1991). These shortcomings are part of the learning process that creates innovation.

This outdated model also reflects to the traditional approach to public procurement (i.e. the "off-the-shelf" approach, where procurers merely research supplier's catalogues and choose their product). Particularly the first two allowed approaches (Open procedure and Restricted procedure) heavily depict this, as negotiation and interaction with suppliers are not permitted. This approach inherits no learning aspects or feedback loops from buyer-supplier interactions, and therefore is not considered effective for the purpose of procuring innovative products.

4.2.1.2. The Chain-linked model of innovation

To address the issues that criticize this static model, several alternative models were developed, such as the widely accepted "Chain-Linked Model", featuring five major paths of activity instead of just one (Kline and Rosenberg 1986). The Chain-Linked model incorporates various feedback

loops occurring in the innovation process, and reflects uncertainty as an inherent aspect of the process, as illustrated bellow in Figure 10.

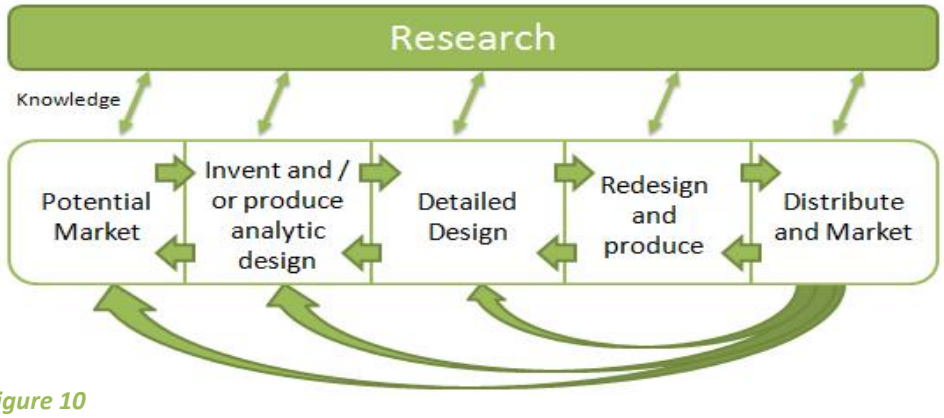

Figure 10
The Chain-Linked model of the Innovation Process (Source: adapted from Kline and Rosenberg 1986)

It also shows room for reduction of uncertainty at each step and every feedback link, as several tests and performance measurements can be introduced in the process, allowing shortening the overall time required (Kline and Rosenberg 1986). In this model, the Research phase is underlined throughout the process, linked to every other stage.

This innovation model is the most suitable for procuring innovation and should reflect the approach adopted by the procuring authorities. Tendering procedures such as the Negotiated procedure can incorporate this view, but do not necessarily do so: when the contract notice is published prior to contacting suppliers to negotiate their offer, the procurer is already too late to incorporate supplier's knowledge into the request (since it is not allowed to purchase something different than was initially announced), and procurers can then only negotiate practical aspects of the contract. The exception to this is the case of the Negotiated procedure *without* prior publication of a contract notice. Nonetheless, the general idea from the Chain-Linked model is that buyer-supplier interaction is desired from the very beginning of the procurement process. If the procurer engages in negotiations with suppliers already knowing (or believing to know) what he is looking for, it is again breaking that feedback loops linking to Research.

The tendering procedure that most reflects the Chain-linked Innovation model is the Competitive Dialogue, since it is divided into several stages (see Table 2). In the first phase, the procurer describes the

problem to all interested suppliers, after which the procurer runs a pre-qualification competition, where it resorts to several indicators to select a more restricted number of suppliers from the initial total of participants. These indicators are per example past performance and historical data, past participation in similar procurements, size and capacity, etc. Through interactive dialogue and ongoing learning loops the procurer is able to define the requirements necessary to achieve the described objective, after which suppliers are requested to submit their bids. This interaction also serves to mitigate risks across the different phases (illustrated in Appendix 1). Here, the procurer does not assume from the start to know exactly what he is to purchase, but rather first describes the general problem or need to the market. The procurer is also not limiting its purchase to the already available products, but instead gets to learn from suppliers what they can best offer for that particular case, and therefore leading to a better understanding of his possibilities. Furthermore, the procurer is able to incorporate future objectives into the purchase, by describing longer-term aims that he seeks to achieve. He is not only purchasing a product for his organization, but also contributing for the diffusion of that innovation acting as a Lead User, signaling and facilitating its adoption for other organizations. Particularly for mature public organizations, these external dimensions should be a core aspect of their procurements.

4.2.2. Public Procurement for Innovation

Public Procurement is known to be a powerful source of innovation and literature on this topic is widely available (Von Hippel 1986, 1988; Edquist, Hommen and Tsipouri 2000; EC 2005; EC 2006; ICLEI 2007; OGC 2007; Edquist and Hommen 2008; EC 2009a; EC 2009b).

Until about 10 years ago this phenomenon was called “Public Technology Procurement” (Edquist, Hommen and Tsipouri 2000). Since then, the concept of *technology* has been replaced by that of *innovation*, reflecting a widening of the content of the notion (Edquist and Zabala 2012). While the vocabulary has evolved, the substance remains relatively the same: to use public demand to stimulate innovation. PPI is therefore a demand-side policy instrument.

The ultimate objectives of innovation policies are politically determined, and can address different concerns, such as economic, military, social, and environmental. However, these still have to be "translated" into direct objectives, or in other words, into innovation terms. According to Edquist and Zabala (2012), this is rarely done in an efficient way, resulting in an innovation policy problem: a low performance (low intensity) of the innovation system for particular innovations for which the direct objective is a high intensity.

The (non-existing) products ordered in the process of PPI are neither the beginning nor the objective of this concept. Instead, the rationale for PPI is twofold: to satisfy human needs, and/or to address societal concerns (Edquist and Zabala 2012). The nature of certain challenges such as Global warming, the declining supplies of energy, water and food, ageing societies, public health, pandemics or security, does not allow defining policies to target them neither as a whole, or at the same time, and especially not only with one policy instrument (Lund Declaration 2009, as cited by Edquist and Zabala 2012, 3).

Instead, policies must focus on narrower objectives concerning partial problems related to the bigger issues. This is where the use of PPI can address meeting more limited goals as energy saving, better operational systems, and increasing efficiency, and should therefore be part of mission-oriented policies.

PPI can influence the rate (related to "number", "speed" and "importance") and the direction of innovations (shaping innovations and creating new trajectories). It can also lead to a stronger consolidation of the supplying firms: Edquist and Zabala (2012) describe the case of Ericson and ASEA/ABB in a Swedish PPI project. This indirect effect has a strong influence on competitiveness and growth.

These authors also present a PPI taxonomy, which I will summarize in the next paragraphs, and can be seen in the following Figure 11.

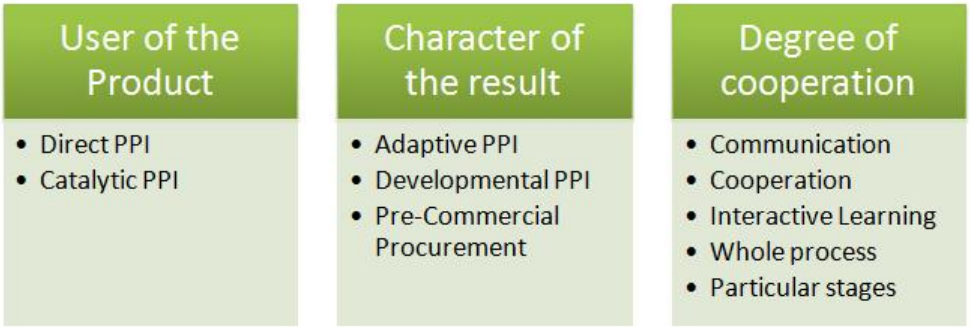

Figure 11

Taxonomy of PPI processes (Source: adapted from Edquist and Zabala 2012)

The first dimension concerns the user of the procured product. Direct PPI occurs when the procuring organization is also the end-user, and uses its own demand to induce innovation. Nonetheless, particularly because of the signaling power of mature institutions, the resulting product is also often diffused to other users, and therefore, innovations resulting from Direct PPI can be useful both for the purchasing agency, as well as for society as a whole (Edquist and Zabala 2012). Direct PPI is therefore an innovation-driven approach to the Competitive Dialogue procedure. Conversely, in Catalytic PPI the procurer is not the end-user: it serves as a catalyst to coordinate and provide resources for the benefit of other end-users.

The second dimension concerns the character of the result. In Adaptive PPI, the procurement is diffusion / absorption-oriented, and the result is incremental innovation. In Developmental PPI, the orientation is towards creation: new-to-the-world products and the result is therefore radical innovation. Lastly, Pre-commercial procurement (PCP) is the procurement of (expected) research results, but involves no product development. The concept of PPI is different than PCP: PCP regards the acquisition of expected research results, not the development of new products. The concept of a *buyer* is not involved (Edquist and Zabala 2012). PCP is more of a matter of R&D funding, making it a supply-side policy instrument in relation to innovation (see Appendix 2 illustrating the PCP process).

The last dimension concerns the degree of cooperation and learning in the PPI process, which can differ in intensity (from mere communication between buyer and suppliers to collaboration for interactive learning).

The typical PPI process has six stages, as illustrated in Figure 12.

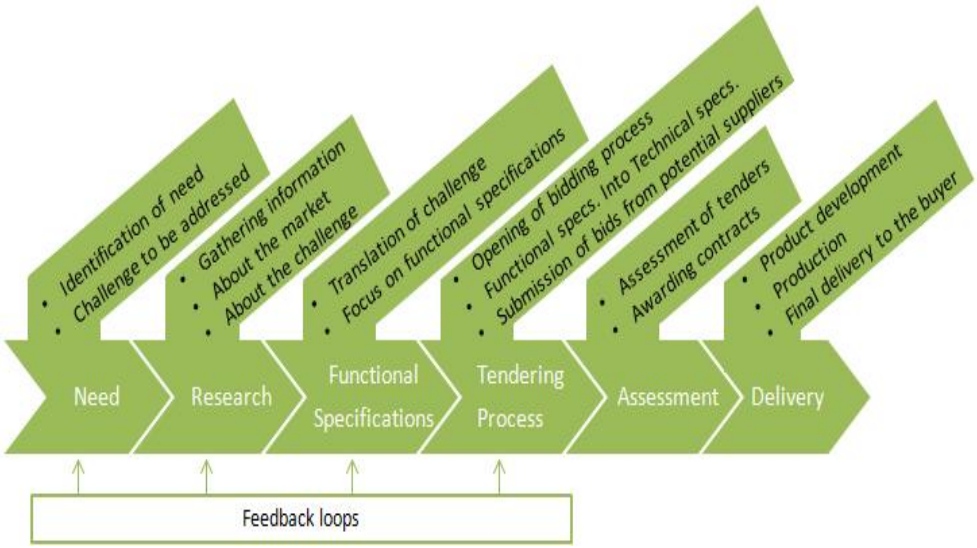

Figure 12
Typical PPI process (Source: adapted from Edquist and Zabala 2012)

We can see above that the structure does not imply merely a linear flow, but rather important feedbacks loops across stages. While the literature suggests diverse approaches for public procurement of Innovation according to different objectives as described previously, the European Commission (2009a) recommends the hierarchy illustrated in the following Figure 13. For the purpose of this thesis, I will focus on Direct PPI instruments, since these are most suitable to be used in basic tendering procedures, which is where I base the focus of my analysis.

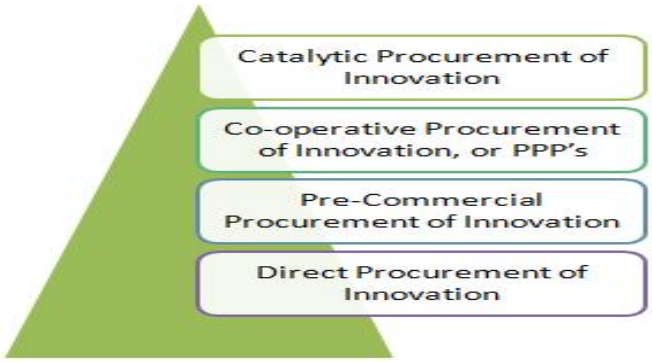

Figure 13
Hierarchy of public procurement of Innovation approaches (Source: EC 2009a)

Scholars have given some attention to the thematic of innovation through procurement, producing a vast number of articles analyzing and supporting PPI (Geroski 1990; Dalphé et al. 1992; Faucher and Fitzgibbons 1993; R. Dalphé 1994; Edler 2006; Edler and Georghiou 2007; Hommen and Rolfstam 2009; Aschhoff and Sofka 2009; Nemet 2009; Rolfstam

2009). This literature's content includes the main drivers, barriers, and suggestions concerning approaches for PPI, derived from case-examples of best practice and theoretical formulations of innovation elements that can be used in the PPI process, summarized in the following subsections.

4.2.2.1. Drivers versus barriers

By closely comparing the main barriers and drivers for public procurement of Innovation, it is interesting to note that several of them directly oppose each other. These are summarized in the following Table 3.

Drivers	Barriers
Public procurement of innovations can stimulate economic development. (Significant 2007, EC 2009a)	Public procurement of innovations requires Senior level buy-in (OGC 2007)
Government's example function to stimulate innovation. (Edler 2006)	• Public procurement officers demonstrate high risk avoiding behavior (Dalphé 1994, EC 2009b, OGC 2007) • Procurement of innovative products creates political risks. (Dalphé 1994, EC 2009a)
Public procurement of innovations can speed up markets for innovative products. (Significant 2007, EC 2009b, Nemet 2009)	Procurement of innovative products increases the overall lead-time. (Dalphé 1994, Edler and Georghiou 2007, EC 2009a)
Public procurement for innovations can boost targeting societal goals. (Dalphé et al. 1992, Edler and Georghiou 2007, Significant 2007, EC 2009a, EC 2009b)	The performance of the eventual outcome is not as specified for innovative products. (Edler 2006, Edler and Georghiou 2007, EC 2009a)
Innovations can generate better long term value for money. (Edler and Georghiou 2007, OGC 2007b, EC 2009a, ICLEI (2007)	Procurement of innovative products is more expensive. (Edler 2006, OGC 2007, Edler and Georghiou 2007)
Public procurement of innovations can help achieve multiple policy goals. (OGC 2007b, EC 2009b)	Multiple conflicting policies seek to influence the public procurement function (EC 2009a)
Public procurement for innovations can exploit synergy effects with other policy instruments to stimulate innovations (Dalphé et al. 1992, Aschoff and Sofka 2009)	The EU public sector procurement Directive (2004/EC/18) restricts public procurement of innovations. (EC 2006)
Technological capacity of public sector users generates a large potential group of users of innovations.	Public procurement has insufficient buyer-supplier interaction to become aware of innovative alternatives.

(Dalphé 1994, Edler 2006)	(Edler 2006)
Governments are capable of bearing possible higher entry costs of innovative products. (Dalphé et al. 1992, Edler 2006)	Procurement of innovative products increases risks. (Rolfstam 2009b, Valkenburg et al. 2009)
Public procurement is the most effective policy instrument to stimulate innovation. (Edler and Georghiou 2007, Aschoff and Sofka 2009)	Procurement of innovative products can result in supplier lock-in risks. (Edler 2006)
High concentrations of public demand early in the life cycle acts as a potential catalyst for innovation activity. (Faucher and Fitzgibbons 1993)	• Public procurement of innovative products can result in overall loses for possible local gains. (Dalphé 1994) • The location of Intellectual property rights are difficult to place in public procurement of innovations. (OGC 2007, EC 2009a)

Table 3
Comparison of main drivers and barriers to PPI (Source: in the table)

One contradiction that first steps out is that, despite innovation procurement allowing a longer term best value for money (Edler and Georghiou 2007) seen as a driver, the fact that it can be more expensive than regular procurement is seen as a barrier (Edler 2006).

Several other divergences emerge. It is argued that Governments are capable of bearing possible higher entry costs of innovative products; capable of speed up markets for sustainable products through PPI; and that the technological capacity of public sector users can potentially generate a large group of lead users of innovations (R. Dalphé 1992, 1994). At the same time, the fact that PPI requires Senior level buy-in (OGC 2007); that PPI tends to under-specify performance requirements (Edler 2006); that procurement authorities exhibit strong risk-avoidance behavior; and that public procurement has insufficient buyer-supplier involvements to become sensible to innovative alternatives (Edler 2006), are regarded as barriers.

Lastly, considering policy instruments and other policy goals, the main drivers identified are that PPI can stimulate economic development; can boost achieving several societal goals; can explore synergy effects with other instruments to stimulate innovation; and that it is the most effective instrument to generate innovation (Aschhoff and Sofka 2009, R. Dalphé et al. 1992, Edler and Georghiou 2007). Conversely, it is observed that these

multiple conflicting policies and goals tend to negatively influence the effect of public procurement of innovation (EC 2009a).

4.2.2.2. Innovation elements for PPI

In this subsection, I will introduce several innovation elements recommended in the literature to address the challenges mentioned in the previous paragraphs. The EC (2005) presents one of the most comprehensive collections of elements to stimulate innovation in public procurements found in the literature. Among others, it recommends the following features summarized bellow in Table 4.

Phase	Element	Recommendation
Across all phases	Competitive Dialogue	To use of advanced tendering procedures such as the Competitive Dialogue to stimulate innovation.
Preparation phase	Market Consultation	Research by interacting with market players.
Preparation phase	Technical dialogues	To engage in technical dialogues prior to seeking tenderers.
Preparation phase / Across all phases	Functional criteria	To specify functional or performance-based criteria, instead of focusing on technical requirements.
Preparation / Specification	Subcontracting	To overcome supply chain problems related to innovation, by having suppliers making sub-contracting more visible.
Preparation	Future needs	To early announce future needs and requirements to the market.
Preparation	Expertise building	To make purchasing authorities familiar with Procurement of Innovation procedures through education and workshops.
Specification	Variant bids	To permit the submission of variants allows a bigger pool of alternatives for the procurer to draw from.
Specification	80/20 rule	Allow tendering parties to deviate from the regulations for a part of the tender.
Specification	Contract clauses regarding IPR	To organize the contract conditions in order to allow the transfer of intellectual property to the supplier.
Specification	Tender size	To suit the size of the tender to the most appropriate size at which innovative products are most probable to be submitted, through joint buying or purchasing in lots.

Specification	Unrequested bids	To better address unrequested proposals through procedural design.
Specification	Private partnerships	To coordinate with the private sector when Directives for public procurement are allowed in national legislation.
Specification	Contract clauses	To avoid too strict confidentiality clauses that can push back suppliers with innovative products.

Table 4
List of Innovation elements for the PPI process (Source: EC 2005)

These elements concern different stages of the PPI process. I excluded particular elements, such as to coordinate with the private sector through Public Private Partnerships (PPP), since these are not applicable in basic tendering procedures. In the following subsections, I will present the implementation of these elements in the recommended (strategic and tactical) phases to explain how they work to stimulate innovation.

4.2.2.3. Elements in the Preparation phase

Market consultation is defined as the systematic collection, classification, and analysis of relevant information for prices and availability of products (Van Weele 2005). For the objective of stimulating innovation, market consultation should focus on researching for new solutions that are not known to the purchasing department. This requires particular knowledge about the need or problem to be solved, along with *out-of-the-box* thinking from the procurer, to consider alternative solutions not yet implemented. Market consultation should also be used to research the likeability of suppliers to develop innovative solutions. It can be even disconnected from the purchasing process itself.

Dividing the tender into lots is an exception allowed in EU public sector procurement Directive (EC 2004). This is done to stimulate SME participation, as smaller companies do not have the same capacity as big suppliers. Depending on the nature of the tender, this may have a negative impact on innovation.

Another exception allowed is the 80/20 rule, where tendering parties are allowed to deviate, to a certain extent, from tendering regulations for a part of the offer (EC 2004).

4.2.2.4. Elements in the Specification phase

Despite some elements in this section referring to other phases of the procurement process, they need to be decided in the specification phase (per example, tender selection criteria).

MEAT, as mentioned earlier, is an awarding system that allows awarding a tender considering various aspects besides price (EC 2004). By using this method, procurers allow suppliers to differentiate their offers by introducing benefits in several areas, such as long-term benefits, or sustainability. This should be combined by analysis such as Total Cost of Ownership (TCO) or Life Cycle Costs (LCC) - a cost approach where tenders can be accounted for all direct procurement cost as well as potential future costs, such as usage, delivery, maintenance, and disposal.

Functional specification should focus on what need the solution should address, or how it is to be used, rather than describing rigid technical requirements. This aims to give enough room for suppliers to innovate, and present alternative solutions for the same problem, rather than being restrained by technical particularities imposed by the purchaser.

A variant bid is an alternative competitive bid from the same supplier. By allowing variant bids, purchasers allow suppliers to present a new, more challenging and innovative offer. For this, the procurer must specify the minimal requirements of variant bids in the contract documents (EC 2004).

Rewarding innovative capability stimulates innovation by positively discriminating for a company that proves its innovation capabilities (for this, special attention must be given to how to measure and award innovative capabilities, by using particular Key Performance Indicators such as historical performance, past participation in PPI processes, etc.). Both the innovativeness of the supplier and the product itself can be granted a higher score. However, special note should be made to carefully design the scoring mechanism to assure fairness and non-discrimination.

Norms for stimulating desired development allows purchasers to include requirements in the tender in order to stimulate knowledge exchange. This can also give suppliers a chance to prove the higher quality of their products.

Lastly, by including contract clauses aiming at creating incentives for continuous improvement, the purchaser can stimulate innovation by guaranteeing the supplier with a safe market for its product, mitigating its risks to innovate.

4.3. Conclusion

To this point, I have introduced the problematic of balancing exploration and exploitation both at a firm level and in public procurement. I have also argued that the public sector is best suited for pursuing Exploration activities, and discussed the external and internal pressures that influence procurement practices. Additionally, I have introduced a broad overview of traditional public procurement practices, which have more of an Exploitation orientation, and the concept of PPI, with an orientation towards Exploration. These different approaches will serve as the Theoretical Benchmarks for this study's analysis chapter (Section 10), with their main differences summarized in the following Figure 14.

Codes	Procurement for Exploitation	Procurement for Exploration
Tendering Procedures	Priority to simple procedures	Priority to Competitive Dialogue
Priority of Dialogue	Low	High
Requirements	Technical terms	Functionality, or performance-based
Type of interaction	Negotiation	Interactive Learning
Purchase time	Fast: easy comparison among tenders	Slow: Face-to-face interaction Different tenders to compare
Type of Contracts	Dominance of Fixed-Price contracts	Favoring Target-cost contracts
Participants	Competition brings prices down	More participants = More ideas
Objectives	Immediate upgrade need Routine purchases	Addressing future ambitions Strategic purchases
Time Horizon	Short-term	Long-term
Expertise	Low : Common practice following regulations	High: market dialogue, mitigate risks, integrate future ambitions
Risk	Low	High
Innovation	Low: Adapt to market's offers	High: Induce innovation

Figure 14
Comparison of Theoretical benchmarks: Traditional versus Innovation Procurement

As I will explain further in this thesis' Methodology section, these differences are the codes I will be looking for in the empirical findings to characterize the orientation of the Norwegian procurement practices. The next section will present the political context of public procurement in Norway, in regard to the relevant goals and missions of its Innovation policy. After this, I will give a brief introduction to main drivers of innovation in ICT, followed by the Methodology section.

5. The political context of Public Procurement

The white paper report produced by the Ministry of Trade and Industry in 2008 describes the Norwegian vision and goals concerning Innovation. The vision statement is "An Innovative and Sustainable Norway". Focus points in this vision are "*to establish favorable conditions for increased innovation by advancing: a creative society with a sound framework and a favorable climate for innovation; creative human beings who develop their resources, while grasping the possibilities to apply them; and creative undertakings that develop profitable innovations"* (MTI 2008).

The relevant missions for this Master thesis presented in this report are the following:

- Creating an innovative and competitive Norwegian economy;
- The simplification of rules and administrative tasks to increase wealth creation and competitiveness;
- The Government's ambition is for Norway to become a leading nation in environmental technology.

This report also includes goals concerning the Norwegian public procurement function. The following goals address particularly public procurement:

- Establish favorable conditions for commercializing good business ideas through better information about current policy instruments, and assess new policy instruments;
- Public procurements can be conducted in such a way that they contribute to environmentally friendly and innovative solutions;

- The Government wishes to promote innovation through public procurements;
- Innovation should be given greater priority in procurement processes;
- Establish favorable conditions for wealth creation based on sound solutions in the public sector and increased use of public data;
- Strengthen the municipal sector as a service provider;
- Simplify interaction with the public sector and ensure greater use of innovative solutions.

6. Innovation drivers in the ICT sector

Until this point, my discussion was on theoretical terms and not specified for any product group. As explained in the Methodology section that follows these paragraphs, unable to analyze in detail the procurement practices for all product groups, I decided to focus my analysis on the ICT sector, at the expense of the generalizability of my findings. The following sections will narrow the focus of this thesis to public procurements in this sector. I will now give a brief introduction to important drivers of innovation in ICT, relevant for this thesis.

In the search for innovation drivers specific to the ICT sector, one particular dimension immediately comes forth: Sustainability. Other important innovation drivers relate to the dimensions of Competition, Networking and Interactive Learning, which are inherent aspects of the procurement process, particularly the PPI process.

Most innovation in this sector is oriented towards system efficiency and cost reduction, where energy usage and system capabilities are important criteria. Sustainability can be achieved *in* ICT itself, which includes concepts such as the promotion of so called “green-chemistry” to reduce the use of hazardous materials; to promote the recyclability or biodegradability of defunct products and production waste; and to maximize energy efficiency throughout the product’s life time. Sustainability is also achieved *through* ICT, which includes the promotion of “Clouding” and similar consolidation opportunities; promoting service-oriented architecture; adopting Software-as-a-Service (SaaS) approaches; and the promotion of

Automation. These two sides of product innovation and service innovation towards sustainability reflect the concept of Eco-efficiency (DeSimone and Popoff 2000): a powerful driver for innovation in this sector.

In the next section, I will present the methodological approach to this research.

III – Methodology

7. Methodology

7.1. Research Methodology

The research will be carried out with the following main activities:

- Comparison of the traditional and the PPI approaches to public purchasing;
- Analysis of the main procurement practices in Norway and barriers to adopting a PPI approach;
- Evaluation of the feasibility of the different procurement strategies.

The process of approaching my research question is guided by the research methodology framework from the work of Bryman and Bell (2011) and is pictured in Figure 15 regarding the overall process of this study. This overall framework is supplemented with insights from the work of Dubois and Gadde (2002), Guba and Lincoln (1994) and Yin (1994), among others.

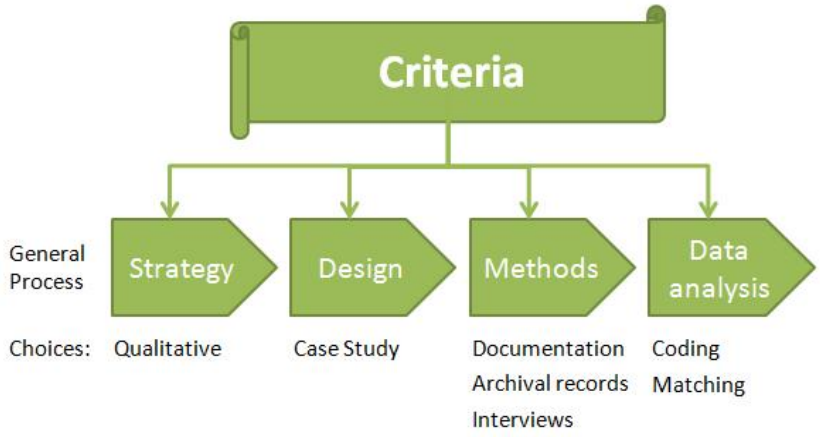

Figure 15
Research methodology

I apply *Systematic Combining* as a method of reasoning, also called the Abductive approach . The relationship between theory and empiricism (i.e. the data I will generate with the process) can be described as follows: the theory will direct the search for empirical data while empirical findings will uncover new aspects of the research questions and applied theory, also called "active data" (Dubois and Gadde 2002, 557).

The chosen approach is best to expand the understanding of both theory and empirical phenomena without being restricted to the rigorous

framework from the "one-way given guidance" of pure deduction or induction, as pictured in Figure 16 bellow.

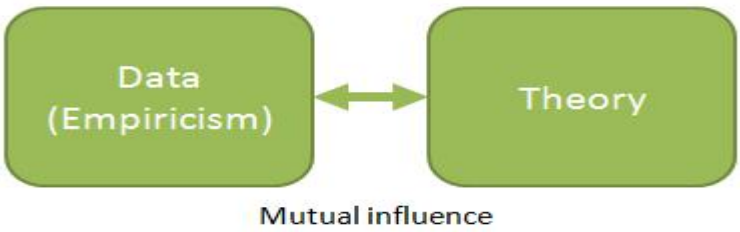

Figure 16
Method of Reasoning: the Abductive approach (Adapted from Dubois and Gadde 2002)

It can be put that, while analyzing the current procurement practices and the main barriers to PPI in Norway is closely linked to deductive reasoning, the suggested improvement recommendations arise from an inductive process. This pluralistic position reflects the iterative process of my work in this study (Perry 1998, 788f.). By being aware of these continuous loops and interplay occurring during my research, I can address my research design and methodology in order to receive the most information during the data collection process. However, identifying the right methodology in this flexible framework formed a challenge in itself. The process of how my work emerged and how feedback loops formed my final thesis proposal becomes obvious, for example in the interviews: while the first interview's focus was rather broad in the initial phases, the latter ones are marked by a more narrow focus, integrating relevant findings from previous interviews to stimulate the debate of ideas.

7.2. Research Strategy

To build the research strategy, ontological and epistemological considerations must be taken as a starting point (Bryman and Bell 2011). Ontology deals with the nature of social entities and whether those can own an external reality or are socially constructed by the involved actors. Epistemology, on the other hand, deals with the question of what can be regarded as acceptable knowledge, with the particular question regarding if the canons of the natural science studies can be applied to the study of social reality. These considerations lead to a particular underlying paradigm since "all scientific research follows a set of procedures that must begin with a group of assumptions, a set of beliefs: a paradigm" (Hiles 1999, Guba and

Lincoln 1994, 107). The work of Guba and Lincoln (1994) constitutes the foundation for identifying different kinds of paradigms. The most representative paradigm describing my thesis can be named as Post-positivism (Guba and Lincoln 1994, 110), also called (Subtle) Realist Paradigm (Perry 1998, 186f.). The underlying ontological reasoning belongs to Critical Realism: that reality is assumed to exist but is subject to flawed human intellectual mechanism.

Concerning epistemology, I adopt an objectivist point of view. This influences my research strategy since my aim is to understand the current setting for PPI processes, collect situational information, and reintroduce my findings as an element in theory, without introducing any normative or subjective positions. In particular, the post-positivism paradigm is confirmed to be best suiting for using a case study design (Perry 1998, 186f.) as explained in Section 7.4 *Research Design*.

I conduct a qualitative research strategy since, so far, there has been little academic attention into optimizing and fostering the PPI process in Norway. Qualitative studies are considered best suited for such cases, since their open design allows not only capturing new dimensions, but also ensuring flexibility throughout the research. Although qualitative strategies have been claimed as “soft” (in comparison to “hard” quantitative studies), the qualitative approach is more suitable to produce findings which were not determined in advance.

Although verification constitutes one element in this thesis, the most interesting one is that it includes a discovery dimension in the inquiry (Guba and Lincoln 1994, 106). Guba criticizes that “Quantitative normative methodology is thus privileged over the insights of creative and divergent thinkers” (Guba and Lincoln 1994, 106). However, this flexible and *out-of-the-box* thinking is the required mindset to overcome the current PPI barriers. A quantitative approach is suggested as a further investigation of the findings made during the qualitative research.

7.3. Sampling

Sampling is described as the approach to contact a segment of the population which is selected for investigation (Bryman and Bell 2011, 176).

As already stated in the title of this thesis, the sampling frame is limited to following units: Governmental ICT purchasing departments and its corresponding suppliers. To approach these units, a non-probability, purposive sample method was applied (Bryman and Bell 2011, 62f., 441 ff.). The reason is that I want to analyze and solve problems specific to ICT procurement by detailed examination, instead of conducting a generalized study involving all product groups. One method for this is the theoretical sampling approach (Bryman and Bell 2011, 441). Theoretical sampling gives guidance to choose new participants, to modify interview guides, or to add data sources as the study progresses until theoretical saturation is reached (Bryman and Bell 2011, 442; Draucker, et al. 2007). Theoretical saturation concerns the refinement of ideas until no new relevant information can be gained, contrasting to emphasis in boosting sample size (Bryman and Bell 2011, 443). This goes in lines with Guba and Lincoln's work (1985, 204) which recommends a sampling selection "to the point of redundancy".

The participants will be carefully depicted due to the quality of informants (Spradley 1979). Morse (1994, 228) characterizes those informants as follows:

- They have available the knowledge and experience that the investigators need;
- They are capable of reflection;
- They are articulate;
- They have time to be interviewed;
- They are willing to take part in the investigation.

The approach by which the ICT-related objects of study were selected is the following:

1. By researching the online databases for tender publications (Doffin and Ted), I was able to identify major purchasers and suppliers of ICT in Norway. As explained in Section 3.3 *The development of public organizations*, mature organizations have a higher degree of political commitment due to the large amount of public funding involved in their operations, their large area of influence, and their signaling

power. Therefore, these are most prone to engage in innovation-oriented procurements, contrary to younger organizations.

2. Small and medium sized companies are chosen basing on public procurer suggestions.
3. Companies involved in the same bid competition for a PPI project are prioritized.

Another way of gaining access and knowledge about other actors involved is the so-called Snowball Sampling approach (Bryman and Bell 2011, 192 f.). After making initial contact with, per example, a public purchasing department, I ask the interviewee to provide me with further contacts of companies which are known to have been involved in public procurement processes. Combing the theoretical with the Snowball Sampling procedures allows me to have a broad picture of the actor arena in the private ICT sector. Since the number of major public ICT procurers is limited and easily available online (on procurement databases Doffin and Ted), identifying and contacting public purchasers proved to be less problematic.

Whereas the database offers neutral information about the project and companies involved, the information on small and medium companies might be biased to the individual procurer perception and characteristics (his/her opinion, experience, mental capabilities etc). To counter this biases procurers and suppliers were requested to suggest further companies to contact.

Non-sampling errors, such as unwillingness to participate in an interview (non-response), lack of knowledge in conducting interviews or flawed processing of data, constitute a crucial challenge for this thesis. To counter these problems I strive to contact more companies than needed, to assure an appropriate number of interviews. Furthermore, a detailed interview preparation should allow high-quality interviews. Recording and carefully transcribing the interviews aims to ensure high replication (see further elaboration in Section 7.4 *Research Design* and Section 7.7 *Research Criteria*). As it turned out, theoretical saturation was reached by interviewing 3 public purchasers and 4 ICT suppliers (i.e. by this point, the

findings from the interviews were already predictable). The list of interviewees and schedule can be found in Appendix 3.

7.4. Research Design

The research design provides a framework for the collection of the data. The strategic considerations in combination with the limited parties involved make it apparent that the best suiting research design is a case study with an explanatory and explorative focus. Case studies consist of intensive examination of a bounded system with the aim to provide an analysis of the context and processes in depth (Benbasat, Goldstein and Mead 1987, 370).

The unit of analysis goes in lines with the research question and is the procurement process. Those two case study types can be implemented due to broad framework provided by the Abductive reasoning. Whereas the explanatory part of the case study uses the theoretical basis to explain practical barriers in the PPI approach (linked to deduction), the explorative part is based upon empirical findings to investigate the priority attributed to different Innovation elements pertinent to PPI and therefore contribute to refine theory (linked to induction). This constant matching process is further described in Section 7.6 *Data Analysis*.

This study proved to be a revelatory case (Bryman and Bell 2011, 60). The most interesting and challenging aspect is that this kind of research has not been conducted before, i.e. there is no previous attempt to provide a priority in Innovation elements concerning procurement. Single-case studies are ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. Furthermore, it has been recommended that when the research is exploratory, a single case may be useful as a pilot study (Benbasat, Goldstein and Mead 1987, 373). The PPI process for ICT and its improvement might function as a point of reference for other product groups of relevance for PPI approaches. Equally, it reveals representative elements since it exemplifies an everyday situation for public procurement departments (R. K. Yin 2003, Bryman and Bell 2011, 62). Since I focus on one unique feature of the case, the PPI approach for ICT in Norway, I use an idiographic approach (Bryman and Bell 2011, 60).

Using the principle of a case study as data collecting method, it is important to recognize and take into account both the advantages and the disadvantages of this type of data collecting (Tellis 1997, R. Yin 1994). First, the overall picture of the research object can be elaborated more in depth than by quantitative techniques. Second, this kind of research inhabits and allows flexible ways of doing research when experiencing a changing situation, which is highly applicable to my work, since my study aims to foster a change in current practices. Third, case studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data. This means that I do not restrict my analysis to the perspective of the main actors (in this case, public procurers), but also of other relevant groups of actors (suppliers and public procurement support institutions such as DIFI) and the interaction between them (Tellis 1997). Lastly, but most important for my research, the results are more easily accepted in the field due to on-site fieldwork with those various parties involved.

On the other hand, disadvantages in the case study design concern the fact that the external validity is under pressure. With a single case study it is difficult to declare the results applicable to all other cases. Furthermore, the uniqueness of the constellation created during the case study (per example, the personal interaction during interviews) complicates replication. As these hindrances are discussed in depth in Section 7.7 *Research Criteria*, the striking issue is that the quality of the case study research is related to wise choices made, which is based on former experience in case study research. Up to now, the case studies I have worked on have been of a theoretical nature; therefore I have to ensure that I prepare myself for the interviews carefully.

7.5. Data collection

Case study is known as a triangulated research strategy (Tellis 1997). Snow and Anderson (cited in Feagin 1991) stated that triangulation can occur with data, investigators, theories, and even methodologies. The need for triangulation of data arises from the requirement to confirm the validity of the processes, which goes in lines with my post-positivistic reasoning. In

my thesis, triangulation is pursued in data and by using multiple sources of data (R. Yin 1994).

According to the classifications made by Yin (1994), the primary information sources constitute documentations, archival records and interviews. Documentations will provide me with knowledge about the PPI process in theory and in other practical examples. Archival records include PPI procedural recommendations from DIFI's collection of best practices, found in Section 8.1 *Direct PPI in Norway*. However, interviews constitute the most important data source. They provide me with information about actors, about practical barriers in the ICT procurement process and most desired Innovation elements. As the interviews are a main source of information, it is of central importance to be informed about the interviewee's general position (e.g. his position in the ICT company), the company itself (e.g. its size and product specialization), past participation in PPI processes and reasons for non-participation. Using in-depth interviews of carefully, multiple-sampled participants suits to case study design, since it provides me of intense and detailed information (Bryman and Bell 2011, 60). According to post-positivistic reasoning, triangulation of data and data sources is even more important in order to refine fallible observations of reality (Perry 1998, 787).

A main hindrance in data collection is the following: a missing (public) database dedicated to past PPI processes in Norway. Although DIFI summarizes best practices from past procurements and provides a few case examples, an impartial database where all such procurement's practices are gathered is still missing. The procedure most reflecting PPI is the Dialogue based procurement, which is present in documentations at Ted and Doffin, since purchasers must specify the procurement procedure in their tender notice. However, details regarding how the process was conducted in practice, along with the barriers encountered and the main learning taken from the project is missing. Since this practical information about previous PPI processes and its participants is not available, conducting meetings with the involved parties is the only way to bring up these aspects.

Interview and question design

Designing interviews is marked by two opposing approaches. One approach is structured interviews. Structured or standardized interview aim to minimize differences between interviews (Bryman and Bell 2011). However, standardization does not allow a customized, individual approach. Therefore my questionnaire will be accompanied by individual components to ensure a "perfect fit" with the individual situation, i.e. contextualizing the answers. This combination is often referred to in terms of "In-depth interviews". These interviews can be performed face-to-face, allowing asking more and in-depth questions. This allows me to avoid biases in respondent's reply due to paying attention to the characteristics of the interviewee (see this and other obstacles in Section 7.7.2 *Validity*).

This approach also opens up the possibility to balance the use of open and closed questions. Open questions are helpful for exploring new areas and reveal unexpected topics or concerns. For example, this becomes apparent in the later question design (which includes dominantly *what* and *how* questions in order to understand the nature and complexity of the case (R. Yin 1994, 5f.). Yet it has to be carefully designed that those question do not bring up themes which are not relevant for the actual research question and are later time-consuming to analyze. The coding problem is discussed in Section 7.6 *Data Analysis*. Closed question need to be evaluated carefully before, which forces to structure the questions in order receive the most insights by the answers. The questions used for the interviews can be seen in Appendix 4.

Before starting an interview I ask the interviewee for permission to record our discussion. Although recording supports later analysis and increases validity of my work, ethical considerations are of major importance, and thus, if an interviewee refuses recording I respectfully accept his/her decision (Bryman and Bell 2011).

7.6. Data Analysis

The Abductive nature of my work in combination with analyzing a revelatory case also determines the way of data analysis. The process can be

describes as a "back and forth between framework, data sources, and analysis" (Dubois and Gadde 2002). This can be seen in Figure 17.

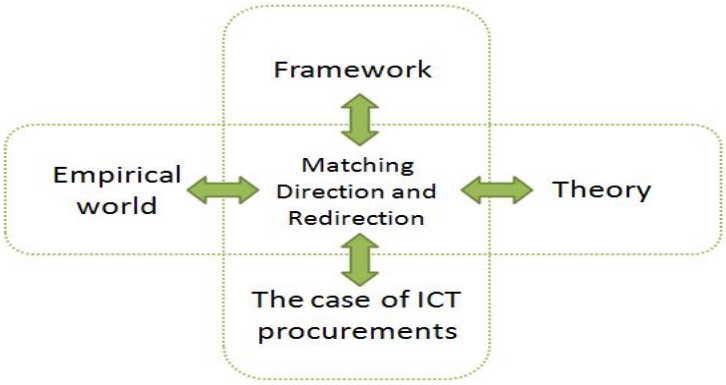

Figure 17

Systematic combining (Source: adapted from Dubois and Gadde 2002)

Analytical induction or grounded theory methods are not suitable to apply due to the nature of revelatory case studies. As stated in Yin (1994, 109) "Analyzing case study evidence is especially difficult because the strategies and techniques have not been well defined". Therefore, I will hold to guidelines proposed by Yin (1994, 109 ff.) and precise them by steps stated in Bryman and Bell (2011) and Dubois and Gadde (2002).

First of all, my analysis' strategy helps to define priorities for what to analyze and why. I will use two strategies: Developing a case description will guide the analysis of the explanatory part of the case by relying on theoretical propositions. Second, those strategies will be used by applying the Matching and Explanation Building technique, specific for analyzing the case. This will be used in Section 10, when comparing the codes from the Theoretical Benchmarks (Figure 14, Section 4.3) to the empirical findings, matching patterns and building my explanation.

Emphasis will also lie on coding since it helps to label, separate and organize the data. To structure my data I will use the process suggested by Bryman and Bell (2011). First, I create pre-analytical categories during my interviews. A broad range of categories for capturing the PPI process and its characteristics should guarantee that all possible problems are touched upon. Per example questions will be categorized under categories as "General information", "Participation and Experience in PPI processes", "Barriers in PPI", etc. However, those pre-formulized categories constitute only a starting point, while the unstructured questions design in the interview

should allow new issues to surface. Secondly, after conducting the studies, I have to detect the most important key factors (codes) which came up during those interviews (Section 9). As I am going to use open and closed questions a slightly different coding approach will be applied. The closed questions in Appendix 4 are either of nominal or ordinal scale. For those types of question I can form a mode value in order to identify the most common features. After reviewing the answers to my open questions, I will search for significant remarks and observations to generate an index of terms (codes) that will help me to interpret and theorize in relation to the data. Therefore, eliminating redundant codes is essential to focus on the problem and streamline the analysis. Finally, coding data and considering their interrelationships should help to identify underlying theoretical concepts. For example, if codes and data often refer to aspects as “lack of deep ICT knowledge” and “too rigid procedures”, it can point to potential improvements for the PPI procedure. Common criticism of the coding approach refers to context being lost and also the narrative flow being interrupted. Although categories are always correlated, the analysis is based on facts, which can easier be taken out of context than emotions, per example. Although the narrative flow might reveal new problems and relationships, I analyze problems which are actually occurring outside the individual (although s/he might have an influence on the choice of procedures adopted). Analyzing facts also helps to avoid biases in coding due to the researcher perception (see in detail the next Section 7.7 *Research Criteria*).

7.7. Research Criteria

According to Bryman and Bell (2011, 43), classical research criteria are the measurement of reliability, replication and validity. However, most of those criteria were designed to evaluate pure quantitative studies. Due to the difference between qualitative and quantitative studies, several authors argued for evaluating qualitative studies in another light (Bryman and Bell 2011, 395 f.). Therefore I am going to adapt the classical research criteria for the qualitative part of my work. Hammersley (1995) also proposed relevance as a criterion. This criterion requires that the research actually

possesses a certain level of general importance and contribution, although the subjectivity of this evaluation is problematic. Section 1.1 *Problem statement and Significance* reflected on the aspect of relevance.

7.7.1. Reliability

Reliability questions if the results of a study are repeatable and therefore, consistent. LeCompte and Goetz (1982) underline the difficulty to "freeze" a social setting and its environment, which in particular applies to the interviews. Therefore, any replicating attempts need to adjust to my initial situation. This should be guaranteed by a detailed record of my study, and especially the transcription of the interviews which can be seen upon request (Sections 9.3 and 9.4 present the most relevant interviews). However, one interviewee refused recording while another interview's recording revealed significant sound quality problems due to the noisy setting in a café, rendering this interview impossible to transcribe. To compensate these missing recordings, I resorted to detailed field-notes.

7.7.2. Validity

An analysis which uses mainly language as a form of research often tends to cause greater variability. In this section, the single components of validity are explained in detail.

Beginning with measurement or construct validity, this criterion is concerned whether or not a measure derived from a concept actually does reflect the concept that it is supposed to describe. This criterion is applicable to the quantitative ranking during the interviews, where the interviewees were asked to rank the preferred innovation elements. Since each question is designed to measure solely possible PPI improvements, I can achieve high validity. Furthermore, the ranking is designed according to the Likert scale with an ordinal scale type. Working with ordinal scales allows me to calculate a mode or median value. Again, it has to be mentioned that asking carefully selected participants does not reflect statistical requirements of significance and representativeness, however, the aim is to reveal indicative preferences for the specific PPI process in ICT purchases.

Second, internal validity will be analyzed. This criterion demands that there is a good match between my observations and the theoretical ideas I develop (Bryman and Bell 2011). In consequence, my qualitative research has to minimize the "reactive affect" , i.e. assure that the behavior of the observed actors does not change as they know that they are being interviewed. The most probable case is that the interviewees try to picture themselves in the best light and deny problems in their role during the PPI process. Therefore, triangulation of the data and asking interviewees with different positions in the PPI process (public purchasers vs. private supplier) should guarantee a holistic view and reduce biases from single individuals. Another challenge in validity is that I do not pursue an entirely standardized approach in the questions. Standardized questions help to reduce variations due to error, in particular with closed questions, as respondents allocate themselves to categories. For the open questions, I have to guarantee a high quality in transcription and analysis. However, the individually designed questions inhabit a greater risk of variability due to inconsistency in the coding process. For both type of questions it was ensured that question are easily understandable, not ambiguous or too technical (see further rules in Bryman and Bell 2011).

Third, focus on external validity. This one questions if the results of a study can be generalized beyond the specific research context. By using strategic sampling and a case study design, transferability is rather low. The central aim is to understand complexity and improve the current status of the PPI process in Norwegian ICT purchases . However, it cannot be denied that case studies have the potential to reveal best practice methods, which might then be adjusted and implemented in another environment, i.e. to PPI processes for other product groups .

Fourth, ecological validity is regarded. Here the question is if the research captures daily life conditions, or if the research execution evokes unnatural or too abstract conditions. In other words, it questions if the theoretical findings relate to practical situations. It is also the measurement which is highly relevant for qualitative studies as it challenges the quality of the interview approach. This thesis strives achieving a high level of ecological validity in the PPI process for ICT. My analysis and proposed

measures are clearly related to practical life, as otherwise implementation would not proceed, and thus, a more innovative procurement process would not take place.

7.7.3. Objectivity

Objectivity requires that the research conductor excludes personal values in his work. This criterion will be fulfilled as my work focuses mainly on facts with a post-positivistic reasoning and is not intended to make moral statements.

7.8. Scope and limitations

I consider two main requirements concerning the innovation-oriented procurement instruments to be included in this study:

1. The instruments should be relevant for basic tendering operations; and
2. The instruments should be applicable in strategic or tactical stages of the procurement process;

The instrument that best fits these requirements is Direct Procurement of Innovation, which is the main focus of my analysis, therefore not addressing more complex procedures such as Public-Private Partnerships and Catalytic Procurement.

Due to the time limitation for this study, I was unable to expand my area of analysis to all major product groups that have substantial weight in the Norwegian public procurement portfolio. I decided to investigate one single product group in depth (ICT products) to better understand the sector-specific interrelations between the involved actors, at the expense of generalizability.

I was able to achieve an even mix of interviewees featuring both sides of procurements (suppliers and purchasers), as well as public management experts. The objects of study selected for this study were major public purchasers and suppliers of ICT products limited the area of Oslo. I also interviewed a medium-sized supplier, although my findings were similar to the bigger players, which reverts to the concept of theoretical saturation. Nonetheless, my analysis left out smaller purchasing organizations and other regions of Norway.

My analysis on the priority of Innovation elements and the most recognized barriers was made at Face-Value, in the sense that these were introduced to the interviewees as described in the literature and on the EU directives. I did not attempt to integrate these in the current Norwegian policies and regulatory framework. My intention was to find out their perspectives regardless of what is currently expressed in the regulations.

IV – Empirical framework

By adopting an Explanation Building approach for the following Analysis section, this chapter will present the set of causal links to explain the current situation of PPI in Norway. As argued by R. Yin (1994), these causal links are complex and difficult to measure in most case studies and Explanation Building is recommended to address this through a narrative form.

8. Procurement for innovation initiatives

In this section I will present an overview of the Norwegian initiatives towards public procurement of Innovation. In the Norwegian procurement context, Innovation is defined as *"a new product, a new service, a new production process, application or form of organization that has been launched in the market or put into use in the production of to create economic value"* (MTI 2008). Another definition as put by DIFI, regards innovation as "*both new knowledge and new combinations of existing knowledge*" (DIFI 2012). It defines the acquisition of innovation as the purchase of:

- The latest products or services available on the market;
- Products or services involving a development or optimization of existing solutions;
- New products or services that require R&D;
- Products or services that are designed for use within a single sector / single market;
- Products or services from multiple vendors that gives a whole new product or new service.

Furthermore, DIFI stresses that being a first buyer of newly developed innovations allows public agencies to be involved in better serving the business community and help the spread of new solutions.

DIFI is currently working on developing these types of initiatives with intention of getting them in place in the upcoming years. Being a fairly new organization (formed in 2008), DIFI's main approach to

procurement of innovation is through two salient initiatives: supporting Pilot Projects and Direct Public Procurement. The first initiative, Pilot Projects, escapes the focus of this study. The Direct Procurement of innovation however, being the main focus of this thesis due to its suitability with basic tendering procedures, is elaborated further in the next subsection.

8.1. Direct PPI in Norway

DIFI presents a clear distinction between traditional procurement and the Direct Procurement of Innovation process that it encourages procurers to follow when seeking to acquire innovative products (illustrated in Figure 18).

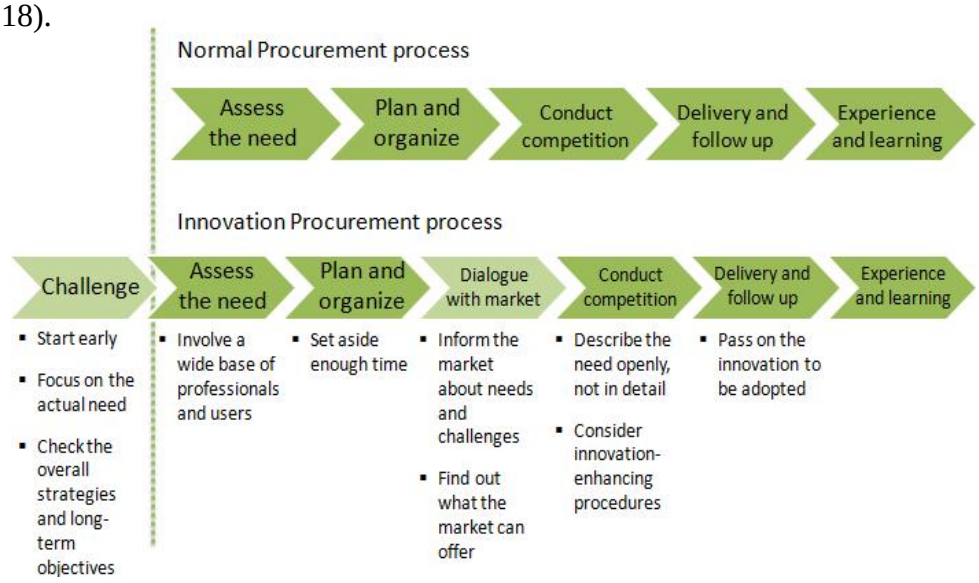

Figure 18

Comparison of Normal Procurement with Innovation Procurement (Source: DIFI 2012)

These recommendations aim to address the government's goals of: conducting public procurement in such a way that they contribute to environmentally friendly and innovative solutions; promoting innovation through public procurements; and giving greater priority to innovation in procurement processes.

As we can see from the illustration above, the Norwegian approach to Innovation procurement follows the guidelines presented in the literature review, in the way it incorporates several elements of the Chain-Linked Innovation model such as fostering a deeper relationship with the market throughout the procurement process. The benefits from this close interaction

up to the competition phase are expected to produce innovative and more suitable outcome to the purchasing organization.

Since procurement is decentralized, DIFI is not responsible for managing the procurement processes. Instead, it serves as an advisor and coordinator if help is solicited. It advices purchasers in the following manner simply put: if the product being sought is available on the market, the procurers can adopt a traditional procurement approach; if the product is not available on the market, adopt a PPI procurement approach. This is in line with the Flemish model for innovation procurement recommended by the EU (2009b), illustrated in Appendix 5.

Several innovation elements aiming at stimulating the procurement of innovative products are also suggested in the Norwegian PPI approach, and are summarized in Table 5, as follows.

Procurement Phase	Innovation Elements recommended by DIFI
Preparation	Take advantage Market consultation
	Focus on Functional specifications
Specification	Resort to the MEAT Criteria Total Cost of Ownership / Life Cycle Costs
	Adapt size of purchase - Lots purchasing
	Competitive dialogue procedure
	Allow the submission of Variant Bids
	Criteria to rewarding innovative capabilities
	Norms for development in desired direction
	Incentives for continuous improvements
	Award Environmental gains
Non-applicable to basic tendering procedures	Pilot Projects

Table 5
Innovation elements present in Norwegian PPI approach (source: DIFI 2012)

Despite these innovation elements being prescribed in the literature for addressing the barriers inherent to the PPI approach, the adoption of these is also discretionary to the purchasing organization. I will compare the elements present in the DIFI recommendation with the theoretical barriers and drivers in the next paragraphs.

8.2. Comparison with theoretical barriers and drivers

By comparing the instruments described above with the theoretical barriers and drivers, we can see that the main driver rises from the political objectives of creating and strengthening an innovative and competitive economy in Norway. This matches the theoretical drivers in Table 3 regarding governmental ambition and the use of public bargaining power. It is also in line with the recognition of the potential of public procurement to stimulate the development of markets for innovative products. We can also notice that, by analyzing the developed instruments with regard to the theoretical barriers, these instruments are in reality tools for addressing the barriers when procuring innovative products. This can be seen in the following Table 6.

Theoretical barriers to PPI	Innovation elements in the Norwegian approach
Procurement of innovative products is more expensive.	MEAT criteria combined with TCO or LCC analysis. Procurers can demonstrate longer-term benefits.
Procurement of innovative products increases risks.	Focus on functional specifications; Contract clauses such as Incentives for further development in desired direction and continuous improvements; Include future objectives. Procurers can mitigate risk by assuring that the functionality of the product being purchased addresses the immediate need and also includes future objectives of the organization.
Procurement of innovative products increases the overall lead-time.	Market consultations; Competitive Dialogue. Procurers can accelerate the process by early engaging with the market.
The performance of the eventual outcome is not as specified for innovative products.	Focus on functional specifications. Procurers can evaluate the outcome through performance-oriented criteria.
Procurement of innovative products creates political risks.	-
Procurement of innovative products can result in supplier lock-in risks.	Division of the tender into lots; Contract clauses for continuous improvements in desired direction. This allows the stimulation of participation from multiple suppliers (also addressing the exclusion of SME's).
The EU public sector procurement Directive (2004/EC/18) restricts public procurement of innovations.	80/20 rule; Focus on functional specifications. Procurers are thus able to experiment outside the regulations and increase their bids pool.

The location of Intellectual property rights are difficult to place in public procurement of innovations.	-
Public procurement of innovations requires Senior level buy-in.	-
Multiple conflicting policies seek to influence the public procurement function.	-
Public procurement officers demonstrate high risk avoiding behavior.	Market consultations; Competitive Dialogue; Variant bids; Focus on functional specifications; Include future objectives. Allows the procurer to better assure the outcome of the project and reduce risk.
Public procurement of innovative products can result in overall loses for possible local gains.	-
Public procurement has insufficient buyer-supplier interaction to become aware of innovative alternatives.	Market consultations; Competitive Dialogue; Variant bids; Focus on functional specifications; Include future objectives. Procurers open their array of alternatives.

Table 6
Comparison of Norwegian Innovation elements with theoretical barriers (Source DIFI 2012)

As we can see, several barriers still remain unattended. The existence of multiple conflicting policies that influence public procurements for innovation keeps pressuring procurers to simultaneously address different dimensions such as price versus environmental gains versus innovativeness of the products sought. The perception of potential political risks also remains unattended. Alongside this, the barrier regarding public procurement for innovation requiring Senior-level commitment further justifies procurers' risk-avoiding behavior (OGC 2007).

9. Innovation in Norwegian procurements of ICT

In this section, I will present the main findings from my interviews with public ICT purchasers, suppliers, and Public Management experts. These will regard several aspects: the most used procedures, their perception of an innovation focus in public procurements and the procedures most used, their involvement in PPI projects, their perception of major barriers to

PPI in Norway, and their opinion regarding the different Innovation elements.

9.1. Findings on Sustainability as an ICT innovation driver

As explained in Section 6, Sustainability and environmental-related concerns form a powerful driver for innovation in ICT. I will start with a description of my findings on Sustainability as an innovation driver in Norwegian ICT procurements.

Envisioning fostering Sustainability in public purchases, the Norwegian government has included the policy goal of using sustainability as a significant dimension in all procurements as of 2008, as illustrated in Figure 19 (ME 2007).

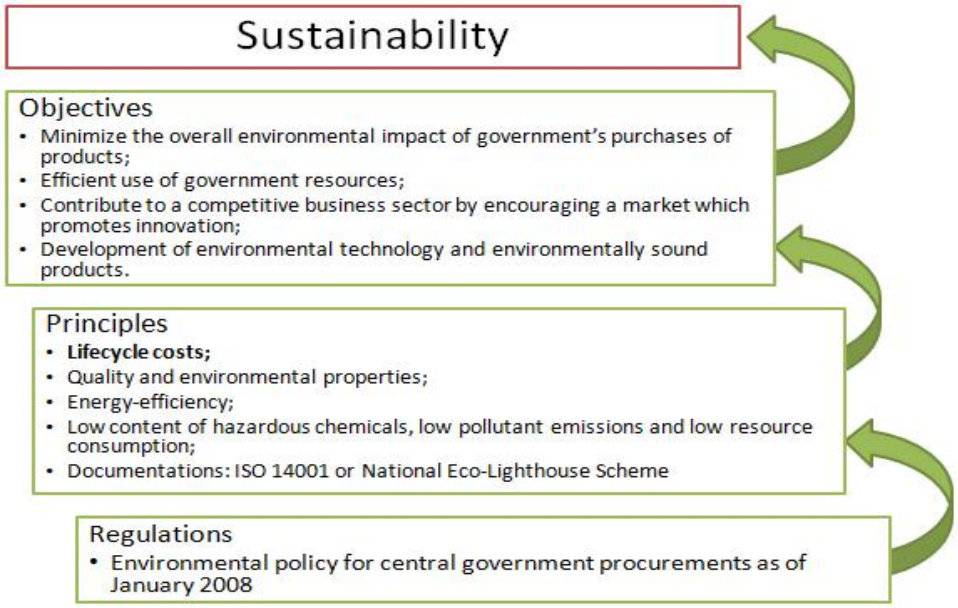

Figure 19
Norwegian Public procurement for Sustainability

Sustainability can indeed be seen as an innovation driver for ICT products in the sense that the more demanding public organizations are on their environmental requirements, the more suppliers innovate to meet this demand. Procurement regulation also requires the use of Life Cycle Cost analysis (marked bold in Figure 19) in all purchases as of 2008.

However, as explained by DIFI's Innovation expert Mrs. Elisabeth Sundholm who introduced me the basics of Norwegian procurements and Innovation policy, the adoption of Sustainability elements is discretionary to

each public institution (just as the Innovation elements introduced in previous sections).

From a recent DIFI's survey regarding the actual use of Sustainability requirements in the different product group's purchases, it was found that 85% of ICT purchases in 2011 incorporated sustainability elements (DIFI 2011). From these, 45% used other environmental criteria than the ones recommended by DIFI, while 10% used the criteria from the EU Flower / Nordic Swan environmental labels. However, the criteria recommended by DIFI already incorporates the EU Flower / Nordic Swan requirements, but DIFI explains that these are less demanding and therefore preferred by some procurers (DIFI 2011). The remaining 15% did not use any environmental criteria in their ICT purchases.

The product group "ICT products" includes a range of equivalent product categories whose list of CPV (Common procurement vocabulary) codes can be seen in Appendix 6, and the requirements are summarized in the following Table 7.

Type	Criterion
Technical Specification	The product shall meet the applicable energy savings requirements for document management products according to ENERGY STAR ®
	The product shall meet the applicable energy savings requirements for PCs acc. ENERGY STAR ® (The decision applies only to "small-scale" servers)
	Flat screens shall comply with the applicable energy savings requirements for displays in accordance. ENERGY STAR ®
	If the memory is specified, up to half of what the machine can be equipped with at maximum and if the machine has more than one memory, at least one memory must be left blank for future upgrading
	Parts for repair, replacement or upgrade are guaranteed to be available for at least 3 years after the product is produced.
	Parts for the operation, repair, replacement or upgrade is guaranteed to be available for at least 5 years after the product is produced.
Award Criteria	Parts for the repair, replacement or upgrade guaranteed to be available for at least 5 years after the product has been manufactured.
	Plastic parts heavier than your 25 g does not contain flame retardant substances or mixtures that are assigned to any of the following risks: R45: may cause cancer. R46: may cause hereditary defects

	▯ R60 may damage fertility ▯ R61: may be harmful to the child during pregnancy
Contract Clause	Packaging: If the supplier uses packaging, it shall no later than by closing present evidence that the material is being taken care of in an environmentally sound manner.
	If it gets delivered excess equipment, the vendor must collect and process it securely through electronic waste processes, or for reuse if the employer requires it.
	For all equipment, documentation must be attached showing how equipment should be used to minimize environmental impact. When it is possible, manufacturers must ship products already set up with an environmentally efficient layout.

Table 7
Recommended Sustainability criteria for ICT procurements (Source: DIFI 2012)

9.2. Interviews with ICT public procurers

I will begin by presenting the interviewees position and experience with public procurement of ICT, as well as examples of relevant projects they have been involved with. I will regard the procedures most used, the major obstacles to PPI in Norway mentioned, and the interviewee's position regarding different innovation elements in their efficiency towards stimulating innovation in procurements. The relevant findings from the interviews are gathered and summarized in Section 10.2 *Analysis of the interviews*.

9.2.1. Statens Vegvesen – Autosys project

Position and Background

The representative of Statens Vegvesen (SV) interviewed for this thesis was Mr. Lars Kalfoss, who holds the position of Director in the ICT department and works with SV since 2009. SV has yearly procurements on all types of equipments ranging from PC's, servers, audio or video conferencing systems, and software, to storage, network, and mobile applications, accounting for approximately NOK 400 Million per year. By the time he joined the organization, major ICT initiatives took place, such as the Autosys project: NOK 300 Million procurement for a vehicle and driving license registration system, where the lead suppliers include companies as IBM, Bekk, Steria and Ciber.

Tendering procedures and innovation drivers

Regarding the procurement procedures most used for SV purchases, Mr. Kalfoss explained that in a public company a procurer can adopt one of three procedures: a process where procurers state very fixed requirements and choose the best offer with no prior negotiation with suppliers; a process similar to the first, but that allows negotiation with suppliers; and a third process of a dialogue with competition. For particular purchases, such as networking and telephony contracts, SV had run a negotiation procedure, but for purchases of equipment as PC's, servers, storage, media conferencing, and software, it usually resorts to the Fixed-price procedure (Open procedure) with no negotiation. For this, the procurer had fixed requirements, evaluated different options, and picked one of the companies that participated in the bid competition.

We discussed that SV mostly awards these type of contracts for two years, in a 1 + 1 basis, up to a maximum of four years, to assure that the contract can be renegotiated when the supplier (for any reason) does not meet what was accorded. *"It would be best for the organization if it was allowed to run Negotiation procedures all over, but that is not how the rules and regulations are put in place: the main rule is the Fixed-price: that is the dominant rule. Negotiations are exceptions and Dialogues even more so"*.

He also explained that, according to the current regulations, if it is difficult to express in much detail and predictable requirements what it is to be purchased, then one can run a negotiation process. In the case of PC's per example, one can easily specify the requirements, and therefore cannot run a Negotiation process: that should be a Fixed-price contract. *"I think it is a bad approach but those are the regulations. I think the idea behind it is good, because when you buy "bread and butter", it should be possible to specify to great detail and then choose the best offer. It is very visible, it is transparent, and then you go public with a vendor or producer and can tell the difference between the offers. The bad thing with it is that I do not think you get the best price. I think you can achieve to get a better price when you negotiate, but it takes longer time, so it is a more resource consuming process"*.

In his view, the most time and resource consuming procedure is the Dialogue Competition, but that he would like to be able to combine both

negotiation and development. "*This way, the organization can get new ideas and develop new products, concepts, etc"*. On the other hand, by sticking to one vendor, the purchaser benefits with attractive discounts. *"Some people believe in having two vendors competing on every delivery. Other people believe in one vendor. I believe strongly in one vendor, because then you can commit a certain volume and you get a far better price. Our process' costs dropped more than 30% going from two vendors to one vendor. You have to figure out in great detail how the market and the price mechanisms work. You should decide on your procurement process accordingly."*

Major barriers

We then turned our discussion to his perception of major barriers in public procurements, when Mr. Kalfoss argued that the biggest barrier is the regulations favoring Fixed-price procedures. He explained that it would be best to be able to drive more negotiations and dialogues. *"I think that it would be nice to drive more negotiations. I think that the vendors would like that too, because when you ask a bid, you have to put some risk margin on top, since you're not quite sure what the requirements are (…) there should be some premium on top, and then you can discuss in much more detail and run a negotiation process."*

The potential for innovation from specifying the need to the suppliers on functional terms instead of technical requirements, gave way to some discussion. "*I agree of course: when you buy a PC, it is still functionality you are acquiring. But PC's from Dell are just like HP's, so even on functional level it is very easy to translate this into technical requirements. But I do agree that it is better to focus on the functional level."*

He commented on the out-coming benefits: *"We have a functional approach because, when you are running a process, you are interested in having several areas to maximize the participants in the process. If you give that in technical requirements, you very often can experience that you half the numbers of participants."* I also asked what specifically do the regulations say (see EC 2004). *"If you can, you have to specify in great detail. It does not say technical requirements, but that you have to specify to great detail what you are looking for.*" Since for equipment such as PC's, functionality is very easy to translate into technical requirements, the regulations require using a Fixed-price

procedure for these cases. This focus on price, in his view, is a big problem for innovation in public procurement.

As a result, Mr. Kalfoss argues that public procurement is currently a weak driver for innovation in ICT. He added that he remembers the Norwegian project Altinn (a public reporting online platform) to have been very innovative at its time, but still has several problems today.

At this point we discussed an example of external pressure in public procurements. *"We are running a project now. We are going to replace the toll collection system for roads: it is a central system, and we will replace that for a new one in 2014. We consider that this (process) cannot be with a fixed price procedure, since it is hard to define. (…) For this project we have first run a Dialogue phase. But the problem with the dialogue is that it is extremely time consuming. And we have a fixed date: we have to have the new system in place by the 1st of November, 2014. It's a matter of running against time to manage that process. So now we are now running a more traditional negotiating process on that project, even if the main rule is a fixed process. "*

Lastly, we discussed his opinion on the major barriers to PPI. To this, Mr. Kalfoss' opinion was that the major barriers are the EU regulations, the time and resource consumption of these procedures, the increased lead-time for innovative products, and the risk of supplier-lock in reflected in the rigid contracts. He concluded that the MEAT criteria and complex tendering procedures are more relevant for projects: when buying PC's, these are very similar from one vendor to another, and therefore of no need for such elements. It is his opinion that to divide the tender would result in losing powerful volume discounts, and finally, that the best option for increasing SME participation in big procurements is to make subcontracting more visible, or to have public procurers define segments, or niches, where SME's could participate.

9.2.2. Oslo Airport – FIDS Database

Position and Background

The procurer representing the Oslo Airport was Mr. Amund Westbye, who is working for one and a half years in the ICT Project and Business Development department, dealing with procurement and ICT project

management related to passenger experience and Terminal operations. Previously, Mr. Amund has worked in the finance sector and has an academic background in Industrial Economy. The type of tenders he works with relates to passenger traffic and passenger information display systems, such as the FIDS database – a NOK 10 Million procurement project.

Tendering procedures and innovation drivers

Mr. Amund discussed that the Airport typically follows the EU rules depending on the project. *"For the FIDS we had a dialogue process: there was a pre-qualification published in the international tender database with a broad description of the project to catch the attention of possible vendors who want to qualify. Then they send us information about their records, size of the company, etc. We look at those applications and select companies for the next phase, where we issue RFTs. Then, based on the tenders, we have some negotiations and choose the vendor."*

We then discussed details about the pre-qualification phase where Mr. Amund explained the requirements relating to this phase. *"We had 21 companies looking to pre-qualify, some were too small and were considered as too economically unstable: we need know that they are around for as long as 10 years, need to know they are solid and of a certain size because that is how long we need to use the system. Although some procurers follow these rules too precisely, it really has to be strict. Most of the companies we disqualified did not have the relevant references about similar projects that they had done before. We have some standards for annual revenue. Per example, we had a company of a few people, and they actually had a good product, but they could not prove that they would stick around for more years and that we could rely on such a company."*

We discussed the most used tendering procedures for the Airport's purchases. *"Most of the purchases we have are off-the-shelf since there are so many innovative airports, that somebody has innovated before, so it is easy to adapt those products. For ICT systems, we prefer not to have that many individual adaptations because that will cost you every time you upgrade, support is more expensive, etc. We rather stick with off-the-shelf systems if we can because the expenses of customizing are skyrocketing. We also do the dialogue procedure, where we have a pre-project and we talk to the vendors to find out what is the new technology, what can we get, what is out there, and they get to know what*

our plans are. Then we try to align interests and see what can be done. That is a rather open phase where information is exchanged more freely, but once you get into real procurement, and RFT is out there, you need to be stricter, you cannot tell one vendor more than to another, etc."

At this point, we discussed the advantages of the open dialogue procedure. *"If you buy off-the-shelf, there are much more competitors and you cannot get all interested parties to qualify to give you their offer. But when you want to develop something narrower, then there are less companies that are able to do it, and so it makes more sense to use a more complex targeted procurement procedure. Of course, it also has to do with the thresholds and the project size."*

Regarding the main objectives in such procurements, he argued that getting a good price and mitigating corruption were the main focus. *"For a project manager it would be very easy to do the wrong thing. It is very tricky to keep complete objectivity, and therefore the strict rules give us a very clear way to behave and both parties know that."* We then discussed the price component in public procurements. *"Price counted for 40% for the FIDS project, but we clearly targeted that it should have special features that are new to us. It is also important that these features are perceived as innovative by the public and that we are one of the most innovative in that area. But we are still buying an off-the-shelf product that the vendor has to do something new for us. The remaining 60% we call it Quality and its main content is that it fits the specifications: an extensive document of over 40 pages, where it explains exactly what we want, so it is very technical, but also included the project governance. We need to trust that they can deliver a good project, knowledge and management capabilities, and follow the time schedule, etc. This is part of the quality aspect of the project."*

Major Barriers

I asked Mr. Amund his perception of major problems in these procedures. *"Once you are considering these procedures, you realize they are too narrow (…) too strict. When you want to do something quickly and innovative, you still have to follow the procedures".* He regarded the current procedures as too strict and narrow. *"We are free regarding the length of the requirements, but the main requisite in the Dialogue Competition is that in the RFI we clearly tell the vendors what we want to do. In the pre-qualification we write how the process is going to proceed and then we need to follow that. The specification could be very*

broad, but sometimes you try to fasten the process. It is easy afterwards to see if vendors have the right thing, but in case of a dispute, you really need to have something to back you up on your decisions. In the app part of the project, the specifications were very broad: we did not know how the app would turn out like, so we did not focus much on the technical part. Even though an app is not new to the world, you still want something unique and new, so you give them liberty to put it together."

He added that the public sector in Norway is extremely powerful, and thus a heavy source of bargaining power. *"In Norway, half the economy is state, municipalities, and such. They own a lot of stock in companies, so the state is pretty much everywhere. Even though a public company owned by the state would not have to follow so strict rules, it still plays a huge part in procurements. We try to be innovative, and public procurement supports that. We are in an industry where we have to be innovative. We are running a good surplus since we have a monopoly - it is hard not to make money; it is the main airport so it is easy to argue that we need to innovate. This gives us more freedom since there is just more money around. The bargaining power here has two sources: the money we spend and the competition we put together; and that in some areas we really are in the forefront of technology, we are big, innovative and unique. So when vendors try to offer us something they need to treat us as pilot customers, invent for us and give us the latest technology."*

At this point, we discussed what keeps Norway from using that bargaining power. "*I would say that in Norway, since we have oil, most innovation is directed to that industry, while countries like Sweden and Germany have more industrial production which needs to be on the edge. As a purchaser to take that risk, to pay extra to get something new, you need a supporting culture. This includes top management to agree to take risk, since it causes delays and extra spending. Since governmental bodies tend to have monopoly, you have no incentive to be on the edge, because you can just get by with what you have. Most municipalities deal with things as taking care of elderly people, water supply, garbage collection etc, which are capital intensive areas, and they perceive they cannot innovate anywhere - it is not as innovative as ICT. Most innovation there is to cut costs. In the Airport, even though we have a monopoly, we still feel we are in Competition with such as the Stockholm and Copenhagen airports."*

We discussed the problem for vendors. *"The government has a lot of money due to the oil fund and all that, but in reality it is really strict and though on all expenses, you really cannot add anything extra, so it is hard for a vendor to work with the government because it is so strong. It pushes prices and it doesn't allow much slack for innovation."*

Finally, Mr. Amund commented on the main barrier to innovation-oriented procurement in Norway. He discussed that the increased risks is something that cannot be bypassed, and in an integrand aspect of such procurements, and that the creation of political risks is related to the organization's culture of innovation. *"To get Senior commitment solves a lot of problems: then there is no problem anymore. They say do it and we just do it."*

9.3. Interviews with ICT suppliers

Similarly to the last section, I will now present my findings from interviews with ICT suppliers involved in major public procurements.

9.3.1. IBM – Altinn Platform

Position and Background

IBM's representative was Mr. Morten Andreas Meyer who is the Director of IBM's Global Business Consulting services and Public sector leader, engaging with clients in both the private and public sector. Previously, Mr. Meyer has worked in the Ministry of Modernization where he was responsible for procurement standards and regulations. During this time, he regarded different dimensions such as Competition in procurements and national ICT, Sustainability and Innovation policies. He contributed to enforcing cooperation among ministries and to the decentralization of procurement to individual agencies. Since joining IBM, Mr. Meyer was involved in two innovation-based procurements, one of which was Altinn, where the Dialogue Competition procedure was adopted.

Tendering procedures and innovation drivers

We discussed his opinion on this type of procedures. "*I think that the idea for the dialogue base procurement process is of great use. I think that as a vendor, a supplier, (…) we are interested in how to find the discussions with the client before they launch their RFPs*." In his view, in many cases vendors find

themselves wishing they had contributed with more input and ideas to the client before an RFP was launched. "*This is difficult and wishful procurement process. In the traditional procurement process the client tells the market very exactly what they want, or what they believe they want (…) and that does not give us the best possibility, the best opportunity to shape the deal as we think would be best both for the client and for the Norwegian system. So I think that the idea behind the Dialogue base procurement process is very good."*

Major Barriers

Although he also added that, for several reasons, this procedure has its limitations. "*It has to be a really large project. You cannot use it for the smaller projects. For companies like Accenture (…) and IBM, I would say it would need to have a potential for a revenue stream of USD 100M to be attractive, because it is really resource consuming. And that's a really hard balance in such a small market as the Norwegian, where there are realistically only 2-3 vendors that can manage such costly processes as this: IBM, Accenture, EVRY, and such."*

Regarding this exclusion of SME's, we discussed the element of compensating suppliers for their tendering costs, with intent to stimulate SME participation. *"We have been part of a dialogue-based procurement process with the Directorate of Health, where they were procuring a national-reaching summary record, and after the pre-qualification and RFI phase, it was Accenture, EVRY and IBM who were invite to the Dialogue phase. They used the mechanism to pay the vendors -they offered us NOK 500.000 - but we were spending NOK 4 Million for the competition. It would be very expensive to pay suppliers for their costs. It's a strong signal (…) it might be necessary, but to give a compensation even close to the total is very difficult. Smaller companies on the other hand, are very often part of the big companies' offers, in the sense that they are subcontractors to the companies that are taking the lead. So I think there is still room for smaller companies to be part of the consortium."*

Mr. Meyer discussed that innovation-oriented procurements are very demanding process for the vendors (who see the initial dialogues as "free consulting"), but with much opportunities for the client. "*A problem is the procurer's approach of a negotiation rather than a dialogue. This does not allow vendors to propose their ideas (…) Many times, the process was not conducted as we expected.*" This has to do with the procurer's expertise, to which he added

that such procedures require better knowledge and capacity from the client. His opinion is that procurers are very conservative and risk avoiding: *"They avoid being blamed during these procedures, since they are less transparent than Fixed-price procedures, and therefore rather stick with traditional approaches"*. This risk avoidance is further resulting from the lack of experience in properly taking advantage of market dialogues. Besides, Mr. Meyer saw the tendency from procurers to favor Fixed-price contracts which, in his words, "*always incline towards financial discussions*", as a major barrier to innovation-oriented procurement. He argues that vendors offer skills and services, and therefore only a more cooperative interaction can contribute to share risks and foster innovation. "*Software is not the core of the procurement: more the integration, the surrounding services, training, (…) is usually a much bigger part than the software or product."*

Another critique was that the ideas submitted to the procurer in the initial dialogue phases (such as practices and service offers) cannot be protected since the dialogue is open, and that the winner typically incorporates all good ideas from other competitors in his final offer. This should be addressed trough knowledge protection clauses and similar elements to stimulate suppliers to early share their ideas, and not *"hold back potential key elements, not sharing them too soon"*. We also discussed that procurers should "*properly explain the need, the users and usage of the solution they are looking for"*, but that there is no need to specify them lengthily in narrow and strict technical specifications: this should instead be done in functionality terms.

Lastly, regarding his opinion on the use of Sustainability as a driver for innovation in ICT through the implementation of environmental criteria in procurements, Mr. Meyer explained that when he was working in the Ministry of Modernization, his objective was of making these criteria mandatory to all purchases. This did not go forward, as we have seen that these sustainability requirements are discretionary. In Mr. Meyer's view, *"this way, they are just not effective for policy delivery"*.

Furthermore, he explained that the current criteria merely reflect industry standards to which all suppliers comply regardless of the requirements. In other words, sustainability is already a differentiator

element in ICT: *"This industry is currently very environmentally-focused industry, tending to produce sustainable innovative solutions".* In his view, *"Innovation should cope with environmental requirements, since there is a global demand, which could effectively make Norway more competitive"*.

Lastly, Mr. Meyer observed that *"They (policymakers) could make the environmental criteria twice as demanding as they are now, and it would still not have a negative effect on innovation. Actually on the contrary: It would instead induce innovation"*.

9.3.2. Accenture

Position and Background

Mr. Jan Brandvold, Accenture's Sales Director, has worked with public tenders since the early 90's, as well as with private tenders. His first role at Accenture was as technical advisor and later began working with bid management, where he was involved in procurements such as a USD 100 Million project in the Norwegian Health sector in 2010.

Tendering procedures and innovation drivers

For small projects, this company usually allocates around four or five people, who work with the company's response, pricing and legal aspects of the contract, while for big projects, such as in 2010, the company would allocate from 30 to 40 people. "*This costs a lot of money, so we have to be really good at deciding which bids we are going to go for. It is extremely costly to lose"*. We discussed public procurement as a risky game for the suppliers: *"We like to win on at least half of our proposals. A bid like this can easily cost us from USD 1 Million to USD 3 Million, so we cannot afford to lose that many. I guess around USD 500.000 is the average cost of entry for a big project, but we know it will still cost us a lot more money"*.

Regarding the potential of smaller projects, Mr. Brandvold commented *"We do not really want small projects like one consultancy per year, unless it is a way to get in contact with the buyer and start a relationship"*. He explained the need for a relationship with the client. If the company found anything in the tender databases that it had not prior knowledge about, it would usually decline from participating. *"We need to know about it before. We need to know the customer, because after the publication they cannot get into*

a learning relation with you any longer". If the requirements are already set, the company would be playing on some other competitor's terms. *"We really need to engage them before that (…) so that they know what we can do, and we are able to help the purchaser shape the proposal request towards us. This gives us much better odds"*. This interaction allows the client to know what the suppliers can do, since in these are people buying from people, with much more factors to discuss than price.

Mr. Brandvold explained that usually the company knows the big projects in which it can participate: *"It is public information when a contract ends and the purchaser will be looking for a new tender"*. By then, the company needs to have engaged with the client, after which the tender is publicized and process begins: *"Sometimes they have one big meeting for all vendors to ask questions or take a RFI first to have less work themselves (…) Then, all the suppliers who want to participate have to demonstrate their size, capabilities, etc, which is more like a beauty contest (…) and then they select which suppliers are qualified to participate - this is the pre-qualification phase. Only seven or eight usually qualify and these are the only ones who get the RFP"*.

Major Barriers

Regarding the major barriers in public procurement, Mr Brandvold regarded as a problem that purchasers *"describe very rigidly what they want because they want to be able to compare apples with apples, which usually ends up being a price game"*. In his view, this is a problem because most of the times the purchaser has particular goals for its request, but that they never seem to strive for matching these goals with what they are actually buying. They publicize their criteria and price is usually from 30% to 60% in importance, according to Mr. Brandvold. *"Then there are other more subjective criteria, which allow them to select an offer they like better, rather than the lowest priced one"*.

He argued that this is a very rigid process with a weak link between procurer's goals and what they actually buy. In his words, *"I would like to see this: clients measure the results of the system and those requirements should in theory reflect the outcome of the purchase, which in practice does not necessarily happen. Clients can ask us to make that process engineering before purchasing*

and get to know us, and see what we can do to help them - and we could price our solutions accordingly. This is a much better approach, since we are on the same boat: it's a win-win". Reflecting on the reasons why this is not adopted, Mr. Brandvold explained that the procurement regulations forbid the advisory company to participate in the competition, preventing them from setting the requirements in their favor.

Concerning his perception on public procurement as an innovation driver in ICT, Mr. Brandvold felt that it is not a strong force, but rather specific to some areas. Typically innovation was still directed to very standard things, such as where some incremental development meant to replace an old system. At the same time, he also felt that the project Altinn was quite innovative at the time. Innovation in such cases came from trying to find new ways to apply ICT when there is not existing solution that can help.

Despite innovation approaches improving the more they is used, and the more procurers share their knowledge, procurement in general is still struggling to adopt "out-of-the-box" thinking. *"Clients are scared of getting caught against the Competition rules"*. This includes problems such as a procurer publicizing a request, and later, throughout the dialogue, getting to realize that some vendor has a much better offer which does not fit on the requirements he issued. In such case, either the client accepts that he will not be buying the best option, or he decides to buy it regardless, which can result in problems from the remaining competitors who have already spent on consultations with the client and such. *"They are used to the hard-way following the formalized rules and typically go by the book. (…) and see these different approaches as somehow dangerous"*.

Mr. Brandvold preferred the more open, dialogue approach, in the way it allows suppliers to learn from the client and also from other competitors. *"Despite being more resource-consuming, it is much better than having questions thrown back and forth and not knowing what is most appropriate for us to offer"*.

Traditional procedures are not very open. By following the regulations, it is fairly easy to verify the appropriate choices, comparing volume and prices of options. *"Clients have this old feeling that they need to*

protect their recognition, that they do not risk putting themselves on any line even if that could bring them a better solution". To ease this, the public sector would have to move people around who have experience in successful dialogue-based procurements. *"There is a lack of expertise in there. In Railroads, per example, they have a procurement department (…), but they have some much to do there that they have to hire consultants to do it for them. It's insane; it's like hiring a consultant to hire a consultant"*. There should be teams with experts in these procedures (such as in organizations like DIFI as observed by Mr.Brandvold), that other organizations keep close contact with, sharing learnings and improving the procedures.

At this point we discussed other barriers. His opinion was that, the procurement of innovation process does not necessarily have to be more expensive, because it all depends on making a good analysis. If so, then clients can indeed end up buying a better product that justifies the efforts and risks. Nonetheless, overall losses can always overcome the gains. It can increase the overall lead time, since feedback is crucial and it needs to be face-to-face with the client. This makes the learning process slower. However, he observed that *"not specifying performance could actually save time"*.

Political risks are also inherent to such procedures: rules and protocols on one side, and the non-transparency of dialogues on the other. *"This should not be the case. They should be able to conduct this process in a way that mitigates supplier-lock in and other risks"*. Senior-level commitment is important at this point, since procurers have to be sure of their decisions. Some policies such as requirements for data privacy, or keeping certain data in Norway, can work against procurers. Risk avoiding behavior results from this. Even facing a better solution, procurers can decide not to change their request due to the regulatory complications.

The purchasing organizations need deeper interaction with suppliers. In some cases, the solution requires certain adaptation from the client, who cannot expect the new solution to work optimally by itself. *"We have had the case of selling a system based on 10.000 requirements and there was hardly anything in there about training, about organizational changes, etc. Sometimes they plan well for that, but often they just do not make that necessary change in*

management. Sometimes they need to change the organization itself (…) it is not just an ICT change. Without this the procurement could be disastrous".

Finally, Mr. Brandvold recommended procurers to focus on specifying requirements in functionality terms, and to leave the technical aspects aside for suppliers to deal with. Also that purchasing organizations need to share people with experience, as well as explore and understand success stories and share that knowledge. *"They (clients) should have a common post review (database), (…) a collection of the basics. What we do in Accenture is to make the case anonymous and post it on our website for everybody to see. I can go in and contact the customer and the person who delivered it and ask for specifics (…)".* Another suggestion was to optimize the business model: *"Clients could make it a win-win that does not consume so much time and money, as long as they have somebody with expertise to do it"*. For this, procurers should be given tools to better understand what their possibilities are in any situation: divide or aggregate purchases in ways that allow more suitable tendering procedures, per example.

9.3.3. HP

Position and Background

Mr. Hans Espelid works as Key Account Manager at Hewlett-Packard. He is working with public tenders and RFP's since 2007, delivering different client solutions such as notebooks, desktops, monitors, and such, as well as cases in the private sector. Examples of HP tender contracts in Norway include USD 8 to 15 Million per year to the Defense sector, USD 4 to 8 per year to the Norwegian Police, and USD 2 to 5 Million to the Norwegian Tax authorities and the NRK (Broadcasting).

Tendering procedures and innovation drivers

According to Mr. Espelid, the most common procurement procedure is the Open Tender. *"It is hard to find tenders with specific innovation focus"*. In his view, the low quality of buyer-supplier interactions is the biggest cause of problems. *"The customer`s ICT department and the customer`s Procurement department just do not understand each other. It is most common that the (client's) ICT department has a "hands-off" policy during the procurement process. The big problem then arises when the procurement team is answering*

clarifications that are requested by the bidders. Often the clarifications are requested in order to help the customer get a more innovative focus, but these are often disregarded as "Not to be included" or "No change in the requirement specification" by the procurement department. It is easy for my company to see who is included in the process just by looking at the requirements, or from the feedback bidders get from the clarification requests."

We then discussed the role of public procurement as an innovation driver in ICT. Mr. Espelid's opinion was that, in its current state, procurement has a very weak role in innovation, due to several hindrances. *"Not good at all. The key issue is that ICT innovation does not happen overnight. One thing that often creates an issue, in respect to innovation, is the four years limitation on public contracts. On client solutions this is usually not a big problem, but with core infrastructure, this poses a big problem when the public customers move in one direction for four years, and then have to restart and move to another direction four years later"*.

Major Barriers

In his view, the biggest barriers were the risks involved in PPI procurements, the multiple conflicting policies influencing procurements, the increase overall lead-time, and the lack of proper buyer-supplier interaction. To address these, Mr. Espelid explained some initiatives from his company, and their results. *"Sometimes, (HP) requests our public customers to help us with testing future products/solutions/technologies, etc. in their operational environment, but the public customers are very restricting with these requests. As an ICT supplier we have to test some of the prototype products (i.e. software solutions) in a true "hot" environment, but the opposing organizations do not want to spend their time and resources with these types of test projects"*. We discussed that facilitating this would be beneficial for both organizations, through mutual learning. The problem results from the fear of supplier lock-in, and the "understaffing" in public organization's ICT departments. *"If customers were really interested in innovation, they should add a responsibility to actively seek out information and interact more with the key ICT companies"*.

Lastly, we turned our discussion to aspects of innovation in ICT, and potential ways to measure the effectiveness of an innovation-oriented project. In his view, the current trend of innovation in ICT is the focus on

lowering running costs, or Total Costs of Ownership (TCO), for each user in the organization. *"Carbon footprint or total energy reduction per user could also be good indicators. Some quantitative indicators within administering costs could be measured. But innovation could also envelop qualitative indicators, such as "to what extent have our organization reached its goals as to where we want to be technologically".*

9.4. Findings from multiple choice questions

In this section, I will present the results from my multiple choice question regarding interviewee's priority ranking of innovation elements, intended to summarize the findings from the interviews. While I merely present the results in the following subsections, these will be discussed in depth in the Analysis section of this thesis.

9.4.1. Procurer's priority ranking

Figure 20 illustrates the ICT procurer's perception on each element's effect on innovation.

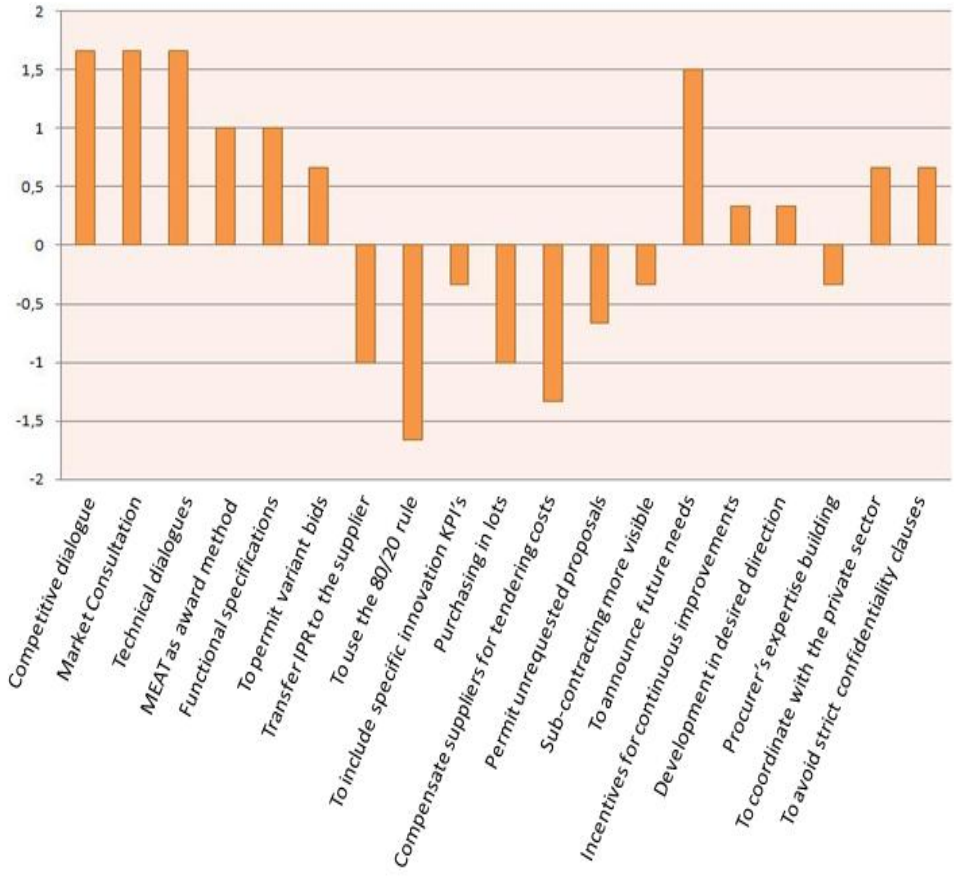

Figure 20

Purchasers' side Innovation elements priority ranking (simple average)

9.4.2. Supplier's priority ranking

As in the previous subsection, Figure 21 shows the results from the supplier's side.

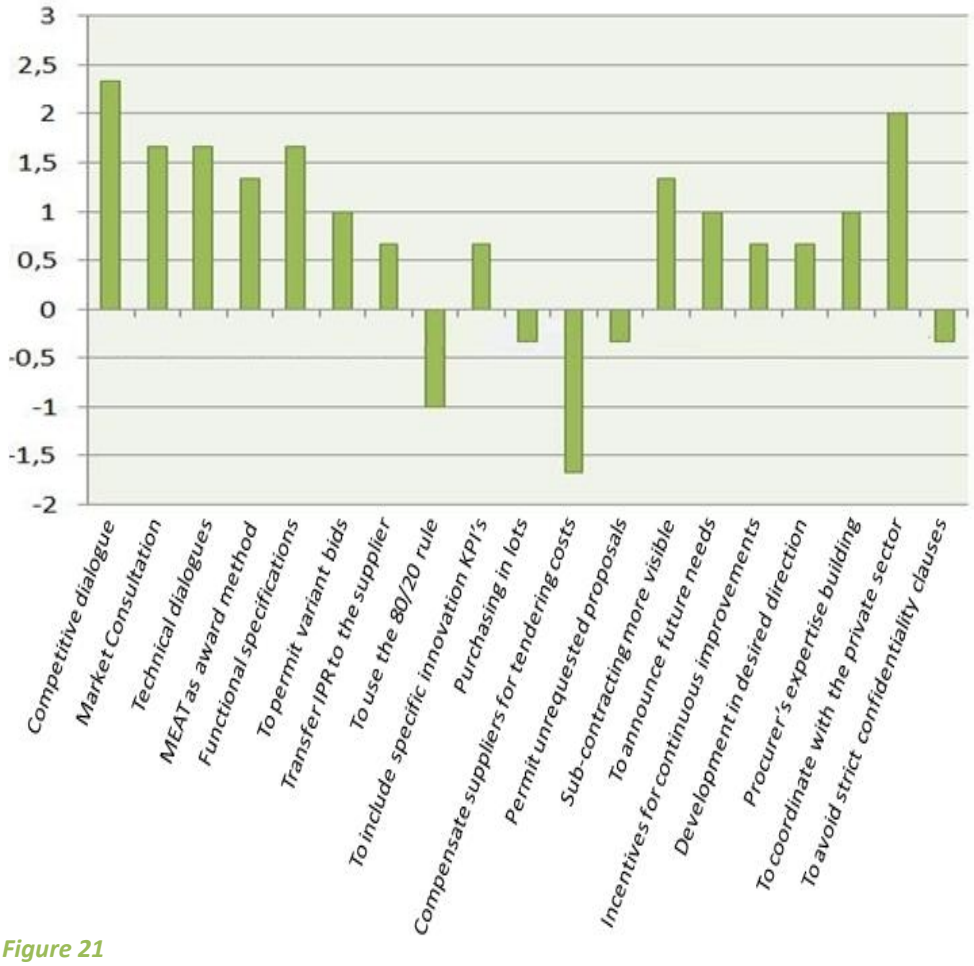

Figure 21

Suppliers side Innovation elements priority ranking (simple average)

9.5. Conclusion

This section has presented the empirical findings from my research. It regarded the use of Sustainability as an innovation driver in ICT through the use of environmental criteria in public procurements, the interviewee's considerations concerning the most used procurement procedures, and their perception of major barriers to innovation-oriented procurements. Finally, I presented the findings from my multiple-choice question regarding the priority of innovation elements that can be used to stimulate innovation-seeking in public procurements.

V – Analysis

This is the explanatory part of this thesis. The purpose of the following paragraphs is to address whether the current state of public procurement in Norway has an Exploration or Exploitation focus. For this, I will compare the empirical findings with the Theoretical Benchmarks (presented previously in Section 4.3, Figure 14) in the discussion that follows.

10. Analysis of the findings

10.1. The effect of Sustainability criteria on Innovation

I will start with addressing the effect of the environmental requirements on innovation in ICT procurements. Despite the ambition of using these requirements to drive innovation, it is crucial to understand that for these sustainability elements to have a positive impact on innovation as expected by demand-side policies, they must indeed reflect innovation drivers in the ICT sector.

However, besides the obligation from the regulations to analyze Life Cycle Costs in each purchase, which in itself does not necessarily entail a sustainability perspective, the adoption of these criteria is discretionary to each procurer. This heavily weakens the usefulness of the procurement function regarding policy delivery, according to interviewees such as IBM's, who argue that only making the sustainability requirements mandatory to all purchases could have a strong beneficial effect on driving innovation.

In addition to this, there is a more fundamental problem, as illustrated bellow in Figure 22. It is important to note that the criteria used are very lax and not demanding, in the sense that the recommended sustainability criteria merely reflect the current industry standards. They do not demand more from the market than it already typically offers. These criteria were summarized in the previous section in Table 7 and are included more extensively in Appendix 6, where we can see requirements such as "*must adopt ENERGY STAR® requirements"* (an international standard aiming for nationwide energy savings).

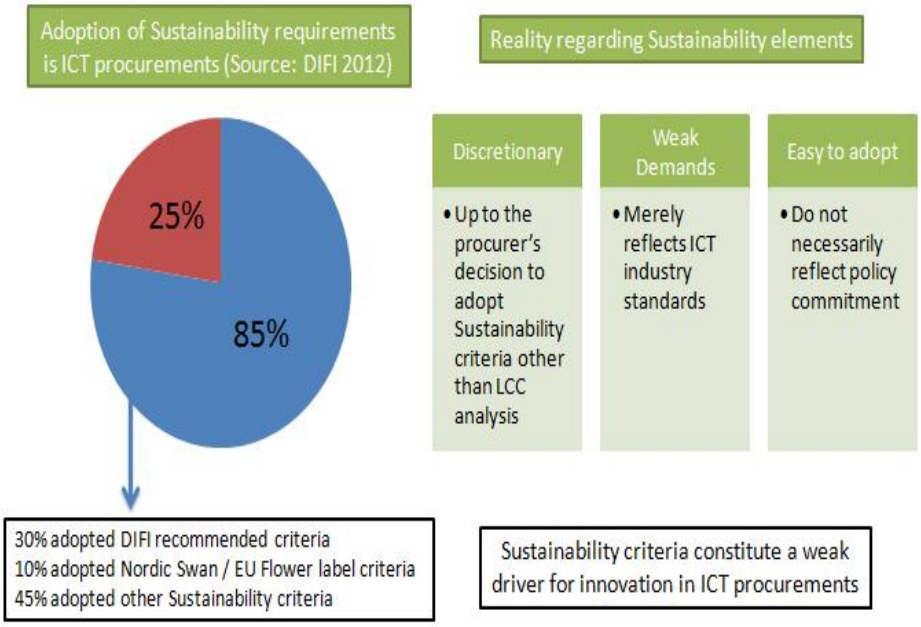

Figure 22
Sustainability criteria as an innovation driver for ICT procurements in Norway

ICT suppliers regard criteria such as "*Plastic parts heavier than 25g cannot contain flame retardant substances or mixtures that are assigned to risk phrases as may cause cancer (…)*" as something that all suppliers easily comply with. They also argued that for contract clauses, such as "*Parts for the operation, repair, replacement or upgrade is guaranteed to be available for at least 5 years after the product is produced*", there should be a distinction between technological and economical lifetime and that these criteria do not necessarily have to do with sustainability.

Finally, regarding criteria such as the maximum sound level allowed from ICT products, interviewees argued that such criteria merely reflect industry standards which all suppliers already integrate in their products. This explains why a small percentage of ICT procurers have not included any Sustainability criteria in their purchases in 2011: the products they purchased are likely to integrate these requirements already, and by using these criteria procurers are only further complicated the already strict requirements list in their tender requests.

This concludes that despite being a key driver for innovation in ICT and also being present in the Norwegian Government's policy objectives, findings indicate Sustainability to currently play a weak role in stimulating innovation in ICT public procurements. Interviewees argued that in order to improve policy delivery and stimulate the procurement of sustainable and

innovative products, these requirements should be revised with greater ambition and be made mandatory for all purchases. They argue that the typically Scandinavian view of "*favoring putting a carrot in the front, rather than a whip in the back*" expressed by DIFI, is naive and assumes the individual political commitment of procurers to the Sustainability and Innovation policies.

Considering the barriers to the innovation procurement approach (such as the requirement of Senior-level support and the perception of PPI being more expensive), carrying out these requirements in practice becomes more of a hassle to the procurer regardless of their political commitment. Voluntary action is unlikely to be enough, and the solution of adopting more and increasingly tougher regulation is supported by policy experts and environmental activists, but also recognized that it needs to be combined with educating and organizing consumers (Nidumolu, Prahalad and Rangaswami 2009).

10.2. Analysis of the interviews - Open questions

The open questions were used to start the discussions and give interviewees freedom to name ideas and their perspectives. The findings from the interviews will be discussed in the next paragraphs, and are summarized in the following Table 8.

I begin with noting that every interviewee recognized the dominance of the Open procedure and Fixed-price contracts in public procurements. This is justified by the nature of routine purchases (i.e. standard products bought off-the-shelf). In turn, this implicates that procurers consider the vast majority of purchases to have a weak strategic potential for their organization. The consequence then is of the purchasing organization adapting to the solutions offered by the market, rather than using its own demand power to induce innovation.

The dominance of simpler, traditional tendering procedures also reveals a low focus on the importance of the dialogue with the market throughout the procurement. For these routine purchases, the tender request is much formalized (focusing on technical requirements) and allows a fast and easy comparison between supplier's bids. While on one hand, the

innovation-oriented procedures recommend a widening number of participants to stimulate interaction and ideas-exchange, procurers focus on competition allowing getting a better price and that sticking to one vendor brings substantial volume discounts.

Interviewees	Procedures preferred	Innovation drivers	Major Barriers
Statens Vegvessen	• Negotiation • Dialogue	• Dialogue allows more ideas. • Focus on Functionality.	• Regulatory constraints. • Time and budget pressure.
Oslo Airport	• Dialogue	• Bargaining power of public sector. • Need to be in the technological forefront.	• No need to innovate – can wait for the market. • Lack of competition in public sector. • Too rigid technical requirements.
IBM	• Dialogue	• Sustainability requirements. • Cooperation and interactive learning.	• Lack of procurer expertise. • Focus on price.
Accenture	• Dialogue • Public-Private Partnerships	• *Out-of-the-box* thinking. • Face-to-face interaction.	• Time and resource consuming. • Procurers assume to know the best alternative. • Risk-avoiding behavior.
HP	• Dialogue	• Pilot projects • Interaction	• Lack of buyer-supplier interaction. • Lack of innovation indicators.

Table 8
Summary of relevant empirical findings

This leads to the conclusion that procurements have a short-term horizon focus, such as upgrading a system at best price, rather than the long-term focus of addressing bigger challenges and meeting policy ambitions.

The next section regards the multiple choice questions concerning the major barriers to PPI, which is intended to structure and systematize the previous ideas into a holistic view.

10.3. Perception of main barriers – multiple choice

Another important finding is in the perception of the main barriers: according to the empirical findings from the multiple choice question regarding barriers, purchasers and suppliers have a very distinct perception. The following Figure 23 illustrates this.

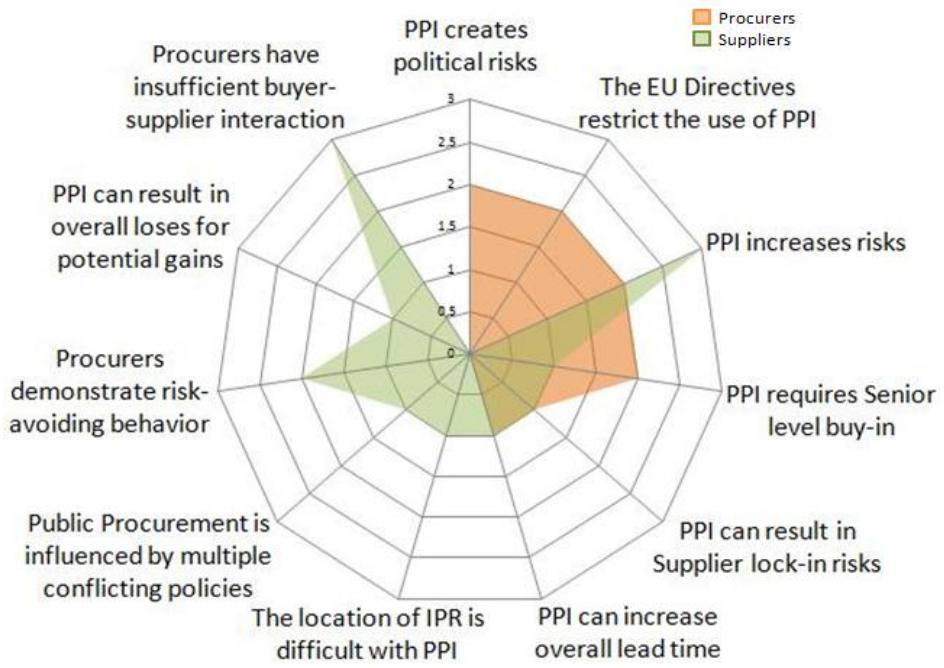

Figure 23
Procurers and Supplier's perspectives of major barriers to PPI

Procurers on one hand seem to perceive barriers mostly related to the outcome of the project, underlining problems such as increased project risk, increased lead-time, creation of political risk, and risk of supplier lock-in. They argue that PPI processes are not much adopted because of the potential political risks involved (such as derived from the non-transparency to the exterior observer, contrasting to the traditional approaches), and that adopting these practices requires Senior level commitment. Overall, the main reason for the low adoption of more open procedures is related to the

perception that the EU Directives disencourages the use of such approaches. Procurers see no need to resort to Dialogue Competitions when in most cases they are able to define in detail the requirements of the product they are looking to buy, and according to the regulations, they are thereof indicated to adopt traditional procedures.

Suppliers, on the other hand, see the barriers in a different light. While they agree that procuring innovative products has an inherent dimension of risk and also admit the potential political risks from adopting a Dialogue-based procurement, they see the main barriers in the procurer himself: procurers demonstrate risk-averse behavior, suffer the pressure from multiple conflicting policies, and that they are unprepared to properly manage a Dialogue-based approach (as an interviewee commented, "*instead of an open dialogue, I was surprised to find more of a negotiation with a strong focus on price*").

Lastly, the dialogue phase was also criticized from suppliers, in the sense that ideas brought to the table cannot be protected, and that the winning tenderer would be the one that best (and most cheaply) incorporates all good ideas in its offer. Suppliers thus hold back ideas, not revealing key elements too soon, which could be resolved with the implementation of targeted elements such as strengthening knowledge protection clauses.

10.4. Priorities of ICT purchasers – multiple choice

The following Table 9 presents the hierarchy of preferred elements from the graphs presented in Section 9.4.1, with the best and second best elements marked green, and the least preferred marked red.

The results are in line with the recommendations suggested in the literature, reflecting the eagerness to early engage with the market prior to defining the actual need and its tender notice publication. By recognizing the need to announce future objectives to the market as early as possible, procurers admit the potential of the public procurement function towards better policy delivery when purchases are conducted with a long-term perspective.

ICT Purchasers: Most favored Innovation elements	
Number	Explanation
1	Use advanced tendering procedures such as the Competitive Dialogue
2	Resort to Market Consultation when assessing the need, and to find the optimal solution
3	Engage in technical dialogues prior to seeking tenderers
14	Announce future needs and requirements to the market as early as possible
4	Resort to MEAT as award method at all times (combined with TCO or LCC analysis)
5	Focus specifications on functional or performance-based criteria rather than on technical requirements
18	Coordinate with the private sector through Public-Private Partnerships (PPP) and Pilot-projects, when these are allowed in national legislation
8	Use the 80/20 rule to allow suppliers to deviate a part of the tender from tendering regulations
11	Compensate suppliers for their tendering costs

Table 9
Hierarchy of Innovation elements from purchaser's view

The second-best elements are nº 4, 5, and 18. These, such as nº4, are representative of the purchaser's willingness to base their tender valuations on other criteria besides price. While such subjective criteria as "quality" are regarded as ambiguous and prone to raise evaluation difficulties, they also reveal that purchasers value the quality of the purchase itself and its fit into the organization's objectives more than price. This element also suggests taking into account costs from the use and operation of the product purchased. By adopting a TCO analysis into the tender evaluation, the purchaser is able to account longer-term perspectives into the purchase (in line with the previous elements discussed).

While element nº 18 underlines the above mentioned eagerness to engage with the market during the purchasing projects, the element nº 5 is most interesting. The preference of purchasers to focus on functional specifications rather than technical requirements reveals the recognition that suppliers should be given more room to present innovative solutions. This indicates that purchasers are eager to allow suppliers to give their opinion and ideas.

The least desirable elements are nº 8 and 11. Despite element nº8 being allowed by the EU Directive 2004/18/EC, it seems to have low popularity among procurers. This may be due to the difficulty in assessing a Dialogue Competition process from the exterior, and the fear of these deviations being regarded as bad practice.

To compensate suppliers for their tendering costs was regarded as a "double-edged sword". From one side, purchasers are unable to compensate suppliers with even close to the total of their tendering expenses otherwise the procurement costs would skyrocket. On the other hand, these compensations are symbolic and indicative of the purchaser's commitment to the supplier, which could be used to foster SME's participation on the procurement project.

In June 2011, the UK's House of Lords' Science and Technology Committee expressed their concern of this apparent exclusion of SME's from public procurement, stating that it is "*antithetical to innovation that government buyers are settling for "proven solutions" from "existing suppliers""* (House of Lords 2011).

The interviewees' general opinion, however, is that despite the evident exclusion of SME's from big procurement projects having a negative effect on innovation, these companies are better off by being included as part of the winner's consortium team, as subcontractors.

10.5. Priorities of ICT suppliers – multiple choice

In this subsection, I will discuss my findings regarding ICT suppliers' ranking of Innovation elements in public ICT purchases (Section 9.4.2). It is interesting to note that the supplier's perspective is similar to the procurers'.

As can be seen in Table 10 bellow, this ranking is very much in line with the purchaser's perspective described in the previous subsection, revealing that purchasers and suppliers see eye-to-eye on which dimensions most benefit the outcome of innovation.

The elements with lowest rank are nº 11, 8, and 12, also similar to the least ranked elements by purchasers.

ICT Suppliers: Most favored Innovation elements	
Number	*Explanation*
1	Use advanced tendering procedures such as the Competitive Dialogue
3	Engage in technical dialogues prior to seeking tenderers
4	Resort to MEAT as award method at all times (combined with TCO or LCC analysis)
2	Resort to Market Consultation when assessing the need, and to find the optimal solution
14	Announce future needs and requirements to the market as early as possible
18	Coordinate with the private sector through Public-Private Partnerships (PPP) and Pilot-projects, when these are allowed in national legislation
11	Compensate suppliers for their tendering costs
8	Use the 80/20 rule to allow suppliers to deviate a part of the tender from tendering regulations
12	Better address unrequested proposals through procedural design

Table 10
Hierarchy of Innovation elements from supplier's view

10.6. Conclusion

To summarize the most relevant empirical findings, we can see:

1. The tendency to use Fixed-price contracts and avoidance of complex tendering procedures (dominance of the Open procedure);
2. Despite procurers understanding the benefits from an innovation orientation in procurements, the focus is on short-term benefits, such as mitigating project's costs, and quickly finding the best solution at the best price;
3. Most purchases are considered of low strategic potential, and therefore, of a low priority to engaging in dialogue and interactive learning;
4. Procurer's lack of expertise and knowledge in taking advantage of the dialogue processes and the overall PPI procedure;
5. While procurers and suppliers regard different barriers to the adoption of innovation-oriented procurements, they have a very similar

perspective on the type of elements that can be used to stimulate innovation in public procurement.

To conclude, comparing the empirical findings to the theoretical benchmarks of the different procurement approaches (Figure 14) reveals a dominance of the Traditional approach to public procurement with high recognition of the benefits of PPI but low practical adoption of the PPI mind-frame. This indicates that the Norwegian public procurement practices in ICT have more of an Exploitation orientation than an innovation-seeking focus, despite the country's political ambitions.

Figure 24 bellow, illustrates this point: empirical findings indicate the causes for the tendency towards Exploitation in Public procurement, while interviewees expressed their preference for approaches closer to an Exploration orientation.

The main problems are internal to the purchasing organization, and therefore the focus of improvement recommendations to strengthen the priority of innovation in public procurements must be within the public organization's structure and purchasing operations.

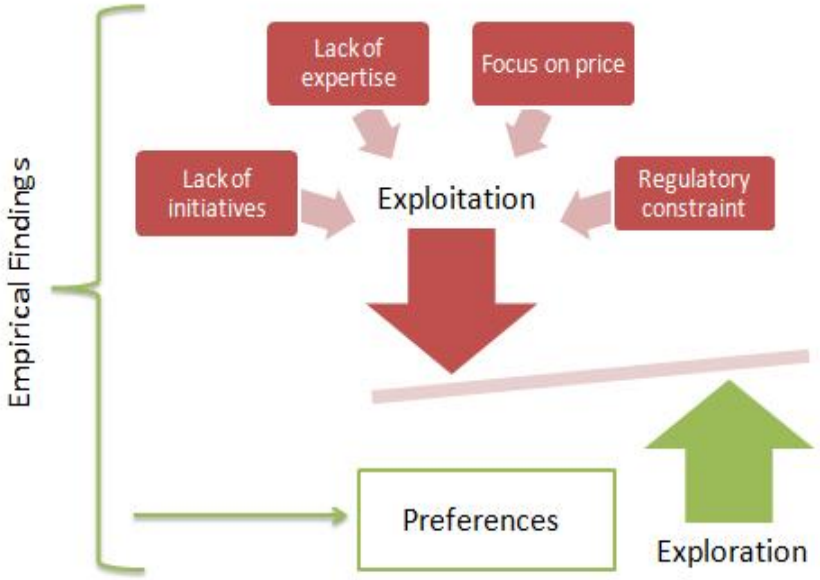

Figure 24
Summary of the empirical findings

11. Implications of the findings

The findings discussed in the previous section suggest the source of barriers to PPI to be on the purchaser's organization and procedures.

Therefore, I will divide my suggestions into Strategic and Tactical recommendations for procurement practitioners.

11.1. Strategic recommendations

First recommendation: Integrating the Chain-Linked model

Adapting the Chain-Linked innovation model to Van Weele's (2005) purchasing model provides an overview of the decision-making process across the procurement procedure, as illustrated in Figure 25.

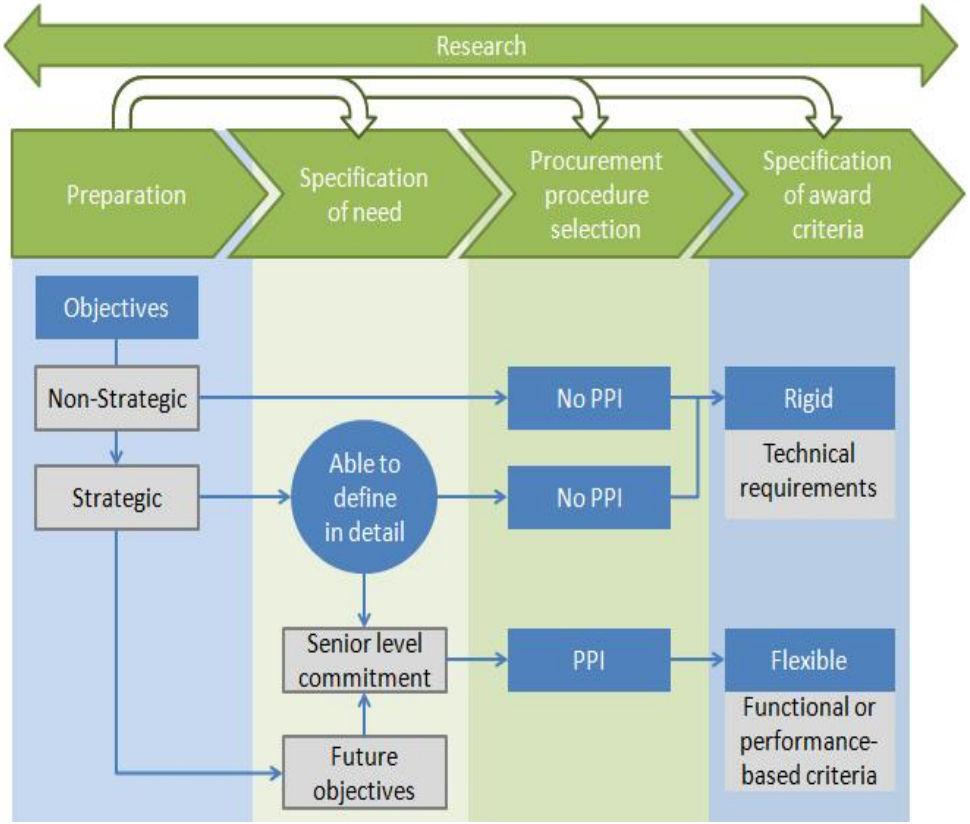

Figure 25
Decision-making on the different stages of the PPI procedure

This allows procurers to visualize the possibility of taking advantage of market interaction and feedback loops that represent an ongoing research throughout the procurement.

In the initial stage, the procurer must first clarify the reasons and the objectives of the purchase. A crucial question arises: Is, or can the purchase be of any strategic importance to the organization?

Second recommendation: Integrating the Olsen and Ellram matrix

To address this issue, procurers can base their decision on the Olsen and Ellram portfolio matrix (1997), illustrated in Figure 26.

This model is an elaboration of Kraljic's matrix (1983), and distinguishes purchases based on their degree of difficulty to manage and its strategic importance.

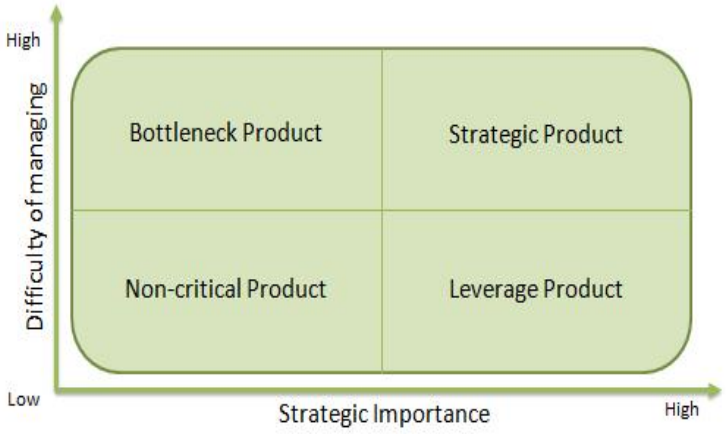

Figure 26
Olsen and Ellram portfolio matrix (Source: adapted from Olsen and Ellram 1997)

As described by Gelderman and Van Weele (2005), purchases fall under four categories:

- *Non-critical or routine items* are of low value, are ordered frequently and therefore cause high transaction costs. Strategies aimed at reducing transaction costs include Category Management in e-Procurement solutions;
- *Bottleneck items* cause substantial problems and risks (this can be handled by volume insurance, vendor supplier control, safety stock and backup plans);
- *Leverage items* allow the procuring organization to exploit its full purchasing power (per example, through tendering, target pricing contracts and product substitution); and finally,
- *Strategic purchases,* which need a more collaborative strategy between both the buyer and the seller. The use of this model is to minimize supply risk and take use of buying power.

Procurers should take into consideration that this model has been criticized as a simplified static model (Olsen and Ellram 1997). Nonetheless, the problem in the current state of the Norwegian PPI

approach is that it seems to push procurers to mostly regard either the Non-critical or Leverage purchase areas of Figure 26. This locks purchasers into procuring incremental improvements to the existing technologies, by consequence also locking suppliers in traditional technologies, not finding incentives to explore alternative solutions.

It is therefore of crucial importance not to limit every purchase to the scope of *what can or can't be defined in detail* to reduce the difficulty of managing the purchase. Rather, the main consideration is what kind of doors can be opened by procuring through PPI. This can be carried out by careful planning and, per example, resort to bundling and aggregating purchases (indeed increasing the difficulty in managing the purchase) and taking advantage of integration possibilities, aiming for a purchase of higher strategic importance. Instead of merely upgrading the PC's for internal operations, the procurer should plan to include future ambitions of the organization in that purchase, and pursuit higher ambitions, such as a full consolidation of networking capabilities, and the promotion of service-oriented system architecture.

The procurer can this way assure that it does not close any doors with rushing into the traditional procedures only because certain products can be defined in detail, as summarized in Table 11. The importance of broadening procurer's horizons, particularly in the initial stages of the procurement, is also recognized in the literature: Edquist and Zabala (2012) give the practical example of the US procurement of the Automatic Dependent Surveillance-Broadcast program, clearly showing how consultation and dialogue between buyer and supplier can directly influence the requirement setting stages.

Barrier	Explanation	Recommendation	Effect
Isolated and self-centered view of procurement department	▪ Procurer tries to benefit the institution he works for. ▪ Forgets his signaling power to other institutions.	▪ Adopting an innovation-driven perspective ▪ Avoiding too many details	Open new doors for itself as well as for other institutions

Table 11
Mitigating short-sighted procurement perspective

Third recommendation: Integrating Vested Outsourcing

Particularly for strategic purchases, procurers can adopt approaches such as the Vested Outsourcing: a result of the University Of Tennessee's award-winning research on key ways to improve outsource performance at lower price.

This hybrid business model is described as a flexible framework for collaborative outsourcing (Vitasek and Ledyard 2009). Vitasek and Ledyard (2009) argue that while many believe that "win-win" is merely a buzzword largely theoretical in nature, this concept is elaborated on a set of rules that allow both parties to have a stake in maintaining the arrangement and working together. This balance is illustrated bellow in Figure 27.

Figure 27
The Performance Pyramid (Source: adapted from Vitasek and Ledyard 2009)

These authors explain ten common outsourcing problems, summarized in the following Table 12. We can see bellow that these outsourcing ailments also reflect the main problems found in public procurement discussed throughout this thesis.

Outsourcing ailment	Explanation
Penny Wise and Pound Foolish	Short-term perspective, focusing on quick-fix solutions.
The Outsourcing Paradox	Detailing to the supplier how to perform the service, instead of allowing it to perform its expertise.
The Activity Trap	Typical transaction-based models where the service provider is paid for every transaction give no incentive for suppliers to reduce the number of non-value-added transactions.

The Junkyard Dog Factor	Outsourcing usually means that jobs will be lost. Many companies choose to keep their "best" employees on board, often the same ones who were asked to help write the statement of work (SOW). SOWs become rigid documents that dictate conventional and less-than-optimal ways of performing the tasks being outsourced.
The Honeymoon Effect	While the provider remains conscientious about meeting the company's expectations and service levels outlined in the contract, it never progresses beyond this point even while performance levels for the services provided may be improving industry wide.
Sandbagging	Rather than establish the highest level of savings achievable as early as possible, the provider will sandbag and offer up the savings in smaller increments over time, in an effort to manufacture future savings opportunities.
The Zero-Sum Game	Companies tend to forget that when companies work together the results are better than if they had played against each other.
Driving Blind Disease	Lack of a formal governance process to monitor the performance of the relationship. Research from the Aberdeen Group (2010) shows that one of the biggest challenges organizations face today is assuring that negotiated savings are actually realized on the bottom line.
Measurement Minutiae	Excess micromanagement. Measurement minutiae is often associated with companies that are suffering from the junkyard dog factor and with agreements that have fallen into the Activity trap.
The Power of Not Doing	This happens when a company falls into the trap of establishing measures for the sake of measures, without thinking through how those measures will be used to manage the business.

Table 12
Ten common outsourcing ailments (Source: adapted from Vitasek and Ledyard 2009)

The concept of Vested Outsourcing is based on five principles that aim to address these problems, as illustrated in the following Figure 28.

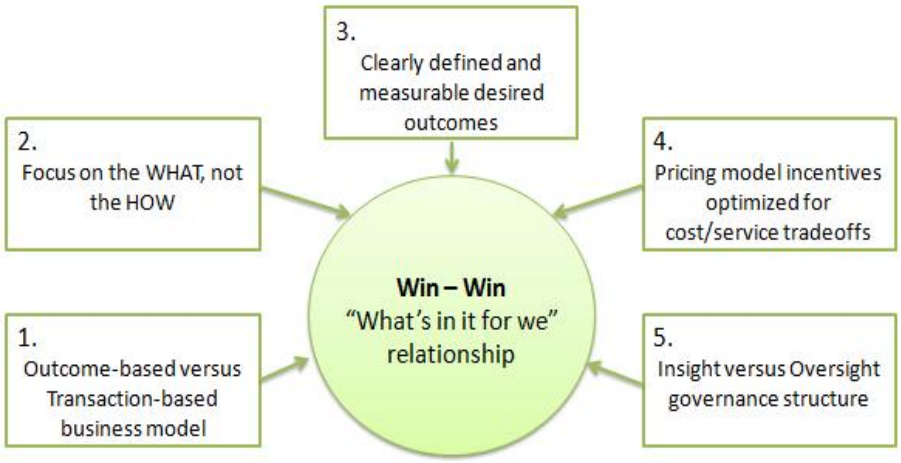

Figure 28
The five principles of Vested Outsourcing (Source: adapted from Vitasek and Ledyard 2009)

Adopting these rules, involved parties are able to create a performance partnership based on optimizing for innovation and improved service, reduced cost to the company outsourcing, and improved profits to the outsource provider. Organizations work together upon a foundation of trust and mutual accountability to achieve the objectives.

Through the careful alignment of performance objectives and controls, the supplier is empowered to pursue improvements that will deliver higher performance, greater profits, and lower total ownership cost (Vitasek and Ledyard 2009). For the service providers, this is an opportunity to exercise greater flexibility in deciding how support is provided, to ensure cash flow stability through long-term contracts, and to increase revenue. For purchasers, it's a chance to enhance performance while decreasing costs and assets employed. In short, vested outsourcing changes the fundamental business constructs of the typical outsourcing approach (Vitasek and Ledyard 2009).

These principles go in line with the recommendations mentioned throughout this thesis, and can potentially be guidelines that procurers in Norway can adopt to explore the potential of "regular", routine procurements, and also when conducting innovation-oriented procurements.

Fourth recommendation: Combination of methods

By combining the suggestions explained above, procurers are now able to make deeper considerations regarding how to better exploit the organization's bargaining power, as illustrated bellow in Figure 29.

Through the combination of the Purchasing model with the Chain-linked model of the innovation process, the degree of interaction with the market, the extent and intensity of the feedback loops throughout the procurement process, and their permeability into the project's outcome should reflect the nature of the purchase and the objectives intended.

In turn, the nature of the purchase is defined in the initial preparation stage, prior to the decision to engage in a procurement process. This question deals with what kind of products are worthy of such as exhaustive and time consuming approach as PPI (i.e. can the purchasing organization use not only the purchase itself but also the procurement process to learn

and strengthen its strategy?). Particularly in ICT, some products are of high strategic importance for the organization, yet also easily defined in detail (such as PC's, servers, and networking capacity) and thus considered routine purchases. The question is "what is appropriate to procure through PPI?" As mentioned, the Portfolio Matrix is a helpful tool that can be used for these considerations, in the way that it allows procurers to define the nature of different purchases and therefore achieve Senior level commitment for engaging in complex tendering procedures.

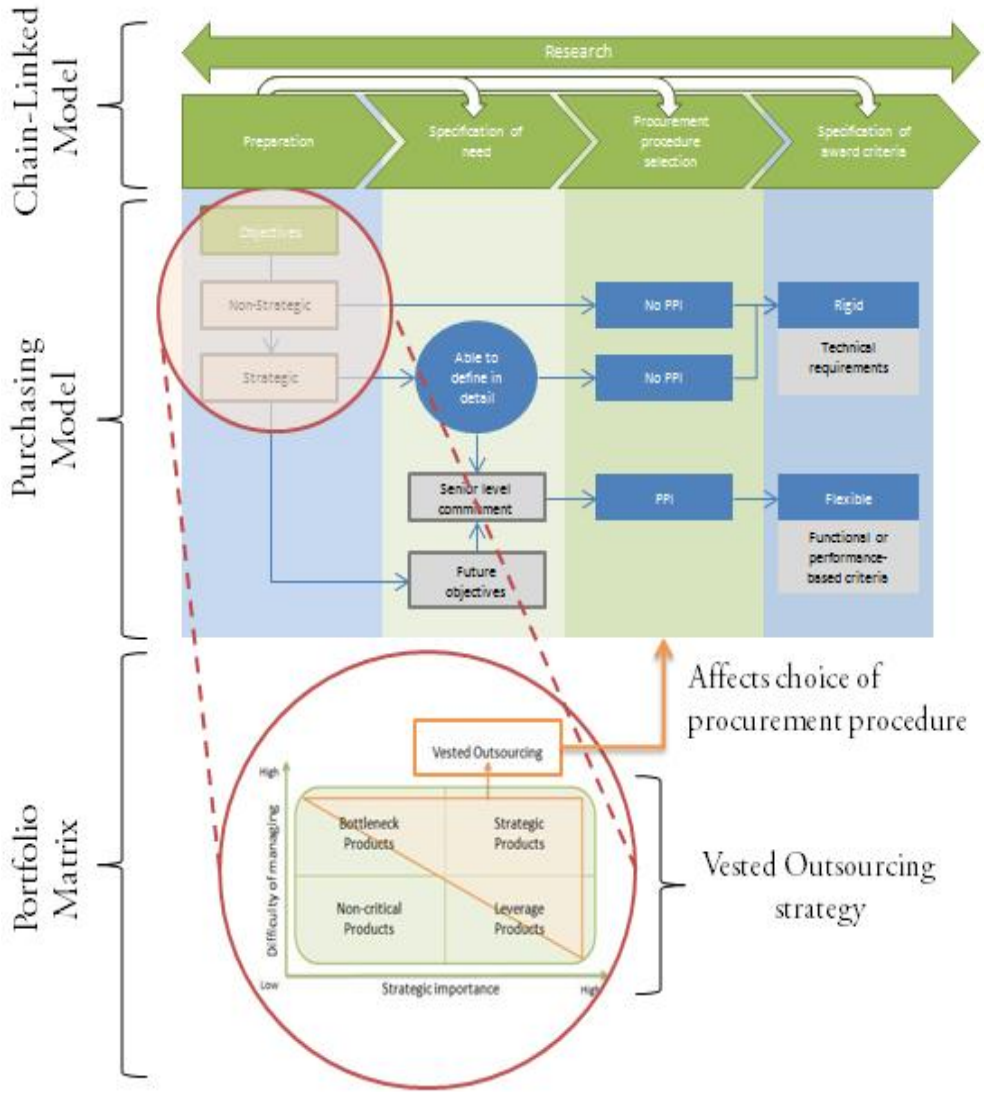

Figure 29
Combined Strategic recommendations

For purchases that fall under the highlighted orange area in the Portfolio Matrix, procurers should consider adopting a PPI procedure, further strengthened by resorting to targeted outsourcing approaches such as the Vested Outsourcing principles. This decision has a direct implication to

the tendering procedures and types of contracts to be used in the procurement process.

11.2. Tactical recommendations

Improving Buyer-Supplier interaction

Suppliers argue that procurers are not knowledgeable about how to properly conduct buyer-supplier interactions. The importance of these buyer-supplier interactions is stressed by the empirical findings, as well as in Innovation literature, indicating that interactive learning among organizations is of crucial importance for innovations to emerge, particularly during the early stages of the innovation process.

Edquist and Zabala (2012) elaborate on the issue that very tight cooperation between a procurer and a potential supplier excludes competition between suppliers, but argue that cooperation should be a guiding principle in procurement policies, conversely to solely ideas of perfect competition. In fact, as pointed out by Elinor Ostrom (1992): *isolated, anonymous individuals overharvest from common-pool resources. Simply allowing communication, or "cheap talk," enables participants to reduce overharvesting and increase joint payoffs, contrary to game-theoretical predictions*.

This learning can be achieved in PPI through, per example, the organization of "focus groups" within particular areas in this first phase of the procurement process. These should include users, politicians, policymakers, researchers, private firms, etc. Diversity is the most desired aspect for these groups, which should represent the Schumpeterian definition of "*new combinations of knowledge*". This underlines the concept that by engaging in dialogue and cooperation, as illustrated in the case of Silicon Valley, players are able to maximize benefits for the entire group.

This interaction is costly and time-consuming and procurers tend to avoid these ongoing research costs before the decision to purchase comes along. Procurers know when a previous contract is about to expire and the need for a new purchase project is arriving, and therefore should begin engaging in such market research with proper timing to be able to make appropriate procurement decisions. This can not only bring better results to

the procurement project, but also actually reduce the costs of the whole procedure. Edquist and Zabala (2012) present the case of the market-oriented energy-efficiency program implemented in Sweden, which saw its longer-term costs go down thanks to the adoption of PPI procedures. This is illustrated in Table 13.

Barrier	Explanation	Recommendation	Effect
Wrong interaction atmosphere between buyer-supplier	Short-term goals of minimizing time and costs	▪ Announce future needs and requirements to the market as early as possible ▪ Create diverse focus groups	▪ Learn about the different perspectives regarding how to define the need, and contemplate all possible venues before deciding which procedure is the most adequate ▪ Cost reduction

Table 13
Improving buyer-supplier interaction

Improving Procurer Expertise

These considerations revert to the case of procurer's expertise. Suppliers argued that most times this expertise is not found in-house: most of the procurers have not engaged in such projects, and the ones that have may have not conducted it properly. The solutions suggested to address this issue are illustrated in Figure 30.

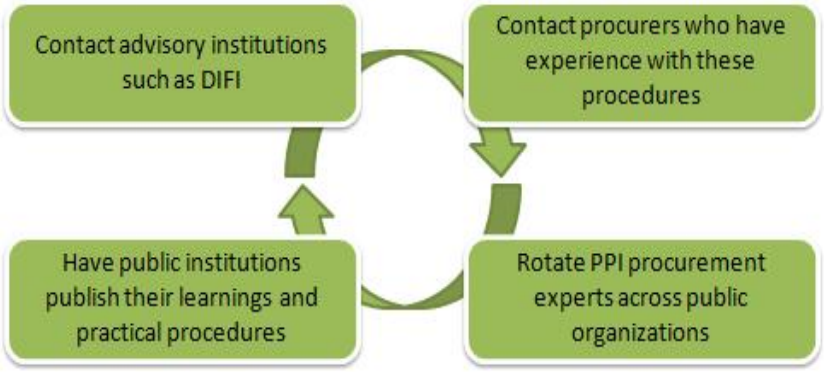

Figure 30
Addressing procurer expertise in complex tendering procedures

While databases like Doffin and Ted can point out the procedures used, they do not explain much about the procurer's preparation, strategy and learning experiences. I argue towards the realization of the elements in Table 14 bellow.

Elements	Explanation
Database 1	To introduce a database at DIFI where innovative solutions and patents are gathered and research upon for an ongoing market research of potential solutions. This database can serve as a primary source of information for any procurer prior to his engagement in Market Consultations, and should cover all product group
Database 2	To gather examples of best practice in Preparation-phase activities, technical Market Consultations, and other practicalities throughout the procurement process. This would provide procurers with insights regarding successful procurements on the same product group. Conversely to the database suggested in point 1, this database can pose issues of security and confidentiality.

Table 14
Elements to facilitate the improvement of procurement practices

Addressing rigid tender requirements

Suppliers in Norway also regard purchasers as not fully knowledgeable about their own need and about what potential alternatives vendors can offer. Therefore procurers should not engage into seeking tenderers before discussing with the market. Additionally, once the purchaser publicizes its RFT, he must stick with those requirements, even if sometime along the project he realizes that other requirements would better suitable. Suppliers argue that this list of requirements does not allow them to suggest alternative solutions, and that in the end they are turned into minimum requirements as the competition evolves into a price game. Finally, suppliers commented that such a rigid list of requirements merely allows procurers to better compare "apples with apples", which is not necessarily beneficial to innovation. They also noted that the "quality" dimension is often used for procurers to argue towards a particular supplier they are most comfortable with. This issue is illustrated in Table 15.

Barrier	Explanation	Recommendation	Effect
Too rigid tender requirements	▪ Procurers are not aware of alternative solutions ▪ Procurers blindly follow regulations	▪ Engage Market Consultation ▪ Focus on Functionality ▪ Adopt complex but flexible tendering procedures	▪ Procurers are not stuck with requirements published ▪ Procurers allow the market to offer its best solutions

Table 15
Addressing rigid tender requirements

For the procurement to induce innovation in the market, it is crucial that it is based on functionalities rather than technical designs. According to Edquist and Zabala (2012), this "translation" of needs/problems/challenges into functional requirements requires highly developed competences from the procuring organization. Such is the example of the procurement of the Swedish high speed train, where "*the lack of experience and flexibility of the procurer led it to demand a locomotive-drawn train. Excessively detailed technical specifications from the procurer (Swedish State Railway Company - SJ) prevented ASEA/ABB from developing a non-locomotive drawn train system (which FIAT did at about the same time). The more flexible design of the FIAT solution (the Pendolino) won the world market* (Edquist and Zabala 2012, 23). This illustrates the importance of specifying requirements in functionality terms to avoid locking suppliers in common/diffused technologies, while at the same time; demonstrates that even highly strategic procurements can have potential adverse results from procurers disregarding such considerations.

11.3. Implications for policymakers

This procurement-planning dimension should be a core aspect of (mature) public organizations based on their potential to influence the market, signal other institutions, and advantages in risk-taking. Therefore, the implementation of a Strategic Business Unit dedicated to Exploration, analog to the private sector's practices, is not only a potential job creation opportunity for the government (which in itself is a policy objective), but also an opportunity to have a strong, future-oriented public sector. This on-going planning should replace spontaneous, isolated innovation projects.

On the other hand, particularly in richer countries, public organizations already use efficient solutions. This, combined with the lack of competition in the public sector, makes procurers adopt a short-term focus, in the sense that they are able to purchase the best, proven solutions from the market by the time that a necessity to upgrade arrives. Procurers are prone to adopt a passive perspective on innovation, waiting for the market to offer efficient, low risk solutions.

This lack of need for innovation is especially palpable in the ICT sector, since the industry is particularly fast to respond to changes, and innovations quickly reach the market. Even with facilitating regulations, the lack of incentives, competition and competitive performance-indicators brings accommodation, preferring less risk and adopting the passive, slower pace of keeping things that *work* the way they are. Fighting this tendency by reviewing public procurement's regulatory framework and providing procurers with the appropriate incentives to commit to innovation ambitions must become an important objective for policymakers.

11.4. Challenges and areas of future research

Several challenges of practical interest emerged throughout this study. Due to the case-study design adopted for this thesis, I am unable to present statistically significant results in the questions regarding the major barriers to PPI in Norway, and the priority ranking of Innovation elements. Future research can address this by adopting an extensive quantitative research design and corroborating my findings regarding where the main problems are, and which are the measures most preferred by practitioners. It can also be of interest to quantify the amount of innovation-oriented purchases as a function of the total purchases of major organizations.

Since my study focuses on the ICT sector, it would be of interest to replicate this research on other product groups, to analyze the relationships among actors in other sectors regarding PPI. Also, by prioritizing mature institutions, my study disregards the potential of younger purchasing organizations, which can also have a significant contribution to innovation. Future research could also focus on deriving best practice examples on Norwegian PPI procurements (per example, how much time ahead should procurers engage in market research and consultations, and the optimal number of participants for the initial stages), as well as a comparison with cases from other countries where these approaches are more developed and implemented.

12. Concluding Remarks

Being a Revelatory case-study, i.e. a study not done previously in Norway, this thesis brings an introductory overview of the main barriers to PPI in Norway, its causes, and recommended solutions. It opens the floor for further research in this thematic to bring Norway closer to its political ambitions of strengthening its procurement function with innovation-oriented practices. By developing a procurement function oriented towards innovation, Norway can stimulate the cooperation between the public and private sector as well as fostering relationships between big bidder companies and subcontracting SME's, thus promoting economic growth, job creation, and a powerful innovation culture. Conversely, the current state of procurers being inclined towards the exploitation of "off-the-shelf" products is inauspicious to innovation and merely promotes the larger players who can afford to participate. It also has the effect of procurers focusing on short-term objectives, rather than the realization of policy ambitions. The suggested modifications in this thesis can be summarized into seven elements:

1. To facilitate ambitious purchasing responsibles;
2. To facilitate future innovation and sustainability aspirations;
3. To promote the focus of procurement specifications based on functionality criteria;
4. To facilitate the use of MEAT as award criteria;
5. To ascertain the optimal use of award criteria and tendering contract clauses;
6. To increase the visibility of subcontracting opportunities in public tenders; and finally
7. To create effective incentives for desirable continuous improvements.

For the realization of the desired political ambitions of Norway, these aspects should become the objective of Innovation policy concerning public procurement.

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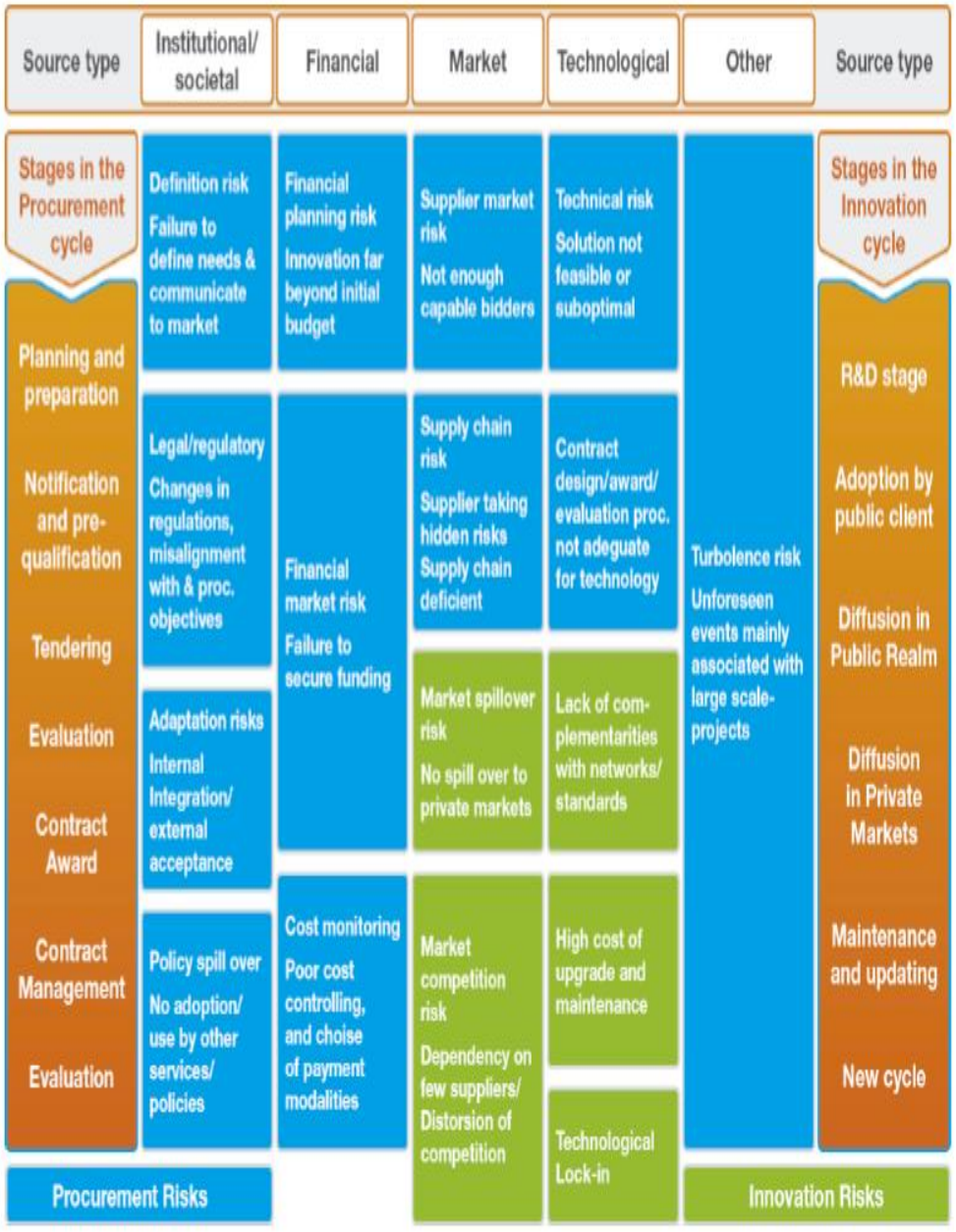
VII – Appendixes

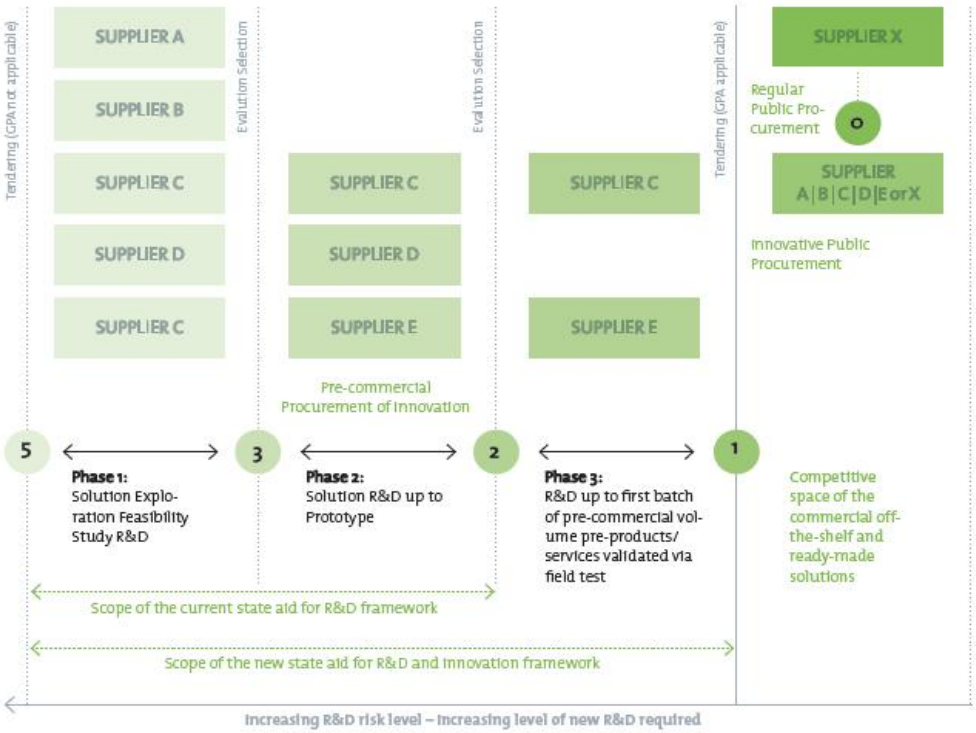
1. The Risk Map in Public Procurement for Innovation
2. Pre-commercial procurement: A phased risk-shared benefit approach
3. Interviews schedule and objects of study
4. Questionnaire for interviews
5. Flemish model for innovation procurement
6. Criteria document: ICT products
7. Preliminary thesis proposal

Appendix 1 - The Risk Map in Public Procurement for Innovation.

Source: V. Thai 2009



Appendix 2 - Pre-commercial procurement: A phased risk-shared benefit approach. Source: EC 2009b.



Appendix 3 – Interviews schedule and objects of study

Date	Company	Interviewee	Role
09-03-2012	DIFI	*Senior Advisor* Bente Hagelien	Public Management
20-03-2012	Banqsoft	*COO* Ronny Dragnes	Supplier
14-06-2012	DIFI	*Senior Advisor* Elizabeth Sundholm	Public Management
26-06-2012	Habberstad	*Social Services Advisor* Ole Morten Boldevin	Supplier
27-06-2012	IBM	*Public Sector Leader* Morten Andreas Meyer	Supplier
10-07-2012	Statens Vegvesen	*CIO* Lars B. Kalfoss	Purchaser
11-07-2012	Oslo Airport	*IT engineer – Project leader* Amund Westbye	Purchaser
12-07-2012	Accenture	*Sales Director* Jan G. Brandvold	Supplier

Appendix 4 – Questionnaire for Interviews

Position and Background

1. Please describe your experience with purchasing / supplying IT to the Norwegian public sector and your role on this process.

2. What examples of purchases / tenders have you/your company been involved in? Capital involved/ Tender size, etc?

Tendering procedures and innovation drivers

3. Describe the procurement process most used? Do you perceive an innovation focus?

4. What do you see as major problems in public procurement in Norway?

5. How do you perceive the role of Public Procurement as a stimulant for Innovation in IT?

6. Please describe what you know about Public Procurement for Innovation (PPI)?

7. Have you ever been involved in PPI procurement projects? How was this conducted? If you haven't, please explain why.

Major Barriers

8. What do you see as major problems in PPI in Norway?

9. Please rank the following barriers in terms of which are most persistent in Norway.

- *Procurement of innovative products is more expensive.*
- *Procurement of innovative products increases risks.*
- *Procurement of innovative products increases the overall lead-time.*
- *The performance of the eventual outcome is not as specified for innovative products.*
- *Public procurement of innovative products creates political risks*
- *Public procurement of innovative products can result into supplier lock-in risks*
- *The EU public sector procurement directive (204/EC/18) restricts public procurement of innovative products.*
- *The location of Intellectual property rights are difficult to place in public procurement of innovations.*
- *Public procurement of innovations requires Senior level buy-in (commitments from management).*
- *Multiple conflicting policies seek to influence the public procurement function.*
- *Public procurement officers demonstrate risk-avoiding behavior.*
- *Public procurement of innovative products can result in overall losses for possible gains.*
- *Public procurers have insufficient buyer-supplier interaction to be aware of innovative alternatives.*

10. What would you prescribe to address these barriers? How can practitioners adopt these suggestions?

11. What kind of indicators could be adopted to measure the effectiveness of the process, its outcome, and the overall policy delivery?

12. Are you familiar with the following Innovation Elements? Please mark those you are most familiar with.

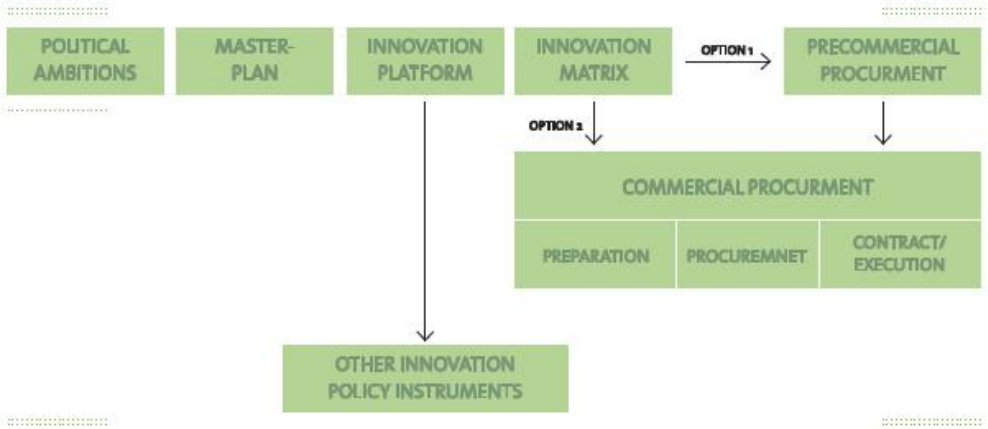
- *MEAT criteria (combined with Total Cost of Ownership or Life Cycle Costs analysis)*
- *Market consultation / Competitive Dialogue procedure*
- *Lots purchasing*
- *Focus on Functional specifications rather than technical*
- *Variant bids*
- *Rewarding Innovative capabilities / Environmental gains*
- *Norms for development in desired direction*
- *Incentives for continuous improvements*
- *The 80/20 rule*

13. Please score the following elements regarding their importance towards stimulating innovation in procurements

- To use advanced tendering procedures such as the competitive dialogue; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To resort to Market Consultation when assessing the need, and to find the optimal solution; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To engage in technical dialogues prior to seeking tenderers; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To resort to MEAT as award method at all times. This can be combined with Life Cycle Costs or Total Cost of Ownership analysis; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To focus specifications on functional or performance-based criteria rather than technical requirements; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To permit the submission of variants, allowing alternative bids from the same supplier; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To organize the contract conditions in order to allow the transfer of intellectual property to the supplier, and overall mitigation of risk; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To use the 80/20 rule, allowing suppliers to deviate to a certain extent from tendering regulations for a part of the tender; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To include specific innovation Key Performance Indicators to allow innovative firms to differentiate themselves in the scoring of tenders and reward innovative capabilities; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To suit the size of the tender to the most appropriate size at which innovative products are most probable to be submitted, through joint buying or purchasing in lots; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To compensate suppliers for their tendering costs; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To better address unrequested proposals through procedural design. -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐

- To have suppliers making sub-contracting more visible, in order to overcome supply chain problems related to innovation; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To announce future needs and requirements to the market as early as possible; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To provide incentives for continuous improvements through contract clauses; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To include Norms for development in desired direction, such as contract clauses stimulating knowledge exchange; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To make purchasing authorities familiar with Procurement of Innovation procedures through education and expertise building; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To coordinate with the private sector when Directives for public procurement are allowed in national legislation, through Public-Private-Partnerships and Pilot Projects; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐
- To avoid too strict confidentiality clauses that can push back suppliers with innovative products; -3 -2 -1 0 +1 +2 +3 ☐☐☐☐☐☐☐

Appendix 5 – Flemish model for innovation procurement. Source EC 2009b.



Appendix 6 - Criteria document: ICT products (translated from Norwegian). Source: DIFI 2012

1 - Recommended environmental criteria for ICT products

1. Criteria for ICT products

This document applies to the purchase of the following products: ICT

Product	**CPV code (2007)**
Desktop computers	30213000
Workstations	30214000
Portable computers	30213100

Server	48820000
TFT/LED display (flat panel)	30231310
Docking Station	cpv code does not exist
Projector (Video Projectors)	38652120
Printers and plotters	30232100
Photo Copy Machines	30121100
Multifunction Printer[1]	cpv code does not exist
Scanners with computers	30216110

2. Environmental challenges related to ICT equipment

The most serious environmental challenges related to energy consumption and chemical spill in production, energy use, and products ' content of hazardous chemicals. Long life, low energy consumption in operation, efficient, reusable, long-term access to spare parts and safe recycling of materials is thus important targets, to reduce the environmental load.

Production of a PC involves large environmental impact. The United Nations report [2] describes the resource consumption of a PC as follows:

- 9 times its own weight in fossil fuels
- 580 kg CO2
- 22 kg of chemicals
- 1 500 kg of water

It shows the way to a report on ICT equipment, public procurement and environmental impact produced for the European Commission in 2008 [3]. Where reference is made interlaid to reports that show that energy consumption in the use phase is 3-4 times larger than the production and that the notebooks use 50-80% less energy than desktops in the operational phase.

Other reports indicate that the climate effects of production and gases (NH3) used in eg. Flat-panel displays may be high. The conclusion is that the environmental impact from the production of the product and its use is essential.

Environmental Factors		**Solution**	**Requirements**	**Allocation criteria**
• CO_2-emissions resulting from the production	→	• The longest possible lifetime per unit • Climate neutral production (or fraction of a difficult to control for such a global industry)	4,5,6,7,8,9	1
• Reduced CO_2 emissions by the use	→	• The purchase of energy-efficient devices and turn them off when not in use	1,2,3	

• The emission of hazardous chemicals in the environment	→	• The purchase of devices with a minimum content of hazardous chemicals • Safe recycling of products that fully open		2

In this document take precedence in the following environmental factor and solutions:

3. Proposals for procurement.

Needs Analysis

Requirements for ICT equipment is changing fast and is a common reason for early disposal of equipment. Changes may be caused by, among others, requirements for new functionality, software upgrade, new working practices or edited work patterns.

Some of the new ICT functions would in itself be able to contribute to reduced environmental impact outside the actual acquisition. less use of paper (e.g., better screen), reduced travel demand (by increasing the application of eSamarbeid with audio and video) or reduced energy consumption (e.g. by virtualizing servers or better management of HVAC systems). The choice of equipment solutions that later turns out to curb such developments due to missing functionality will be both inefficient and unnecessarily stressful for the Organization for the environment.

It is recommended, therefore, that the purchasing manager kvalitetssikrer requirement analysis by going through the following steps to ensure long life and efficient — something you will usually save money in the long term.

Check that the requirement specification from rekvirenten takes into account the development of a 4-5 year term, e.g.:

- **eSamarbeid/eMøter** : Many businesses find that the introduction of an IT-based collaboration tools can reduce the need for travel and thus the project implementation time while the quality of decisions is increased. The environmental impact is reduced. But eSamarbeid that function will end user equipment and ICT infrastructure. The value of eSamarbeid is maximized when all have access to the functionality. One should avoid the new equipment must be replaced or the introduction of new functionality exposed because Pcs missing required CPU power, communication bandwidth or in/out functionality (eg. Webcam) to satisfy the eSamarbeid strategy.

- **Heavier and applications** : There is a tendency for the operating system and applications become heavier as the years goes by – accounting for this requirement in the message? Have less burdensome operating systems? It may be worthwhile to buy a bit more powerful than you need right now and ensure that the equipment can be upgraded.

- **Business Forms, Office and Home Office** : "Flexi solutions". In many workplaces, employees can work from home, they are not necessarily permanent place in space, they can move from the workplace to the "talk" when the phone rings (or Skype for orderly), they bring with them the PC in meetings. If such scenarios is appropriate – has taken the height requirement for them in monitoring – eg. good wireless event, notebook, docking station? What a pity it would be to have to replace the desktop because you just bought. "all" will now have portable ... (and they use a lot less power than desktops).

- **Paper Addiction** : The role has changed from being a means of communication to a screen replacement, because it is often difficult to read on the screen. Good display solutions reduces the need for printouts, but have to be adapted to individual needs. We have surveyed users ' needs? Some businesses have experienced that reformatting the form from portrait to landscape A4 takes advantage of screen space more efficiently and reduces the amount of printing, paper consumption and the need for the capacity.

- **Paper Efficiency** : When the paper is used as it should be written on both sides. This results in a significant reduction in paper consumption [4]. 2-sided printers should be purchased where it is written a lot. It should be considered whether the print setting to set up so that the user must go to the printer and the printing firm before it takes place (called a "follow-me" printing). If you print mostly black and white with some color printing, the printer automatically so that separate those colors are not used for printing black and white pages.

- **Noise** : How important is the noise depends on the location of the equipment and should thus assessed individually. In this guide, we have chosen to only put the noise level for laptop and desktop Pcs based on the thought that these would be used in the working environment and hence, one should always ensure low noise levels to ensure long life. Maybe a print and copy room with door is as effective as a quieter type?

Check that the need cannot be fulfilled in other ways:

- **Purchase of used equipment** : There is a market for "virtually unused" equipment that either have never been sold, or had to be disposed of because of the change in the enterprise ICT strategy, standardization of equipment as a result of mergers and the like. Such solutions stimulate the recycling market anyway, and should not require the same requirements as for new equipment. One gets bought large volumes of the same model of reputable brands that meet the requirements of the performance with low cost. More serious actors offering such products in the market today.

- **The purchase of servers:** Have you considered buying online services instead of machines or clean computers serverpark? Serverpark is a flexible solution that will be able to reduce the need for operational resources in the Agency and

provide higher uptime and lower risk? Many of the parks have increased and high energy costs that it pays for them to invest in efficient cooling systems and virtualization (so many computers can be closed off during periods of low load). Keep in mind that buyers are responsible to ensure that one has taken into account the total cost of a lifetime — and should include current (both computers and cooling), operating environment, bygga real, ...

Disposal/reuse of equipment:

- **Ensure optimum life for old equipment:** many acquisitions are connected with the PW of old equipment. Several vendors have now the possibility to buy/bring back old equipment for resale or recycling of parts or materials. If this acquisition opens up such opportunities should be specified in this competitive basis, but it is made with attention that such alternatives might be demanding procurement expert for evaluating the offers.

Summary:

The purchaser should check that rekvirenten has taken into account the following considerations by the preparation of requirement specification:

- If the business has a 4-5 year term on the ICT strategy
- If there are significant changes in the enterprise working patterns to come (e.g. new Office solutions, more Home Office)
- If you've been considering infrastructure choices that may result in weaker hardware requirements (e.g. choice of different operating system).

General environmental requirements:

- The requirements to the products under paragraph 4.2 "Technical specification" is going to requirements. This means that only vendors who have products that meet these requirements will be included in the contest.
- Criteria which are set to the products under point 4.4 "Assignments criterias" is can-claim, which means that it can be delivered into deals on products that do not meet these criteria. The allocation criteria are somewhat vendors compete for and these are being suitable to distinguish the products from each other in terms of environmental friendliness. The allocation criteria will be vektes in accordance with the regulations on public procurement § 22-2 and weighting should be on at least 20% for travel and be suitable to differentiate premiere/the most environmentally friendly products.
- Weighting should be set above the EEA threshold value.
- Safety should be your own vektingskriterium-not hidden away as part of something else — such as quality.

The product shall comply with Norwegian legislation, regulations on the restriction of use of hazardous chemicals, and health and other products (product regulation), (2004-06-01 no. 922)[5].

4. Recommended requirements and criteria

Environmental requirements and criteria that must be included in the invitation to tender for public procurement. This will be part of the tender documents along with other requirements and criteria. The fundamental principle of proportionality, as set out in the Public Procurement Regulations (FOA) § 3-1, fifth paragraph, means that the environmental requirements and criteria laid down must be proportionate to the contract to be entered into.

After the basic principles of requirements must be relevant to the specific contract, and documentation requirements, it must also be proportionate to the contract. This means that some of the environmental requirements and criteria proposed to be adapted to the specific procurement. This also means that the documentation requirements and quantities must be adapted to the size and type of contract. Some contracts can be complex even if the contract value is not great. This means that it must be considered quite specific about the proposed requirements and criteria are appropriate for the planned procurement.

4.1 The purpose of the contract

Purchase of IT products with low environmental impact in the life course perspective to the office.

4.2 Technical specification — discretionary requirements

The table below connects requirements with products, i.e. describes the mandatory requirements that are relevant to the respective ICT products:

Product	CPV code (2007)	Mandatory requirements
Desktop computers	30213000	2, 4, 5, 8
Workstations	30214000	4, 5, 8
Portable computers	30213100	2, 4, 5, 7, 8
Server	48820000	5
TFT/LED display (flat panel)	30231310	3, 5, 7
Docking Station	cpv code does not exist	5
Projector (Video Projectors)	38652120	5
Printers and plotters	30232100	1, 6, 9
Photo Copy Machines	30121100	1, 6, 9
Multifunction Printer[6]	cpv code does not exist	1, 6, 9
Scanners with computers	30216110	1, 6

1. Product to meet the current energy saving requirements of document management products (Imaging Equipment) siders ENERGY STAR ® '[7]

2. Product to meet the current energy saving requirements for PCs siders ENERGY STAR® [8] .
3. Flat screens to meet current energy saving requirements for monitors siders ENERGY STAR[9].
4. If memory that is specified is up to half of what the machine can be equipped with a maximum, and the machine has more than one memory space, at least one memory location may be empty for any subsequent upgrade[10].
5. Parts for the repair, replacement or upgrade guaranteed to be available for at least 3 years after the product has been manufactured.
6. Parts for operation, repair, replacement or upgrade guaranteed to be available for at least 5 years after the product has been manufactured.
7. Select one of the following requirements. Read the footnote[11] for the Guide.

a) The display's surface should not be blank[12]
b) The display's surface to be blank

8. The product ' declared A-weighted sound level ' (cf 1 pW) compliance. § 3.2.5 of ISO 9296, measured by ISO 7779, shall not exceed:

a) Desktop: 4.0 w (A) (equivalent to 40 dB (A)), in idle state ("idle operating mode") and 4 (B) (A) (equivalent to 45 dB (A)) when the hard drive is active ("accessing a hard-disk drive")
b) Notebook: 3.5 w (A) (equivalent to 35 dB (A)), in idle state ("idle operating mode") and 4 (B) (A) (equivalent to 40 dB (A)) when the hard drive is active ("accessing a hard-disk drive")

9. For products with a printer function to the declared sound power LWAd according to ISO 9296, measured according to ISO7779, not exceed the levels given by the following formula:

   LWAd: 0,035 x PPM + 5.9 (B) where Q is the number of printed pages per minute

   The product shall not exceed LWAd 7.5 (B), with the exception of products where PPM over 71 pages per minute.

Documentation Requirements:

1. Claims 1-3: all products that are ENERGY STAR-qualified (according to the current version) is considered to fulfill these requirements. Alternative documentation may include technical specifications from the manufacturer or a test report from a recognized business that demonstrates that the requirements have been met, appropriate for printing products from ENERGY STAR database[13]. if applicable, the personal statement,

2. 4-9 Requirements: Completed custom declaration form [14] signed by the person who provides services on behalf of offer/vendor.

4.3 eligibility (requirements to the vendor)

None.

4.4 Allocation criteria

Weighting of the allocation criteria require procurement expertise and experience. It is not recommended to use allocation policies unless the client has relevant skills and experience.

Additional points are given for each of the criteria are met. The following table links the assignment criteria of products; This describes the allocation criterion that is relevant for the respective technology product:

Product	CPV code (2007)	Allocation Criteria
Desktop computers	30213000	1, 2
Workstations	30214000	1, 2
Portable computers	30213100	1, 2
Server	48820000	1, 2
TFT/LED display (flat panel)	30231310	2
Docking Station	cpv code does not exist	2
Projector (Video Projectors)	38652120	1, 2
Printers and plotters	30232100	2
Photo Copy Machines	30121100	2
Multifunction Printer[15]	cpv code does not exist	2
Scanners with computers	30216110	2

1. Parts for the repair, replacement or upgrade guaranteed to be available for at least 5 years after the product has been manufactured.
2. Plastic parts heavier than your 25 g does not contain flame retardant substances or mixtures that are assigned to any of the following risk phrases iht. The EEA Directive 67/548/EEC:

- R45: may cause cancer.
- R46: may cause hereditary defects
- R60 may damage forplantningsevnen
- R61: may be harmful to the child during pregnancy

Documentation Requirements:

1. Completed declaration form signed by their own ISP's accountable.
2. All products certified by the European environment mark, the Nordic Swan label, Blue Angel or TCO ' 05 selection is accepted. Other relevant evidence will also be accepted.

4.5 The Contractual requirements

These functional requirements to vendor meet:

1. Packaging: If the Norwegian supplier (manufacturer) using packaging, shall no later than by closing presented evidence that provider is a member of a return order or satisfy obligations through own return arrangement with its own arrangement for finalization, where the material is being taken care of in an environmentally sound manner (Green Dot Norway AS or equivalent refund arrangement).

2. If it gets delivered excess equipment (cables, telephone contacts, etc) to this avhentes of vendor and processed securely by electronic waste or used for reuse if the employer requires it.

3. For each new model provided the principal after the conclusion of the agreement, shall separate the declarations form filled by the manufacturer and be attached to the shipment or made available electronically.

4. The customer reserves the right to request documentation from the vendor in order to verify the contents of the custom declaration form: for example environment make/license, the IT Eco Declaration ECMA-370, form, or other technical documentation.

5. For all equipment to be attaching it to documentation (for the user and service provider) that shows how equipment will be used and with what layout to minimize environmental impact (e.g. double-sided copying for printers and power management for PCs). When it is possible to equip ships already set up with an environmentally efficient layout.

Appendix 7 – Preliminary Thesis Proposal

Student number: **0916491**

Preliminary Thesis Proposal

The diffusion of radical innovation in the Energy Sector:

Not radical enough.

A survey on public and private investors regarding governmental policy

Hand-in date:

16.01.2012

Program:

Master of Science in Innovation and Entrepreneurship

Supervisor:

Professor Atle Midttun

Campus:

BI Oslo

Foreword

This preliminary thesis proposal was a research to understand how to stimulate the private sector to invest in radical clean technologies, through public policy. However, during the course of my research, I considered the constraints of the private sector and realized the better position of public organizations to pull these technologies from the market through the use of their procurement function.

This way, I changed the focus of my thesis from the private to the public sector, and thus focused on how to stimulate innovation through the use of the developed public procurement instruments.

Nonetheless, the preliminary thesis proposal that follows is the beginning of my research on how to best pull new technologies from the market.

Table of Contents

Introduction

Innovative entrepreneurial firms traditional seek funding through Venture Capital and private equity investments (Gompers and Lerner, 2004). Clean energy has become a particularly attractive sector for investment due to increasing concerns regarding global climate change. Governments around the world have consistently adopted ambitious targets to reduce greenhouse gas (Ghg) emissions and stimulate the adoption of clean technologies and renewable energy. Venture capital, which has traditionally been more active in industries such as IT or Biotechnology (Wüstenhagen and Teppo 2006) is shifting its focus towards "cleantech".

However, in the energy sector, typically dominated by mature companies, and despite that the look for radical innovation in the sector has never been higher, radical technology tends to systematically give way to incremental innovations. Investment in resource efficiency rose from 17% in 2006 to 45% in 2010, while investments in energy generation declined from 70% in 2008 to 30% in 2011, according to the research of Cleantech Group. Tom Whitehouse, chairman of the London Environmental Investment Forum (LEIF), stated that in the current risk-averse environment, traditional limited partners are simply not making as much allocation of investments to venture capital as before 2008. This reflects the continuous focus of investment into improving the efficiency of mainstream technologies, while meaning a fundamental lack of capital for the "cleantech" sector, especially towards innovative, but highly risky, new technologies.

With the public sector currently funding under stress, it becomes imperative to find new sources of capital, along with adequately shaped policy instruments and institutions that create the necessary incentives for this type of investment, creating a sound, sustainable Energy Policy. Corporate investors seem to be the best placed to invest in external innovation. There has been a sharp rise in the number of corporate investing in "cleantech" from 49 in 2007 to 84 in 2010.

This paper seeks to find why would VC's, Corporate and institutional investors be interested in investing in these high-risk

technology projects and what are the fundamental changes in energy policy that must be made to further stimulate these investments. Especially in a period of high environmental concern and investment into energy technologies, all innovations must have the opportunity to have their potentialities explored by the market, instead of having it limited to mainstream ones. Although many references are made to the so-called "valley of death" metaphor, where most innovations die in their early markets due to lack of achieving critical adoption rates, it seems instead to be a case of too few births, rather than too many deaths.

Problem statement

The following problem statements are offered, summarizing the main proposal, as a guide through this research:

Can innovation research and diffusion, particularly radical technology, efficiently be stimulated through public policy mechanisms in the energy sector?

Which are the underlying factors, motivations and preferences for investing in "cleantech" projects?

Could the overall innovation and adoption processes be improved through governmental intervention?

If so, which policies and related attributes are perceived as fundamental by investors, to stimulate innovation in the energy sector?

These research questions will serve as basis for further formulating more concrete hypotheses in the H0 and H1 format, to be tested in this study.

Theoretical background

Recent scientific assessments strongly highlight concerns towards the hardships of the climate change impacts from greenhouse gas (Ghg) emissions. However, international negotiations related to this problem are moving too slowly (while maybe even be proven to be inadequate over the next decades), despite the urgency for change (Gro Harlem Bruntland, 2011). A variety of studies has demonstrated that investing into the development of low-cost, Ghg-free and low-Ghg-emitting technologies can visibly reduce the costs of Ghg mitigation, reduce the economic downfalls related to limiting Ghg emissions, and make it more likely that policymakers adopt effective Ghg control policies (Weyant 2010).Many authors, particularly in the work of Grubb (2004), have outlined the many approaches that policymakers can use to promote innovation in low-carbon technologies.

The challenge at hand is to effectively take new technologies from research laboratories into the market, and improving the conditions for them to be able to survive the technology "valley of death". This term refers to the stage in the innovation process in where even though successful prototypes have been developed, the technology faces the tough challenge of successful market introduction and gaining optimal adoption rate that allows it to achieve widespread diffusion. Since it is at this point that innovative firms struggle most, bridging between governments funded R&D and self-sustaining revenue, it is also the point where venture capital and private equity investors must focus their investment.

This reflects the relevance of understanding the investors, inventors and entrepreneur's preferences and requirements, particularly at this stage. However, as mentioned before, even though venture capital and private equity have significantly more visibility and leverage, their investment focus has been primarily towards incremental innovations, due to diverse factors (e.g. risk-adversity, information asymmetries, lack of significant research validation, and overall uncertainty). It is therefore imperative that investors traditionally further down the innovation chain, such as corporate investors and providers of project finance, become increasingly involved at

this stage, since they are equally important for deploying new technologies, due to their relatively larger funding volumes and resources (Wüstenhagen e Burer 2009).

There are at least three rationales supporting government intervention in Ghg reduction: motivating the private sector to reduce Ghg emissions directly by stipulating a price on emissions; increasing the rate of innovative activity in the research and development of Ghg-reducing technology; and educating the public regarding Ghg-reducing investment opportunities.

Policies to promote low carbon innovation are basically divided into technology-push (such as government funded R&D) and market-pull policies (such as public procurement and production tax credits). While technology-push policies are aimed to increase the amount of technology "supply", market-pull policies are intended to increase the "demand" for new technologies, by providing firms and consumers with incentives (Weyant 2010).

A wide debate among scientists and modelers concerning climate and energy policies confronts arguments as to which of these approaches is the most adequate for long-term targets. Some scholars argue that technology-push policies are stronger in order for breakthrough innovation to surface (Hoffert 2002). Others discuss that market-pull instruments should be prioritized, under the assumption that such new technologies are only able to make a difference if they are in fact applied in the market. This view argues that the government's role should instead be of stimulating demand and contributing to induced technological change (Grubb 2002). There is also a discussed perspective that the two approaches must be made complementary.

One market-pull approach to stimulate innovation, according to Weyant (2010), is to rely on externality pricing and the market system. This would optimally induce firms into the development of low-carbon technologies. According to this view, by taxing Ghg emissions under conditions where industries of energy-producing, energy-converting and energy-consuming equipment are relatively competitive (and the "price signal" requisite is politically feasible), innovation would come as result.

This approach argues that the power of markets to pull new, innovative cost-competing technologies into the economy is incredibly strong

At the same time, Weyant (2010) also argues towards complementary non-market-base technology-push policy, as a crucial strategy for Ghg mitigation. This view defends that benefits from technology-push policies result from increasing the stock of new knowledge (as well as the stock of individuals in the economy who can produce and use new knowledge), further than the levels resulted from the operations of markets (even with the appropriate price signals). Technology-push policies usually draw on the "valley of death" metaphor. Even though efficient innovation processes should foresee bridging these "knowledge gaps" between laboratory and marketplace, a properly applied targeted research program in Ghg reduction technology can significantly increase the number of new ideas and inventions that are tried. Proper consumer education programs can also visibly increase the rate of diffusion of these technologies that, even though can become economically viable, have not yet been widely adopted.

This study accepts both views and aims to empirically test which policies are perceived to be more effective and interesting for captivating investor's interest to invest in early technologies while potentially meeting the expectations of inventors and entrepreneurs.

Energy Policies overview

Radical change often requires clusters of complementary innovations, what Freeman (1992) called "changes in technical systems.", and considerable change occurs over long periods of time (in the order of six to eight decades).

While energy producing technologies such as wind or solar were regarded as "radical" in their market introduction stages, and received quite relevant amounts of investment (wind in 2005, biofuels in 2006 and solar in 2007), research has tended to emphasize the evolutionary innovation of these technologies in terms of incremental innovation (Lerner 2011). This is not surprising, since innovation processes tend to become more incremental than radical in large technical industries that encompass strong path

dependencies, such as the case of the Energy sector. The bottom line is that the share of renewable energy in global power supply is around a low 18% (REN21 Global Status Report, 2010).

The electricity supply system is characterized by its capital-intensive structure, wide range of technical components and technologies and a range of actors and institutions. Most of the system components are intrinsically interrelated, while being associated with many technical norms, practices and institutional procedures. These are industries in which appropriability is quite difficult, market entry is expensive and risky, the organization of the market is likely to be oligopolistic (due to the domination of large incumbents) rather than perfectly competitive, and there is a strong strategic hold of information, making it hard to obtain and disperse through the economy (Weyant 2010).

This results in radical innovation in this sector facing considerable barriers, which is reflected on the tendency of investments to be made most significantly in incremental innovations while more radical uprising technologies are left struggling.

The role of governmental policies

Roughly three reasons can be accounted for the absolute low levels of renewable energies worldwide market penetration: economic, regulatory and social, according to Luthi (2010). The main economic challenges are the financial assessment methods utilized for energy projects usually biased towards fossil alternatives, the attractive external cost structure of conventional technologies and the strong governmental subsidies that these technologies still receive. Regulatory obstacles include long, bureaucratic and nontransparent authorization and permission procedures, and instability of support policy with sudden policy changes. Social barriers count for public apathy from misinformation, path dependencies and psychological issues of local stakeholders (such as the “not in my backyard” syndrome of locals concerning the implementation of Energy Wind Mills).

Policy mechanisms play a crucial role in order to overcome these barriers. Varying across countries, these measures have taken several forms and target specific areas, such as fiscal incentives (in the form of subsidies,

taxes, electricity feed-in laws or government buy-downs, market-oriented regulatory standards (renewable portfolio or vehicle emissions) and policy drivers (R&D, targets and timetables, capacity development and transportation), according to the Global Energy Network Institute. These policies can further be broken down to their fundamental attributes in terms of return factors (e.g. in the case of feed-in tariffs, the level of tariff, duration of tariff, return prospects) and risk factors (policy stability, existence of a cap, administrative process complexity, and legal security).

R&D managers and policymakers have continuously focused on supporting "high-risk research" and developing "out-of-the-box" transformational technologies (US Department of Energy 2008, EU International Energy Agency 2009) and have proposed a wide range of programs, funds and agencies. However, while radical innovation has undoubtedly become a central topic in innovation literature, little research has been made into understanding how public R&D programs and policies can be designed to allow the achievement of the often sought radical or breakthrough technologies. Beyond stimulating "cleantech" innovation by putting a price on Ghg emissions, governments can pursuit increasing innovative activity through a number of ways. Such ways include the subsidy of R&D by private corporations; sponsoring graduate fellowships in key areas; supporting university and national laboratory research; strengthening IPR for firms that invest in R&D; offering innovation prizes to companies who achieve specific targets; and sponsoring large-scale demonstration projects of promising technologies (Weyant 2010).

The role of academia

There are several examples of academic research where policymakers must draw from, in order to implement carefully design policies that foster the surface and deployment of new technologies. Markard and Truffer (2006), in their study of nuclear, wind turbines and gas turbines as examples of radical innovation in the electricity sectors, found that radical innovations became established in the electricity industry driven by a combination of internal and external developments. These processes caused friction in the system and motivated policy interventions to support

new technological options. They also found that incumbent organizations (such as electric utilities) are a source of strong resistance to this type of change, by using associations with lobby policy makers and coordinate innovation efforts focused on incremental improvements to the existing technologies. These authors concluded that radical innovations in the electricity sector deeply depend on strong and enduring support from government policies in order to penetrate the sector, along with a positive evolution of the capital markets to facilitate this.

Another contribution is a work focused on wind power, by Garud and Karnoe (2008), comparing the successful development of Denmark's wind turbine industry, with the case of the US (where even with significant financial and technological resources it was unable to create a viable technological path in that industry). These author's argue that Denmark's success is due to their "bricolage" approach (in which a relatively low-tech design was improved over time), while in the case of the US a "breakthrough" approach (which is more high-tech and focused on producing radical outcomes) was found to stifle the learning processes that allow emerging technological innovations to be shaped by multiple actors.

Lastly, one study focused on commercialization and deployment, found that radical innovations are typically launched in niche or submarkets, and the experience gained can consequentially lower costs, allowing the technology to become increasingly competitive in more mainstream markets. Particularly in European countries, policymakers have attempted to replicate these niche conditions, a technique known as "Strategic Niche Management" (Van der Laak, 2007).

Several alternative policy approaches from governments in different countries towards the promotion of renewable energy have created a wide and interesting setting for discussion of policy efficiency and effectiveness. The discussion was typically led along the line of quantity-based versus price-based systems (Menanteau, Finon e Lamy 2003). However, as more knowledge and experience from practical implementation was gathered, the deviation between economic models and the realities of markets and policymaking processes was realized. Studying the evolution of the wind energy market, which has started to become a mature renewable energy

technology, provides good insight on which policies are most effective towards creating the right market environments for new energy technologies. Furthermore, according to Held et al. (2006), other than the effectiveness and efficiency of policies, the fundamental key for the success of developing renewable electricity markets is in a long-term and stable policy environment.

Many studies, such as Bird, Bolinger et al. (2005), compared support schemes using case studies (after the fact analysis), but valid results are hard to find, since significant levels of renewable energy adoption have been achieved only in a few cases. However, this is exactly the type of information policymakers need in order to design effective policies: which risks are regarded as most important for investors and project developers, and how important are those risks; how do financial and regulatory support measures compare, in mitigating risks; how much capital is necessary to reach a certain impact; etc.

Investment in Renewable Energy

New investment in the renewable energy sector has matured and recently exceeded $243 billion per year, the largest part of which being asset financing of projects such as wind farms or biofuel ventures (BNEF, 2011). Experience in other sectors show that investments at the beginning of the innovation chain has a strong influence on innovation and economic development (Gompers and Lerner, 2004). According to Josh Lerner (2011), investment in the clean energy sector has suffered from a set of three main problems in recent years. First, declining energy prices have decreased the public's interest in alternative energy. Second, the sector was struck through the equity markets, as investors sold stocks with any sort of technology or execution risk moving back to more conventional, longer established businesses. Third, in credit markets, clean energy companies that require large amounts of capital have been penalized (World Economic Forum, 2009).

While other factors, such as the increasing awareness about climate change, have probably contributed to the rise in renewable energy investment, favorable regulatory conditions in key markets, such as

Germany, Spain or California, are regarded as crucial (Wustenhagen e Burer 2009). However, there is relatively little knowledge regarding how investors view these policy measures.

One empirical study (Kasemir 2000) presented an exercise with six venture capitalists about European climate policy. Kasemir concluded that investors usually regard subsidies and tax exemptions as effective measures. On the other hand, there were also indications that venture capitalists and private equity investors may not always positive regarding policy. Some of them even have a stance that may be described as policy aversion. Wüstenhagen and Teppo (2006) present a venture capitalist quote, saying: ‘‘If there is no clear need for the government, make them stay out of the way.’’ Burer and Wüstenhagen (2007) show that this view is changing and that some venture capital investors started to manage regulatory risk as part of their strategy in this sector.

There has been a call to include the perspective of investors and project developers in the analysis of energy policies. Since these are the key players involved in the developing and deployment of renewable energy technologies, it makes sense to include their perspective when designing a support policy, as they are the bottom line into actually deciding if a given policy is attractive to instigate development activities.

The Research Design

Surveying VC’s, project investors in corporate units and institutional investors, I will conduct choice experiments, where policy instruments are described with varying attribute levels (a conjoint analysis will compensate from policies being rated based only on their general term, usually not adequate in practice to several particular circumstances) and rated by the investors. In addition to the resulting quantitative rankings, I will use qualitative interview data to collect further information with these investors, as well as with “cleantech” entrepreneurs and inventors, to achieve a broader two-sided view on the effects of these policies on innovation diffusion and adoption.

The purpose of this thesis is to offer insight on the perception and preferences of VC, corporate and institutional investors regarding Energy

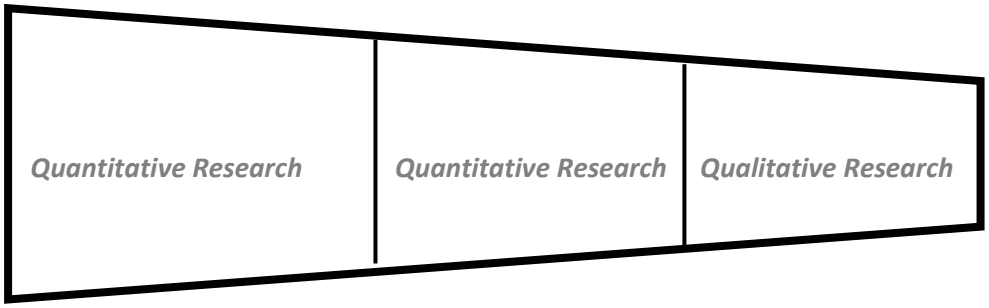
policy mechanisms, particularly towards early stage investment into new technologies. It shall provide empirical evidence about the perceived effectiveness of several policies towards stimulating investment, breaking down market-failures and speed the diffusion of technologies that are welfare improving.

Better understanding the investment decision-making process' motives and requirements, as well as entrepreneur's and inventor's expectations, will ultimately result in a better design of more narrowly targeted policies.

Detailed research design

The work of Wüstenhagen (2009) introduced an initial attempt to quantify the effectiveness of policy measures, as perceived by principal or senior managers of fund management firms in the energy sector. His research was mostly directed to venture capital and private equity firms, leaving a gap for similar research towards corporate and institutional investors. At the same time, the selected methodology relied on investors rating the policies based solely on their general term.

Due to the heterogeneity of investors (such as regarding the type of projects they usually invest in, the firm's risk adversity, the alternative stages of development and characteristics of the projects they allocate investment into), the alternative methodology of resorting to a choice experiment (in the form of a conjoint analysis with varying attribute levels in the description of the different policies), will expectedly reveal more unbiased and insightful results.

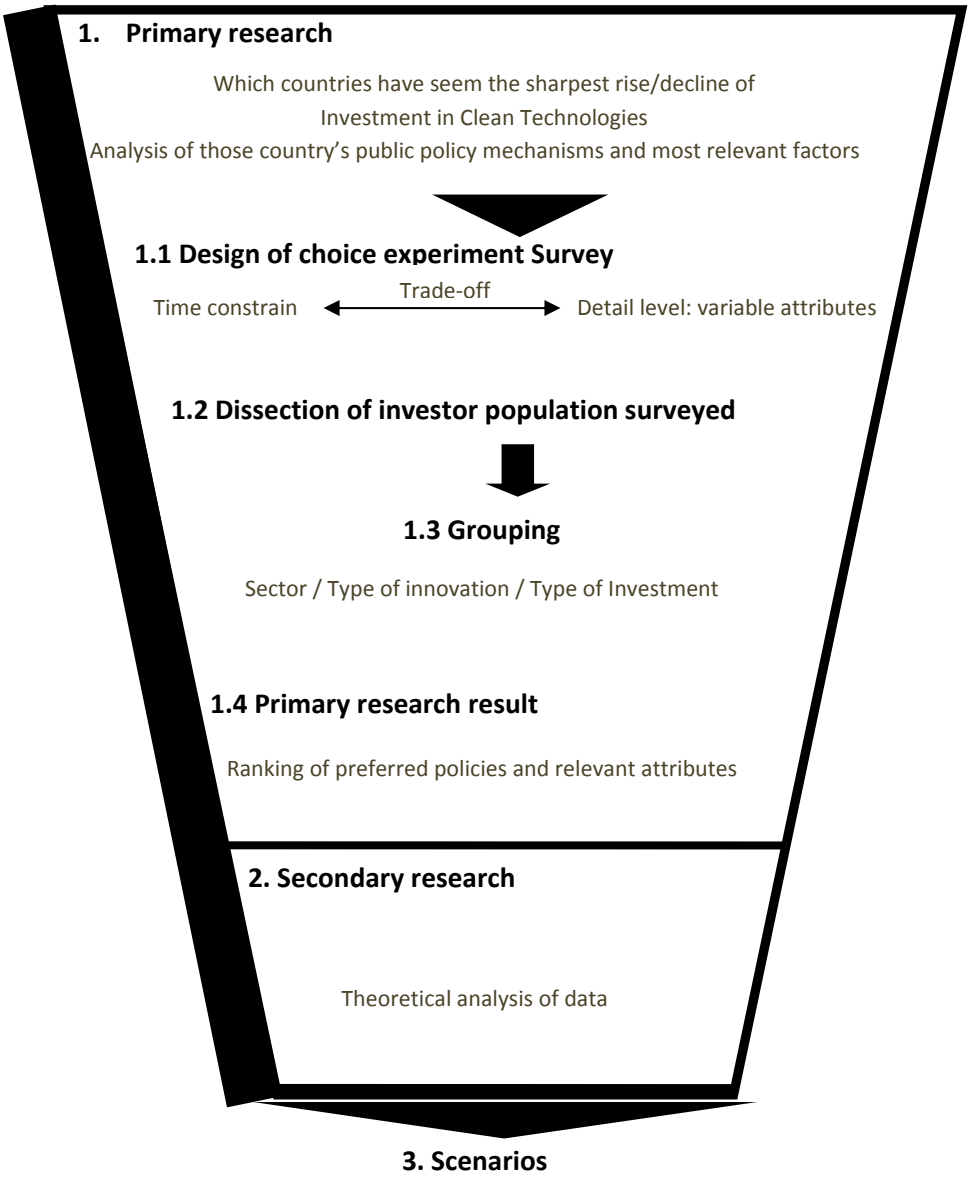


Additionally, for this study, the survey will also include "cleantech" entrepreneurs and inventors, to map and understand the choice similarities or discrepancies. Furthermore, qualitative interviews are to be made to broaden this perspective

Data collection and Thesis progression-plan

In order to effectively answer the research questions, this study will carry out a combination of quantitative and qualitative methods.

There will be three steps for this study, as illustrated in the diagram below.



Answer to research questions

In the first step, I intend to explore which countries saw the biggest rise and decline of investment into "cleantech" in the last years. This will not only provide an overview of the countries that seem to effectively have deployed innovation-stimulating policies in practice, but also the names of investment firms and institutions that have been most active in this sector. At the same time, the countries that seem to not have been as successful at this, will also be analyzed in terms of the policies adopted. A comparison of the perspectives of investors in favorable conditions and investors in unfavorable conditions will be most interesting. Several "cleantech" inventors and entrepreneurs will also be included in the survey as a "supply" counterpart, for comparison and further discussion. The result should surface the key attributes that the governmental policies discussed should incorporate in order to be successful.

The next step is to design a proper survey, adequate to the characteristics of this study. The objective is to conduct a choice experiment, and the main method applied is conjoint analysis, with particular emphasis on stated preference data investigation. Rather than a revealed-preferences approach (e.g. analyzing the actual investment levels consequent of the implementation of a specific policy), which would only provide information about one policy at a time and also could only be properly observed several years after implementation, a stated-preference approach will be used to give a much earlier assessment (regardless of which policy has in fact been introduced in their home country).

The method of conjoint analysis was chosen for various reasons. The first, as mentioned above, refers to the absence of long time series, particularly to analyze early-stage markets, and to mitigate the possibility that analysis after the fact might be too late. The second reason is that conjoint analysis allows breaking down policies into attributes, in order to analyze preferences for particular incentives and stimuli. Lastly, this approach allows to indirectly estimate preferences, by more accurately accessing what investors would do. If directly asked, respondents have

difficulty in describing what they would exactly do. A conjoint analysis has the advantage of making the outcome data, more reliable as an accurate indicator of how investors would behave. Given this, my analysis is made under the assumption that the results are an empirical indication of how such fund managers might react in practice regarding their investment decisions, when faced with varying policy environments.

However, a potential limitation of this approach is that, for information to be gathered about a variety of policies, it is impossible to fully illustrate and discuss the true complexity of the policies, especially because investors have the reputation of being a time- constrained population that is known to be difficult to access. This brings an interesting challenge for designing a survey that both properly describes various policies, in a choice experiment format, while avoiding to the fact that investors might race their way through the survey, compromising the results. The time's average for responding the survey will also be measured and only results whose time is between set deviations will be considered.

As in Wüstenhagen's research (2009), I intend to leave the respondents a choice between different formats of answering questions: a full version web-based questionnaire; a printed shorter paper-and-pencil version; or lastly, a telephone interview questionnaire. In personal interviews I will be able to gather further valuable information about investors' reasoning.

At this stage, data has been gathered from different investors, and therefore I will group the respondents into sections. Investors will be organized according to:

- *Energy experience* – Has/Has not already invested in clean energy. Has/Has not investigated relevant energy and climate policies.
- *Investment focus* – Focus on seed and start-up funding; Focus on expansion funding; Focus on later-stage funding; Funding across different stages.
- *Investment size* – Small, medium and large investments
- *Investment geographical focus* – Geographical location of the investments made.
- *Location* – Geographical location of the investors.
- *Fund size* – Small, medium, and large funds.

- *Investment horizon* – According to the expected time to exit

This will allow for a segmentation of the respondents, their characteristics and their investment's characteristics, and a proper framework for their replies can be derived for further comparison.

By this second stage, I should have a result list of the most preferred policies, in the mostly preferred attributes. It is time to have a deeper qualitative discussion of these results, through personal interviews with local investors and entrepreneurs, in order to validate / discuss the results found from the quantitative ranking of policies. At this time, the interview's objective is to analyze what the behavior would be in practice, if certain (preferred) policies were implemented, and what would the result be in terms of the firm's investment policy.

Entering the last stage of this research, the qualitative data should be compared to the quantitative data, with intention of providing a final answer for the research questions of this thesis.

Objects of study

For the purpose of this study, several elements will be analyzed.

The main objects of this study are, as mentioned, venture and corporate capital investors, private equity fund managers and institutional investors worldwide. Furthermore, for a comparison analysis, this study aims to include "cleantech" entrepreneurs, inventors and R&D firm managers.

Other corporations of interest to this study are as follows.

Governmental institutions

- European Commission - http://ec.europa.eu/energy/index_en.htm
- Innovation Norway - http://www.innovasjonnorge.no/
- Incubators, such as ATI Clean Energy Incubator - http://ati.utexas.edu/
- International Energy Agency - http://www.iea.org/
- European Research Council - http://erc.europa.eu/
- Department of Energy - http://energy.gov/
- National Science Board - http://www.nsf.gov/nsb/
- National Research Council - http://www.nationalacademies.org/nrc/

- California Clean Energy Fund - http://calcef.org

Technical and research institutions

- Cleantech Group - http://research.cleantech.com/
- London Environmental Investment forum - http://london-eif.com/
- Clean Edge - http://www.cleanedge.com/
- E3G - http://www.e3g.org/
- Global Energy Network Institute - http://www.geni.org

Business institutions and related industries

- Clean World Capital - http://www.cleanworldcapital.com/
- 3i - http://www.3i.com/
- Ambienta - http://www.ambientasgr.com/

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