Cleantech Commercialization from a Technology Push Perspective

A Descriptive/Exploratory Study Comparing Norway and Denmark

Matthew Good and Stefan J. M-Møller

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Abstract

Currently, there is a debate about the role government should play in a well-functioning innovation system. Some argue government should take a passive role, only intervening in the system when it fails while others argue that government needs to be more active by taking on risk and directly supporting. This debate is particularly relevant for the cleantech industry since many believe that government action is necessary to achieve its full potential. Norway is an interesting country to study since they have a strong history in cleantech but ranks lower than its neighbour, Denmark in terms of cleantech commercialization. Therefore, the purpose of this study was to investigate and identify ways that the Norwegian government could improve the commercialization of cleantech in Norway using publically funded "technology-push" based initiatives by comparing with Denmark.

The theoretical framework used is based on a commercialization process model developed by Vijay Jolly and the triple helix innovation systems model. The commercialization model provided insight into the actual process of commercialization and identified areas where Norway was weak in comparison to Denmark. The triple helix model identified weaknesses about how the initiatives in each country affect the innovation system.

The analysis indicates that Norway focuses more on the early stages of the commercialization process and Denmark on the later stages. The most challenging stage for Norway is the demonstration phase. In regards to the triple helix theory, Norway focuses less on supporting the creation of innovation and consensus spaces than Denmark. Furthermore, Denmark targets small and medium enterprises more often than Norway. Additional findings indicate Norway has both a weak industry sphere and a weak home market.

The recommendation is that Norway could potentially improve the commercialization of cleantech by having the state take on the role of industry until industry is capable of performing it themselves. Norway could also focus on encouraging the development of more consensus and innovation spaces as well as creating more mechanisms that require collaboration between the three actors and that directly support young SMEs with a demonstrated ambition for growth.

Last, new areas of potential research were identified based on conclusion of the findings and recommendations.

Preface

The following Master thesis is the result of work we conducted between January 16th and May 19th, 2014. During this time, we have studied the difference between Denmark and Norway in terms of how they both assist the commercialization of cleantech through technology-push incentives. We wrote this report as a master thesis for the Master degree in Innovation and Entrepreneurship at the Centre of Entrepreneurship at University of Oslo in Norway.

Working on this thesis has been a challenging process and we would like to aim thanks to our supervisor Nicolai Løvdal for his invaluable assistance throughout the project period. We would also like to thank all of the representatives we have interviewed for giving both their time and insight into Norway and Denmark.

Last, we want to direct our thanks to OREEC for their support in providing funding for this thesis.

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1 Introduction

Ever since Schumpeter wrote about the concept of “creative destruction” in 1942, the contribution of innovation to national economic growth has been recognized as an important field of study. At its heart, innovation is about developing new and existing knowledge and then transforming it into commercially viable products or processes even at the cost of replacing or “destroying” previous technologies upon which entire industries were built. (Schumpeter, 1942)

Today, there is a debate about what role government should play in a well-functioning innovation system. Some believe government should take a passive role, only intervening in the system when it fails. Others believe that government needs to be more active by taking on risk and directly supporting other actors. Mariana Mazzucato, a prominent researcher in this field, advocates for government taking on a larger role, stating that it should actively support the development and commercialization of new technology and not simply "de-risk" the environment or correct market failures. Henry Etzkowitz’s triple helix theory also argues that all of the actors in an innovation system, including government, should be actively involved in shaping an innovation system.

This debate is particularly relevant for the cleantech industry since many, including Mazzucato, believe that government action is necessary to achieve its full potential. Cleantech is defined as activities which develop, produce or implement new or improved processes or products that contribute to producing renewable energy or sustainable materials, reducing the use of natural resources by exploiting the resources or energy more efficiently, reducing the harm caused by fossil fuels and reducing pollution problems through products, processes and/or consultation. (Copenhagen, 2014)

The cleantech industry has been on the rise since its "birth" in the 1970s. At that time, cleantech technology was too expensive, had no widespread political support, and was bound to the labs with no clear return on invested funds and was therefore not a particularly attractive investment. Today, the Cleantech industry has greatly picked up speed and a "cleantech revolution" has emerged, which has led to the claim that cleantech could be a potential source of new economic growth in the ailing European economies. (Pernick and Wilder, 2009)

An interesting country to study in this field is Norway. In 2008, Norway set an ambitious goal of being carbon neutral by 2050 (Environment, 2014). In order to achieve this goal, Norway requires the development of a wide range of cleantech products that will help reduce the overall production of greenhouse gas emissions in the country. It has been home to a number of innovative projects for promising clean technologies such as first commercial seabed tidal turbine (Penman, 2003), carbon capture and storage industrially scaled projects (Sintef, 2002) and a forefront of development and infrastructure of electric vehicles (Overgaard, 2014). Despite being a wealthy country with a strong history in cleantech as well as having supportive policies in place, Norway only ranks 11th in the Cleantech Group's Cleantech Innovation Index (Vince Knowles, 2013) and is considered a moderate innovator in the Global Innovation Index led by Dutta and Lanvin (2013). In comparison, Denmark, ranks 1st in the Cleantech Innovation Index and is rated a top innovator in the Global Innovation Index.

Both of these rankings indicate that Norway has room for improvement in innovation and within the commercialization of cleantech, particularly in how government drives the commercialization of technology. In general, government can take two approaches to driving commercialization. The first approach is to push the development and commercialization of technology through funding and support mechanisms. The other approach is to stimulate markets that will pull the development of technology in a specific direction.

With this in mind, the purpose of this study is to identify what the Norwegian government can do to better push the innovation and commercialization of cleantech through the use of publically funded initiatives. In brief, this paper will answer the question:

> *How can Norway improve the innovation and commercialization of cleantech from the government's perspective?*

To identify potential areas of improvement in Norway, Denmark is used as a benchmark for comparison since it performs highly in global rankings and has a low cultural distance to Norway. In addition, the various publically funded initiatives in each country will be analysed based on a commercialization model developed by Vijay Jolly and the triple helix theory of innovation systems, which will help identify further areas of possible improvement. Because of the inherent complexity of any innovation system, this study does not seek to conclude definitively on what Norway should do but rather identify areas for further research and improvement for Norway.

The next section will discuss the theoretical background on “technology-push” and “demand-pull” mechanisms, commercialization theory and the triple helix theory of innovation systems. The methodology section describes the processes used to gather and analyse the data along with the overall research design. The data section presents all of the findings from the research. The discussion section analyses the data and presents additional findings that were discovered throughout the study. The recommendations section will summarize the results of the analysis and identify areas where Norway could improve its system for cleantech commercialization. The final two sections discuss the limitations of this research, identify areas for future study section and gives some concluding statements.

2 Theory

This section is separated into three parts. The first part discusses the concepts of "technology-push" and "demand-pull" and the differences between these two perspectives. The second part introduces a linear commercialization model developed by Vijay Jolly and elaborates on how a technology moves from idea to market. This theory is used to identify what stage of the commercialization process the different government programs and mechanisms in each country affect. The final part discusses the Triple Helix theory, a complementary approach to viewing the commercialization process. It treats the innovation system as a complex system created through the interaction of three spheres of actors: government, industry and academia. The triple helix theory is used to analyse and compare technology push mechanisms in both countries in how they work to create and support a triple helix system.

2.1 Technology Push and Demand pull mechanisms

When understanding how the government can lure actors towards a specific field of interest, it is understood that there are a vast array of policies that have the potential to stimulate innovation. Two particular policy types stand out, "demand-pull" and "technology push" which are commonly referred to as "push-pull" policies. (Nemet, 2009)

Public technology-push policies reduce the cost of firms to produce innovation and can include tax credits for companies to invest in R&D, enhancing the capacity for knowledge exchange, support for education and training, and funding demonstration projects. Knowledge spillover externalities provide the most prominent justification for such actions. (Jones and Williams, 1998)

Public demand-pull policies can increase the payoffs for successful innovations and may include intellectual property protection, tax credits and rebates for consumers of new technologies, government procurement, technology mandates, regulatory standards and taxes on completing technologies. The importance of "post-adoption innovation" improvements that occur after a technology has entered into use is often used to justify a demand-pull approach (Arrow, 1962).

The origin of the two can be traced back to the widespread recognition technology plays in the growth of the economy (Solow, 1956). Together with the characterizations of innovation

(Schumpeter, 2013, Usher, 1954) a debate emerged in the 1960s and 70s about whether market demand ("demand-pull") or advances in science and technology ("technology-push") are the main influence on the rate and direction of technological change.

On one hand, demand-pull is argued as being the main influence due to a project entitled "HINDSIGHT" by the U.S. Department of Defence which made a historical analysis of 710 key military innovations; for example aircrafts and missile systems (Sherwin and Isenson, 1967, Greenberg, 1966) and concluded:

"*Nearly 95 percent of all Events were motivated by a recognized defense need. Only 0.3 percent came from undirected science*" (Sherwin and Isenson, 1967)

On the other hand, the following response by the National Science Foundation in U.S conducted a project dubbed "TRACES" (Technology in Retrospect and Critical Events in Science), which identified the role of basic research in 341 research events with a focus on magnetic ferrites, oral contraceptives, electron microscope, video tape recorder and matrix isolation (IIT, 1968). This project emphasized that basic research became the dominant influence once a sufficient period for analysis is used; in these cases, it was 30 years.

Demand-pull is the notion that policies can induce investment and consequent improvements in technologies by amplifying the market for them (Nemet, 2009). Studies from the 1950s and 60s argue that changes in market opportunities determine the rate and direction of innovation by creating opportunities in firms to invest in innovation in order to satisfy their needs. Thus demand is credited to "steering" the focus of work into certain problems (Rosenberg, 1969) which can be done by shifts in relative factor prices (Hicks, 1963), geographic variation in demand (Griliches, 1957), identification of a "latent demand" (Schmookler, 1962, Schmookler, 1966) in a market along with any potential new markets in general (Vernon, 1966). These factors will affect the payoff of investments into innovation. In the specific case of energy, the demand for innovation also comes from prices of conventional sources of energy which will affect existing processes (Lichtenberg, 1986) and alternative devices (Popp, 2001).

The demand-pull policy has three main points of focus for critique. The first point being that, methodologically, the definition of "demand" in empirical studies is inconsistent and overall considered too broad of a concept to be useful (Mowery and Rosenberg, 1979, Scherer, 1982, Kleinknecht and Verspagen, 1990, Chidamber and Kon, 1994). The second point is that

demand explains incremental technological change far better than it does discontinuous change and thus fails to account for the most important innovations (Mowery and Rosenberg, 1979, Walsh, 1984). The third and final point is about assumptions concerning firm capabilities. Specifically, there is scepticism over how effectively firms can identify "unrevealed needs" for their consumer, to what extent firms have the techniques and/or tools available to address the variety of needs expected to emerge, and lastly how far firms might venture from their existing products and services to satisfy the unmet demands (Simon, 1959).

Technology-push states that advances in scientific understanding determine the rate and direction of innovation. Following the success of the Manhattan project, Bush (1945a, 1945b) articulated an influential version of this argument which became known as post-war paradigm and later simply the "linear model". It argued for a linear progression of innovation going from knowledge to basic science to applied research to product development and ultimately to commercial products. Dosi (1982) later attributed the "linear model" line of thinking to several aspects of the innovation process, which are increasing complexity necessitating a long-term view, apparent strong correlations between R&D and innovative output, and lastly the inherent uncertainty of the innovation process.

Criticism for technology-push includes that it ignores prices and other changes in the economic conditions that affect the profitability of innovations and that it emphasizes a unidirectional progression of the innovation process, which is incompatible with subsequent work that emphasized feedback, interaction and networks. (Kline and Rosenberg, 1986, Freeman, 1994, Freeman and Louça, 2001).

This later inspired new work and it offered a less deterministic version of the technology-push while still emphasizing the role of science and technology. For example, this new work states that the availability of technological opportunities plays a role in determining the rate and direction of innovation and that they may depend on the science level in each industry (Rosenberg, 1974, Nelson and Winter, 1977, Klevorick et al., 1995). Another strand of new work raised the issues of inter-relatedness of the technological system (Frankel, 1955), the importance of flow of knowledge between sectors (Rosenberg, 1994) and bottlenecks in the system raised technological imperatives to overcome (Rosenberg, 1969). This ultimately leads to the understanding of a concept of science and technology-push that is

multidimensional and has more nuances in the innovation process than the strictly “linear model”.

Thus, to summarize the science and technology-push fails to account for market conditions and demand-pull ignores technological capabilities. It then came to light that both supply and demand are necessary to explain innovation process and they do not simply contribute - but interact with each other (Arthur, 2007) or as further verified by (Mowery and Rosenberg, 1979):

> *“[demand-pull and technology-push are] Necessary but not sufficient, for innovation to result; both must exist simultaneously”.*

2.2 Technology Commercialization Process

As evident from the previous section, we distinguish between "push" methods and "pull" methods. Similar to those are also the two different beliefs on how get something from idea into the market. In the "push" regime it is viewed upon as a linear process that begins with scientific research, going on to development and then on to production and marketing. In the "pull" regime, it is instead viewed as a single market-driven integrated process. In their extreme opposites, they force companies to choose either between conducting long-term speculative research or short-term customer oriented development projects presenting little risk. Neither of the two views are sufficient to describe what a successful innovator does and, as such, Vijay Jolly constructed a model that reconciles and incorporates the advantages of both systems. It sees innovation as a segmented process where each segment requires an integrated approach to come up with a valuable outcome.

Before introducing the model, it is vital to understand more about the need for a commercialization model.

> *“Most technology based inventions never go beyond the conception stage” (Jolly, 1997).*

Ideas often come into the minds of their inventors but only occasionally leave a trace. Patents are applied for and granted yet remain trophies of achievement and records of technical advancement. Even more are implemented as products but fail miserably. Technology stands as an unsound investment for many today and as Archer (1971) wrote:

"Fifteen years is about the average period of probation and during that time the inventor, the promoter and the investor, who see a great future for the invention, generally lose their shirts. Public demand even for a great invention is always slow in developing. That is why the wise capitalist keeps out of exploiting new inventions."

Thus bringing new technology to the market carries a huge risk.

There are no simple answers as to why some technologies succeed while others fail. The failure can exist for many reasons, for example it could have been incorporated into products for which demand never appeared, was only a fleeting craze, could not live up to their aforementioned hype or was not able to attract the sufficient assistance and funding to get the project off the ground.

In order to understand what went wrong, it is necessary to break the whole process of the technology commercialization into parts and analyse the steps to find the error and identify what might be improved or corrected.

With this Jolly (1997) developed the following model for describing the technology commercialization process as indicated by Figure 1.

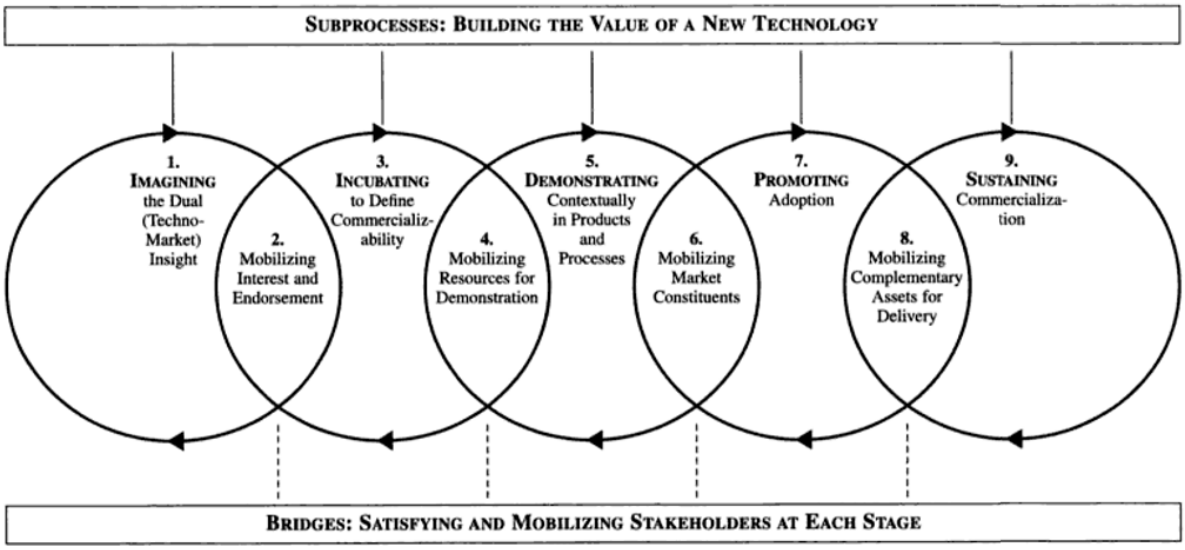


Figure 1: The Process of Technology Commercialization (Jolly, 1997)

This model consists of five sub-processes; imagining the dual techno-market insight, incubating to define the technology's commercial potential, demonstrating the technology contextually in products and/or processes, promoting the chosen adoption for the technology and sustaining the commercialization. In addition, there are four bridges, which are primarily for mobilizing resources whilst going from one sub-process to another, they have to mobilize

the stakeholders to continue having an interest in the technology and prepare for the next step.

Each sub-process has an expected outcome with necessary completion points and a list of who the main stakeholders are during that part of the process.

The imagining sub-process is the notion of commercialization as a process of value recognition. This is the prospect for a technical breakthrough that is combined with a potentially attractive market opportunity. When going through the imagining sub-process there is additionally the concept of dual insight, which defines the importance of having both the technical and market outcomes in mind. The competition between peers starts from the very beginning as ideas have to compete between each other to gain funding, secure resources and must compete with already existing solutions to prove they are more interesting and viable in order to step forward to the next task. Table 1 shows the expected outcome, completion points and main stakeholders of this sub-process (Jolly, 1997).

Table 1: Imagining sub-process

Expected outcome	Exciting, preferably unique technology-based idea linked to a market need.
Completion points	Technical proof of principle, filing key patent(s), preliminary vision for the technology
Main stakeholders	Peers, colleagues, research partners, media.

Once the idea is recognized and endorsed to be worth pursuing, it needs to be proven in some manner that is both technologically and, in terms of the needs it will fulfil, satisfactory. Incubating is the act of evaluating what is required substantively as well as figuratively. It is thus more of competition between technologies and not just ideas as the previous step. It is necessary in this step to have a specific idea on how to gain value out of the new technology so it can be pitched to the relevant grants, venture capital, business angels so they will fund the project. Table 2 shows the expected outcome, completion points and main stakeholders of this sub-process (Jolly, 1997).

Table 2: Incubating sub-process

Expected outcome	Definition of idea's technical feasibility, commercial potential and plan for taking it further
Completion points	Preparing a business case and plan for commercialization, crafting the technology or product platforms, testing with lead customers.
Main stakeholders	Providers of venture capital, development partners, potential users of technology

Demonstration is the sub-process that is associated with product creation. The main challenge of this sub-process is to demonstrate a product and/or process that is commercially viable and both something customers would want to purchase and being capable of implementing it successfully with the technology available. Table 3 shows the expected outcome, completion points and main stakeholders of this sub-process (Jolly, 1997).

Table 3: Demonstration sub-process

Expected outcome	Incorporating the technology in attractive, market-ready products and/or processes
Completion points	Launch of commercial version of product or process
Main stakeholders	Potential customers, suppliers of complementary technologies, internal colleagues in other functions (e.g., manufacturing) and business partners

Promotion is the act of capturing the heart and spirit of consumers and make them go from the initial launch of a commercial version to the act of purchasing the technology. As many as 27.5% of all new products and processes are scuttled due to “uncontrollable” market factors and another 26% fail due to limited sales potential and an inability to find buyers with sufficient interest (Myers and Sweezy, 1978). Table 4 shows the expected outcome, completion points and main stakeholders of this sub-process.

Table 4: Promoting sub-process

Expected outcome	Getting product or process rapidly accepted by various market constituents
Completion points	Capturing a profitable share of market quickly
Main stakeholders	Customers, end-users, opinion leaders, and market constituents mobilized for delivery

Regardless of how much is thought out in this sub-process, market acceptance is never guaranteed and new technologies easily suffer from having to create a market which did not exist prior to the introduction of the technology. As Lubar (1993) explains, technology is not guaranteed and could hinge on things such as fashion to become accepted, like the zipper that caught on - *"...not because button flies failed but because of cultural ideas about modernity and fashion*"

Once a technology is successfully realized, the last step in the commercialization process is to ensure that it stays competitive in the market and achieves a fair share of all the value that has been generated. With the continuous introduction of new technology, products and the subsequent entry of new competitors, this part is not easy. It is a good rule of thumb to remember that sustaining commercialization of a new technology is not equal to winning at all costs; a technology can become inherently obsolete and should be abandoned unless a new product or process can be derived from it.

Table 5: Sustaining sub-process

Expected outcome	Generating long-term value by entrenching and expanding use of the technology and retaining a lead in it
Completion points	Adequate return on investments made in technology and infrastructure for commercializing it.
Main stakeholders	Company management, changing customer segments and business partners.

Thus, as Jolly (1997) puts it:

> *"The value of any new technology ultimately lies in the products incorporating it and their success in the marketplace. Yet many technologies are taken to an intermediate stage and either fail there or get inordinately delayed. This is sometimes due to the merits of the technology itself, but it can be due to a failure to bridge the sub-processes effectively."*

At the end of each sub-process, there must be an output which is either a tangible or an intangible product that has a commercial value. It is continuously vital to create enough value in each sub-process to successfully carry it into the next step by motivating or persuading stakeholders to invest, as indicated by the four bridges.

2.2.1 Comparison with Linear Commercialization and Other Models

The first thing to notice in Table 6 is how similar it looks to the linear view of innovation. That is due to how the commercialization model incorporates the "push" linear flow of thinking with the iteration cycle of the "pull" and as such includes the basic frame, which overlaps as to indicate each cycle is not over at the beginning of a new step.

Table 6: Linear view compared with Commercialization process

Basic Research	Applied Research and Development	Product Development and Engineering	Production and Marketing	Incremental R&D
Imagining	Incubating	Demonstrating	Promoting	Sustaining

The sub-processes are not exceptional or unique in that essence. Other existing models can be used to describe the same flow, albeit, where the commercialization processes differ conceptually and substantively is in the following regard.

Jolly's model represents segments of the innovation process in which each requires input from a variety of functions and external sources, as well as different types of research. Each segment further represents an independent sub-process of value creation and each sub-process must contend with its own set of stakeholders. Every sub-process conforms approximately to the nature of competition and specialization and is used as a method of evaluating how to enter, exit and what possible alliances can be gained when bringing the new technology/product to market.

Other models of commercialization include the Schumpeterian and traditional 3-way classification, Bright's stages (Bright, 1978), Cooper's seven stage new product game plan (Cooper, 2001) National Society of Professional Engineering stages (Howard, 2010) and Dupont (Jolly, 1997). Table 7 shows how Jolly's model compare to the other models and how it incorporates everything into the different sub-processes (Jolly, 1997).

Table 7: Comparison of the Jolly Model to Other Models

Jolly Model	**Schumpeterian and traditional 3-way view.**	**Bright**	**Cooper**	**National Society of Professional Engineers**	**Dupont**
1. Imagining		1. Scientific suggestion, discovery of need or opportunity. 2. Proposal of theory or design concept.	1. Idea generation	1. Concept	1. Idea
2. Incubating	1. Concept development (basic and applied research leading to invention)	3. Laboratory verification of theory or design concept.	2. Preliminary assessment 3. Concept generation (technological)	2. Technical feasibility	2. Scouting
3. Demonstrating	2. Product development	4. Laboratory demonstration of application 5. Full-scale or field trial.	4. Development (engineering, design and prototypes) 5. Testing 6. Trial production and test market	3. Development 4. Commercial validation and production preparation 5. Full-scale production	3. Project 4. Prototype
4. Promoting	3. Market development	6. Commercial introduction or first operational use.	7. Full production and market launch		5. Introduction and commercial
5. Sustaining		7. Widespread adoption as indicated by substantial profits, common usage, significant impact.		6. Product support	6. Product support

2.3 Triple Helix

The triple helix theory views innovation and commercialization of technology as being the result of an integrated social system consisting of actors from the spheres of government, industry and academia. The European Commission believes the creation of triple helix systems is a solution to the "innovation emergency" they currently face and plays a central role their main innovation strategy called Europe 2020 Strategy (European Commission, 2014, Geoghegan-Quinn, 2012). By using the triple helix theory to analyse the relevant programs and mechanisms in Norway and Denmark, it is possible to identify weaknesses that relate to the structure of the system rather than strictly to the process of commercialization.

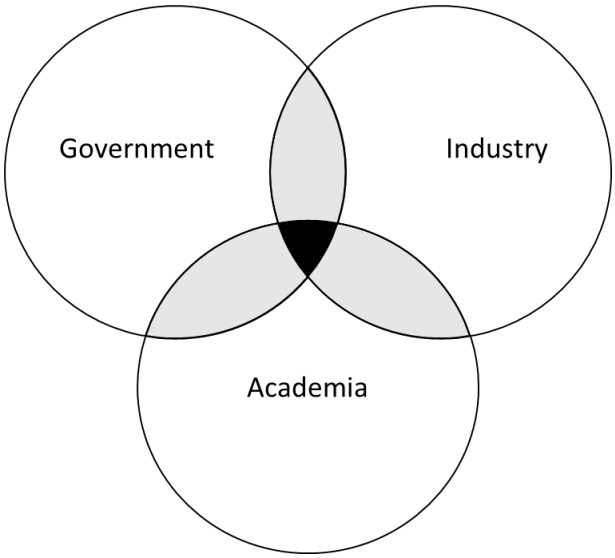


Figure 2: Conceptual Model for Balanced Triple Helix Systems (Etzkowitz and Leydesdorff, 2000)

Figure 2 shows a conceptual model of a balanced triple helix system. According to this theory, all of the actors within an innovation system will lie either in a single sphere or at the intersection of two or more spheres. The triple helix theory also distinguishes between research and development focused actors and those that focus on other topics. Actors can be either an individual or an entire institution working in the system.

Since this study is focusing on how government actors can push the development and commercialization of new technologies, only single sphere, institutional components from the government sphere which have related programs or mechanisms are analysed.

The triple helix theory is one of many that fall into the category of theories called "national systems of innovation" which was first proposed by (Freeman, 1987). At their core, these theories are analytical constructs that aid in the understanding of how an innovation system functions rather than an explicit description of every aspect of the system and how they work (Bergek et al., 2008). One weakness with this approach is that it includes such a wide range of factors that it is difficult to determine what to include or exclude when conducting an analysis (Edquist, 2005). The Triple Helix concept is no different; however, it does provide some more guidance than other "national systems of innovation" theories on how different actors can influence the system.

The following three sections elaborate more in depth about how triple helix systems form and the role of the government sphere in this type of system.

2.3.1 Formation of Triple Helix Systems

The first step towards creating a triple helix system typically begins at the regional level when the three spheres enter into some form of mutual agreement based on their core roles to solve a problem (Etzkowitz, 2008). One example of this is the Energi21 initiative in Norway, which brought together all three spheres to agree on a strategy for promoting clean energy initiatives (Energi21, 2014).

The next stage in the development of a triple helix regime occurs when actors in one sphere begin to take on the role of an actor in another sphere in addition to their core roles. For example, universities can provide venture capital to new start-up firms which is typically an industry sphere role. Taking on the role of another sphere improves the performance of the role overall and can contribute to the core mission of each institutional sphere. Each sphere is then more likely to both generate innovation and support the generation of innovation in other spheres. For example, the university becomes a source of new product development through science parks and incubators. (Etzkowitz, 2008)

Throughout this process of taking on each other's roles, the chance for two-way interaction increases. The third sphere typically enters into these two-way interactions to solve problems or serve new needs that may have emerged during the interaction. The relationships then become three-way or triple helical, which is positive since two party interactions tend towards conflict since there is no one to play the role of mediator. (Etzkowitz, 2008)

As more actors become involved in this interaction and individual actors begin to start their own initiatives, a type of meta-innovation system forms. Individuals are free to take action as they see fit and are supported by both top-down and bottom-up initiatives. Put together, this system encourages a wide range of innovation sources. An important strategy for creating this system is to create an organization or network that represents the interests of the different actors and can work to build support for a regional focus. Individuals and institutions come together to generate ideas and take action to promote regional development. (Etzkowitz, 2008)

Balancing the actions of the three spheres while retaining their core identities is a critical factor in developing a triple helix system. Too much or too little action from on sphere can lead to a sub-optimal system. In fully balanced triple helix systems, actors in each sphere not only perform their core role but also consistently "take on the role" of other spheres in order to support those other spheres in performing their core roles or to provide functions that do not exist yet.

Since the focus of this paper is primarily on what the government can do to improve innovation and commercialization of technology, the next section discusses in more detail the optimal role of government in such a system.

2.3.2 The Optimum Role of Government

A strong innovation system is characterized by the presence of top-down, bottom-up and horizontal initiatives that drive innovation. An example of a top-down initiative is the United States Governments' Small Business Innovation Research program, which provided funding to early stage technology companies (Audretsch, 2003). In contrast, bottom-up initiatives are ones that begin in a decentralized manner by individual or regional actors. A good example of this is the incubator movement in Brazil, which was started initially by universities and municipal governments (Almeida, 2005). Horizontal initiatives are those that arise from the triple helix interactions themselves and are usually the result of discussions between actors in all three spheres.

Government has to be careful not to exert too much control or be too dominant over industry and academia or they run the risk of subjugating the other spheres and stifling innovation. In this regard, an indirect, decentralized policy along with regional initiatives may be more

effective since they can encourage the creation of bottom up and horizontal initiatives to be launched by each sphere in a dynamic way. The government's role in this situation is to encourage the interaction of industry and academia with each other and with the government. (Etzkowitz, 2008)

Government also has a much higher tolerance of risk than industry and is capable of providing funds to early stage, high-risk technology firms. Without the government's support in this area, many early stage firms would not be able to secure venture capital to make it through the "death valley" of commercialization since the risk is too high for standard venture capitalists. (Etzkowitz, 2008)

Technology is changing at a rapid pace and simply supporting existing industries is not enough to stay competitive. Increasing support for advanced research becomes critical to keeping up. However, this needs to be a focused support. Simply providing support across the board dilutes the intent of the support and typically fails to create significant results. Unfortunately, this focus can also be a risk. If a specific field fails to evolve and keep up with the dynamical changing technology environment, all of the money invested in this focus could be wasted. The support needs to be broad enough to enable flexibility while also focused enough to provide the required support level. (Etzkowitz, 2008, Almeida et al., 2012)

Mariana Mazzucato (2013) goes further by arguing that government needs to be more than just an actor that can reduce the risk of a developing a new technology. Instead, they should be more active in shaping and creating markets using the tools that are at its disposal. It needs to take on a leadership role in promoting strategically important new technologies and sustain them until they can compete with existing technologies. When talking about cleantech and the "green revolution", Mazzucato argues for government to take a leading role in supporting these technologies past the demonstration sub-process and until a healthy market emerges. One issue with this is finding both the political and public resolve to provide the necessary support over the long timelines required. In addition, she highlights the need for what is termed "patient" capital from the public sector, which can help support the industry through uncertain or challenging periods. Caution should be taken when designing government innovation mechanisms, such as R&D tax credits, so that they are implemented in a way that will encourage innovation beyond what would have happened anyway. In other words, many incentives provide funds to companies that would have conducted (or have already conducted) a research project and do not actually encourage increased innovation.

To summarize, the optimum roles of government in a balanced triple helix innovation system are (Etzkowitz, 2008):

1. Empowering industry: The government sphere should provide support to the private sector and empower them to take on authority in an area, which helps encourage stability and increase predictability. One example could be providing guarantees on private capital, allowing companies to use it for higher risk projects.
2. Tax incentives: The structure of the tax system should provide protection and incentives for increased innovation and benefits for those who engage in new innovation projects. For example, this could include mechanisms like focused R&D tax credits.
3. Entrepreneurial support: Implement rules and programs to support economic life. For example, the government could establish new agencies to support innovation and entrepreneurship or regulate markets to protect industry actors.
4. Regulatory support: Create legal rights or regulations that provide special rights or privileges to promote innovation. Examples include the patent system or the transfer of intellectual property rights to universities.
5. Basic R&D funding: Provide basic research funding. Examples include public venture capital and other mechanisms that support a linear model of innovation.

The programs and mechanisms operated by government actors must in some way act to support the government sphere in performing these core roles. Additionally, programs and mechanisms should take on the role of the other spheres to support them in either performing their core role or filling a gap in the system.

2.3.3 Relationships between Components

The various components in a triple helix system will relate to each other in different ways depending on the role each component is playing, its position in the system and its evolutionary history. One way to create these relationships is with formal programs and mechanisms that support the other spheres in developing or commercializing technology. Each of the following relationships should exist between government and the other spheres to ensure a well-functioning triple helix system. (Ranga and Etzkowitz, 2013)

Four primary types of relationships can exist between components in a triple helix system. The first type of relationship is one of collaboration and conflict moderation where components act to transform conflict and tension into a productive outcome for all parties. This type of relationship primarily occurs where actors from two spheres are in conflict or have some form of tension and the third sphere steps in to resolve the situation. (Ranga and Etzkowitz, 2013)

Collaborative leadership is the second type of relationship and is "a purposeful relationship in which all parties strategically chose to cooperate in order to accomplish a shared outcome" (Ranga and Etzkowitz, 2013). In this type of relationships, actors work together to achieve a specific end goal.

A third type of relationship is substitution. It occurs when certain institutions are created to fill the gaps created by one sphere or institution's inability to provide the necessary function. An example of this type of relationship would be government acting as a source of venture capital funds or a university acting to create new firms. (Ranga and Etzkowitz, 2013)

The final type of relationship that can occur between components deals with networking. These types of relationships are the formal and informal activities related to linking various players in a triple helix system either regionally, nationally or internationally. (Ranga and Etzkowitz, 2013)

2.3.4 Triple Helix Spaces: Knowledge, Innovation and Consensus

An important concept in the triple helix theory is the formation of triple helix spaces at the intersection of spheres. Triple helix spaces are the physical of virtual areas where the different spheres interact. The formation of these spaces are therefore critical to the functioning of the system. The programs and mechanisms operated by the various government mechanisms can contribute to the creation of these spaces (Etzkowitz and Ranga, 2010, Ranga and Etzkowitz, 2013).

Knowledge Spaces are primarily concerned with research and development activities. The purpose of these spaces is to strengthen and reduce the cost of knowledge generation as well as to increase the access to that knowledge. These types of spaces can also include non-research and development activities like technology adoption or combining existing knowledge in various ways. The main condition necessary for the creation of a Knowledge Space is the presence of a "critical mass" of knowledge resources in a local area along with related actors. (Etzkowitz and Ranga, 2010, Ranga and Etzkowitz, 2013).

Innovation Spaces are where the various components in a triple helix system collaborate to create new organizational formats that will encourage innovation in a region. The formats that work best are dependent on the strengths and weaknesses of the regions where they form. Without a suitable innovation environment to thrive in, companies will be forced to move away. Innovation spaces can consist of technology transfer institutions (ie. university technology transfer offices), business support institutions (ie. incubators or science parks) and/or financial support institutions (ie. venture capital firms). (Etzkowitz and Ranga, 2010, Ranga and Etzkowitz, 2013).

Consensus Spaces are involved with bringing together actors from each sphere together to build consensus on how to strengthen the local or national innovation environment. Simply bringing people together from each sphere is not enough. The presence of a Consensus Space is a key factor in the formation and interaction of Knowledge and Innovation spaces. For example, a consensus space can act as a platform for academics, government officials, industry representatives and community members to come together to develop joint development plans that can lead to the creation or strengthening of other spaces. However, this does not preclude the formation of Knowledge or Innovation Spaces prior to the creation of a Consensus Space. (Etzkowitz and Ranga, 2010, Ranga and Etzkowitz, 2013).

Consensus spaces are only as effective as the individuals involved. One critical factor is the need to have individuals with the necessary decision making power to cause change. The participants must also be able to balance both short-term and long-term perspective and initiatives. Conflict in consensus spaces typically arise as a result of having an unbalanced focus. Short-term initiatives help maintain momentum while long-term initiatives are necessary to achieve the stated goals. Another critical challenge of a consensus space is identifying the solutions that work best in a specific regional context based on its strengths and weaknesses and not simply taking solutions that have worked in other regions in the past (Etzkowitz and Ranga, 2010, Ranga and Etzkowitz, 2013).

3 Methodology

3.1 Research Design

A combination of an exploratory and a descriptive comparative case study approach was used to conduct this study. An exploratory and descriptive design was chosen since the goal of this study is to describe the system in Norway in comparison to Denmark and identify potential ways that Norway can improve their system. Because of the inherent complexity of any innovation system, this study does not seek to conclude definitively on what Norway should do but rather identify areas for further research and possible recommendations.

Since this study is comparing qualitative data about the systems in two countries, a comparative case study with multiple cases is necessary. A case study design was selected since this study is conducting an analysis of a "contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009). A comparative design is combined with the case study design to provide insight into how the Norwegian system could improve and to confirm what is provided by theory.

In total, there are two cases being analysed in this study. One case focuses on the system in Norway and the other case focuses on the system in Denmark. The unit of analysis in each case will be the set of government programs and mechanisms that use a "technology-push" approach to improving innovation and the commercialization of cleantech research. One challenge with comparative case studies is "ensuring that the variable in your study is interpreted the same way by your chosen groups" (Wilson, 2010). This issue is minimized by selecting Denmark as the benchmark case since it has a small cultural distance from Norway and by only comparing formal, well-documented programs.

3.2 Reliability and Validity

To maintain the reliability of the data in this study multiple sources of evidence were used to build the cases for each country and compare them. Sources include national statistics, agency and government websites, program and mechanism websites, official reports and semi-structured interviews with individuals in each country. These various sources of data were used a means of data source triangulation contributes to improving inter-judgemental reliability. Both the Jolly commercialization model and the triple helix theory were used to analyse the data from two different perspectives and is a form of theory triangulation. This triangulation of data and theory helps improve internal validity and provides a form of parallel reliability to this study.

Content validity (Wilson, 2010) could be an issue in this study since both of the researchers are not fluent speakers of the Norwegian language. However, one researcher has an intermediate understanding of Norwegian and the other speaks fluent Danish, which is very similar to Norwegian. Since the Norwegian and Danish languages are quite similar, and both countries have a very low cultural distance, the effect on content validity should be minor. Most of the interviews, with the exception of emails and general correspondence to actors in Denmark, were conducted in English, which may affect the validity of the data gathered since this is not the first language of those being interviewed. Documents that were not available in English were translated to English based on the researcher's knowledge of the languages. Since the majority of data gathered was not related to culturally influenced areas, such as attitudes or behaviour, this should have a limited impact on content validity. A wide range of factors was also used to analyse the performance of each system, which helps improve content validity through triangulation.

The purpose of this study was not to generalize the results to a greater population but rather to identify areas where Norway could potentially improve their system and use this as a source of further study. Therefore, external validity is not a major concern.

A major threat to the reliability of this study is the fact that this study is just a snapshot in time of a highly complex system that tends to take many years to develop. Improving this reliability would require repeating this study using a longitudinal design, which was not possible during the study period, or repeating this study at multiple future dates based on the system that exists at that time. In order to enable that possibility, a database of all of the data

gathered for this study has been created including a list of references, data tables and charts, country overviews, case study protocol and interview recordings and summaries. The majority of the data gathered throughout this study along with the associated data analysis is available in the attached appendices to emphasize transparency.

Two issues also threaten the validity of this study. The first is that there could be historical or environmental reasons as to why the systems in Norway and Denmark have evolved differently. Due to the fact that this study only looks at a single point in time and that it is looking at only the "technology-push" part of the innovation system, there could be other factors that are not analysed that have caused Denmark's system to be higher ranked than Norway's.

Despite these threats to reliability and validity, this study is still relevant since it aims primarily at identifying areas of potential improvement in Norway that could be topics of further study rather than making concrete conclusions on what actions that Norway should take to improve its system.

3.3 Data Collection Process

The first step in collecting data for this study was to gather a variety of innovation statistics and indicators in each country. These statistics and indicators were used to get an understanding of how the two countries compare at a national level. For clarity, they were divided up into the inputs from the state and the various outputs received. This data was obtained from government reports in both countries as well as from the OECD and EU.

The next step was to identify the actors in each country and the relevant programs and mechanisms they provide. A small distinction is made between the definition of programs and mechanisms. Programs are operated by government actors and actively support a part of the commercialization process and can create mechanisms. Mechanisms are the offerings that industry or academic actors can apply to directly. In some cases, a program can be the same as a mechanism.

Information about the different agencies, programs and mechanisms were gathered through official reports, interviews with relevant actors, websites, and informal documents such as presentations or pamphlets. Each country operates a website that collects information on all of

the programs and mechanisms available for cleantech in that country. These websites are “startvækst.dk" in Denmark and "miljoteknologiportalen.no” in Norway. They were used as the primary source for identifying agencies, programs and mechanisms in each country. To minimize the risk of missing relevant data that may not have been posted on these websites, the homepage of every agency discovered was searched. By doing so, new agencies, programs and mechanisms were found which then led to finding more of each, which in turn led to finding more and so on. This is a form of snowball sampling (Biernacki and Waldorf, 1981). In addition, each of the individuals interviewed during this study were asked if they knew of any other agencies, programs or mechanisms that may have been missed.

The criteria used to determine if a particular government actor, program or mechanism was relevant is as follows. First, government actors must be either a government ministry or an agency that is wholly owned by the government and not a partnership with industry or academia. Secondly, the basic criteria for selecting programs or mechanisms was that individuals, companies or institutions have the ability to, at some point, apply to it for support. Programs or mechanisms can be offered either directly from government ministries or through a governmental agency. They must also operate within one of the commercialization sub-processes identified in Jolly’s model. The program or mechanism must also be in active operation. Programs and mechanisms that focused on strategy or policy development were not included in this study as well as mechanisms offered by state-funded universities or industry, since the focus of this study is on “technology-push” and government. Strategy or policy development focused programs and mechanisms are examples of “demand-pull” mechanisms or do not directly influence the commercialization process.

During the process of data gathering, candidates for possible interviews were also identified. Three different categories of people were interviewed.

The first category of people interviewed were representatives from some of the main cleantech innovation related agencies in Norway. Those people were Ane Brunvoll from Research Council of Norway who is Program Coordinator for ENERGIX, Bergny Dahl from Innovation Norway who is Project Leader for the Environmental Technology Scheme and Rune Holm from Enova who is the Program Leader for New Technology and Industry. These individuals were interviewed to get an understanding of the organization, their interaction with applicants, information about their programmes and their intended function, awareness

of the Danish system, what they are doing and the degree of cooperation between other agencies.

The second category of people interviewed were representatives from Denmark. The main person interviewed in this category was Thomas Alslev Christensen from Danish agency for Science, Technology and Innovation who is Head of the Department for Innovation Policy and Department of Research and Innovation Analysis. He was asked mainly the same questions as the first category with the exception that he was asked for their awareness of the Norwegian system. Furthermore, the Danish Business Authority was interviewed for assistance to understand how the system in Denmark was structured.

The last category of people came from a company called TTO AS, which specializes in the commercialization of cleantech and have been navigating the Danish system since 2004. They expanded into Norway in 2012. Two people from this company were interviewed at the same time. Jon Wulff Petersen is the CEO of the company has worked with the commercialization of technology in Denmark for many years. Miriam Meling is a consultant with the company and specialises in the commercialization of technology in Norway. The purpose of interviewing these individuals was to obtain their perspective on the difference between the Danish and Norwegian systems. The questions asked when interviewing these individuals differs vastly from the other categories as they were asked to comment on the weaknesses and strengths of the two systems, what improvements they believe the countries could implement, their viewpoint regarding the interaction between the different spheres, and the utilization of mechanisms in either country. The data acquired through this interview was used to validate or challenge statements made by individuals from the other two categories.

The majority of the interviews were conducted face to face and in a semi-structured manner. Interview guides were developed for each category of interview subjects that contained primary questions, optional probing questions and desired outcomes. All of the interviews were recorded in order to enable a more accurate interpretation, verification of the responses, and to maintain validity and reliability. The interview guides used for each of the interviews along with summaries can be found in Appendix 6.

3.4 Data Analysis Process

A cross-case analysis approach (Yin, 2009) with an attached case study protocol (Appendix 7) was used to compare and contrast the two countries. Profiles were developed for each countries, which included a country overview (Appendix 5), a detailed table containing information on all of the relevant programs and mechanisms found (Appendix 3 and 4), a table mapping the programs and mechanisms into the commercialization model (Appendix 1), and a table categorizing the mechanisms based on the triple helix theory (Appendix 2). These profiles were then compared to identify areas where Denmark's system could be considered 1superior to the Norwegian system and an interview structure was made and used for interviewing representatives from some of the agencies (Appendix 6).

The country overviews contained all of the general and statistical information gathered regarding the innovation systems in each country. They provide a starting point for the analysis of each system and give general indicators as to how Norway could improve its system in relation to Denmark. It should be noted that the statistics gathered from the EU and the OECD suffer from reporting and bias errors and could affect the analyses in this study. For example, none of the private non-profit organizations in Norway are broken out from the public figures, which skews some of the statistics. Another thing to be aware of is that the calculation of GDP does not consider the effect of tax reductions, which, if included, would affect the distribution of numbers in both countries. Finally, there is always an issue with how accurately the various businesses and individuals report data to the government. Unfortunately, these issues cannot be addressed in this study.

The next step involved mapping each program and mechanism to the different sub-processes within the linear commercialization model based upon the definitions presented in the theory section. Every program or mechanism was mapped to the sub-process it was considered to affect the most. By using this method, no program or mechanism was mapped to more than one sub-process within the commercialization process, which made it easier to compare across the countries, find similarities, and draw conclusions from. The total number and budget of all the mechanisms unique to each sub-process was then charted and analysed to give perspectives on how Denmark and Norway differ in every step of the commercialization process in terms of technology-push. One weakness with this approach is repeatability since deciding which sub-process was the main focus of a program or mechanism could be

subjective. Another issue is that some programs could be quite broad and provide support in more than one sub-process.

The budgets for each mechanism is based on publically available data found in annual reports or on websites. In some cases, actual spending was used instead of budgets since some programs or mechanisms do not have a published budget. In addition, in a small number of cases the spending was estimated based on projected spending over a given number years. In these cases, the projected spending was simply divided over the given number of years. This means that there could be inaccuracies in the reported budget figures. Regardless, this data should still provide some general indications of spending levels since the budget figures were aggregated by commercialization sub-process and only one program had a budget that was significantly in excess of the others and that one was not estimated.

The final step of the analysis involved categorizing each program or mechanism based on a number of factors identified through the triple helix theory. The mechanisms were evaluated on what roles they helped the government fill, how they encouraged interaction between the spheres, if they had a specific regional focus, technological focus, what kind of triple helix space it related to and what relationship it encourages between actors. The total number of programs in each category were then tallied and charted. The results of this analysis were then used to identify differences between the two systems. As with the commercialization theory and for the same reasons, the weakness with this approach is repeatability.

Information gathered during the interviews were then used to validate or challenge the results of these analyses.

All relevant information and observations obtained through interviews, reports and other information gathering that did not fall into one of the defined sections but had a perceived impact on the commercialization of cleantech was gathered into its own separate section in the discussion section. These results were then discussed in relation to the other findings and on their own merit.

4 Data

In this section, we present all the data we have gathered throughout the project. The first sub-section covers national innovation statistics from both Norway and Denmark. The second sub-section covers the agencies/actors in each country and the number of mechanisms provided by each. The third sub-section discusses data gathered in relation to the commercialization process theory. The fourth sub-section covers the results found in relation to the triple helix theory.

4.1 National Innovation Statistics and Agencies

In this section, we distinguish between the inputs and the outputs from both countries. The national statistics discussed here are not specifically for cleantech but represents information from all sectors. Rather than giving detailed information about the cleantech sector, the majority of the numbers presented in this section are important for assessing the relative performance of the innovation system in each country. For more information about each country and the associated agencies, consult Appendix 5.

4.1.1 Inputs to Research and Development

One commonly used measure for assessing innovation in a country is the amount of money spent on research and development.

Table 8: Gross Expenditure on Research and Development (GERD)

	Norway	Denmark
GERD per capita population (current Purchase-Power-Parity) (US$)	1094.36 (2012)	1276.84 (2012)
GERD as percentage of GDP	1.65 (2012)	2.98 (2012)
GERD Compound annual growth rate (constant prices)	3.35 (2012)	-0.09 (2012)
Percentage of GERD financed by industry	44.20 (2011)	60.06 (2012)
Percentage of industry financing done by SME	64.7%*	27.9%*

Percentage of industry financing done by large companies	35.3%*	72.1%*
Percentage of GERD financed by government	46.55 (2011)	29.05 (2012)
Percentage of GERD financed by other national means	1.47 (2011)	3.67 (2012)
Percentage of GERD financed by abroad	7.79 (2011)	7.23 (2011)

Table 8 shows that Norway spends significantly less on research and development than Denmark, both in terms of percentage of GDP and on a per capita basis (OECD, 2014a, Christensen et al., 2014). Norway dedicates 1.65% while Denmark dedicates 2.98% of their GDP to research and development. This amounts to US$1,094.36 and US$1276.84 per capita respectively. However, the expenditure on R&D in Norway has been on the rise with a compound annual growth rate of 3.35% whereas Denmark's growth rate is negative at -0.09%.

The total spending on R&D in a country comes from four actors: government, industry, other national means and foreign interests. "Other national means" is defined as higher education institutions as well as private non-profit organizations. Government (46.55%) and industry (44.20%) contribute about the same amount to R&D with government spending being slightly higher. In contrast, industry in Denmark contributes the majority of spending on R&D (60.06%) with government contributing half that amount (29.05%). Furthermore, large industry in Denmark contributes 72.1% of total industry spending which is considerably higher than in comparison to Norway's large industry actors who contribute only 35.3%.

Another important measure of innovation in a country is the amount of researchers and R&D personnel available in each country. Table 9 gives an overview of how each country compares.

Table 9: Researchers and R&D Personnel by Country

	Norway	Denmark
Total researchers (FTE) (Full-Time Equivalent)	27908.00 (2012)	37675.10 (2012)
Total R&D personnel (FTE)	37804.00 (2012)	55711.10 (2012)
Total researchers - compound annual growth rate	2.50 (2012)	-0.71 (2012)
total R&D personnel compound annual growth rate	2.31 (2012)	-0.74 (2012)

Table 9 shows that Norway lags behind Denmark when it comes to both the total number of researchers (27,908 vs. 37,675) and the total number of R&D personnel (37,804 vs. 55,711) (OECD, 2014b). Once again, however, the compound annual growth rate for both total researchers (2.50%) and total R&D personnel (2.31%) is quite high whereas Denmark has a negative growth rate (-0.71% and -0.74% respectively).

4.1.2 Outputs from Research and Development

An important output from research and development is the amount of intellectual property (IP) generated within a country, which is usually measured in the form of patents. The OECD distinguishes between two different kinds of patents: triadic patents, which are valid in the US, Japan and Europe, or those filed under the Patent Cooperation Treaty (PCT).

Table 10: Patents Filed by Country

	Norway	Denmark
Triadic patent families	86.37 (2011)	241.29 (2011)
Patent applications filed under the PCT	594.03 (2011)	1178.01 (2012)

Table 10 shows that Denmark produces more than double the number of both triadic (86 vs. 241) and PCT (594 vs. 1178) patents than Norway (OECD, 2014b).

Furthermore, in terms of money, the rate of return of investment in cleantech for Denmark and Norway has been found to be:

Table 11: Rate of Return of Investment in Cleantech R&D

	The median company in Norway	The median company in Denmark
Rate of return of the last invested Euro in Private R&D in cleantech	22.7%	34.2%

Table 11 shows that Denmark has a higher rate of return on investment on cleantech than Norway with 34.2% to 22.7% (Christensen et al., 2014).

Furthermore, the costs of researchers yields information on how expensive the intellectual output will be in comparison to the amount of researchers and their wages.

Table 12: R&D Investment per R&D Employee

	Norway (€)	Denmark (€)
R&D investment per R&D employee	~150 000	~130 000

Table 12 shows that Denmark spends 15% less per R&D employee than Norway (Christensen et al., 2014).

4.1.3 Innovation Agencies and Programs

Table 13 contains a complete list of Norwegian and Danish agencies identified during this study that are considered to be key players in the field, either in a position of authority or acting with their own budget.

Table 13: List of Innovation Agencies in Each Country

Norway	Denmark
Innovation Norway Research Council of Norway SIVA Enova Transnova GIEK Regional research funds Husbanken Export Credit Norway Norad	National Research foundation Council for independent research Innovation Foundation Denmark Development and demonstration programme (EUDP, MUDP & GUDP) *Council of technology and Innovation *High-tech fund *Strategical research fund Market maturity fund State investment fund Growth fund Industry fund of Bornholm Technology pool by ministry of environment Copenhagen Cleantech Cluster Innovation environments Innovation network for transport Innovation network for environmental technology Loan fund of Northern Jutland The five regions Growth house Export council Midtnet Bigscience Invent now Innovation agents Danida EKF

In total, both countries have 43 mechanisms publically available. Figure 3 and Figure 4 show the number of mechanisms that each the agencies in each country provides. The Danish innovation system is more decentralized than the Norwegian system judging by the significantly larger number of organizations that are active there. Norway has a high concentration of mechanisms within a few agencies whereas Denmark has many spread across multiple agencies.

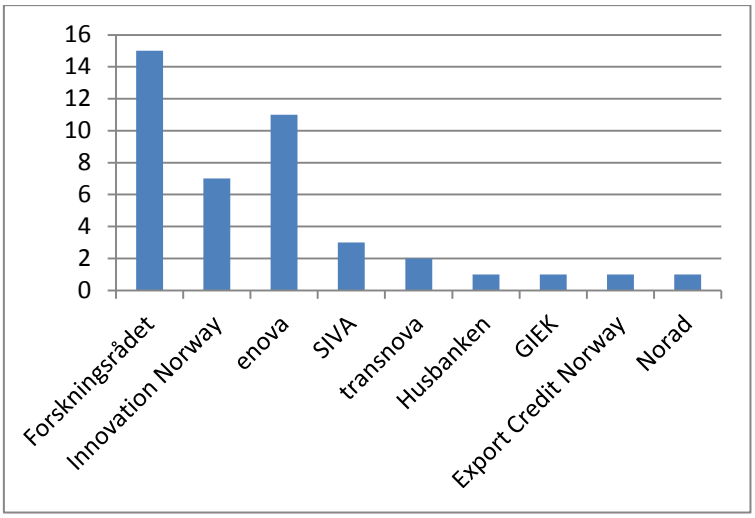


Figure 3: Number of Mechanisms by Agency in Norway (Appendix 1)

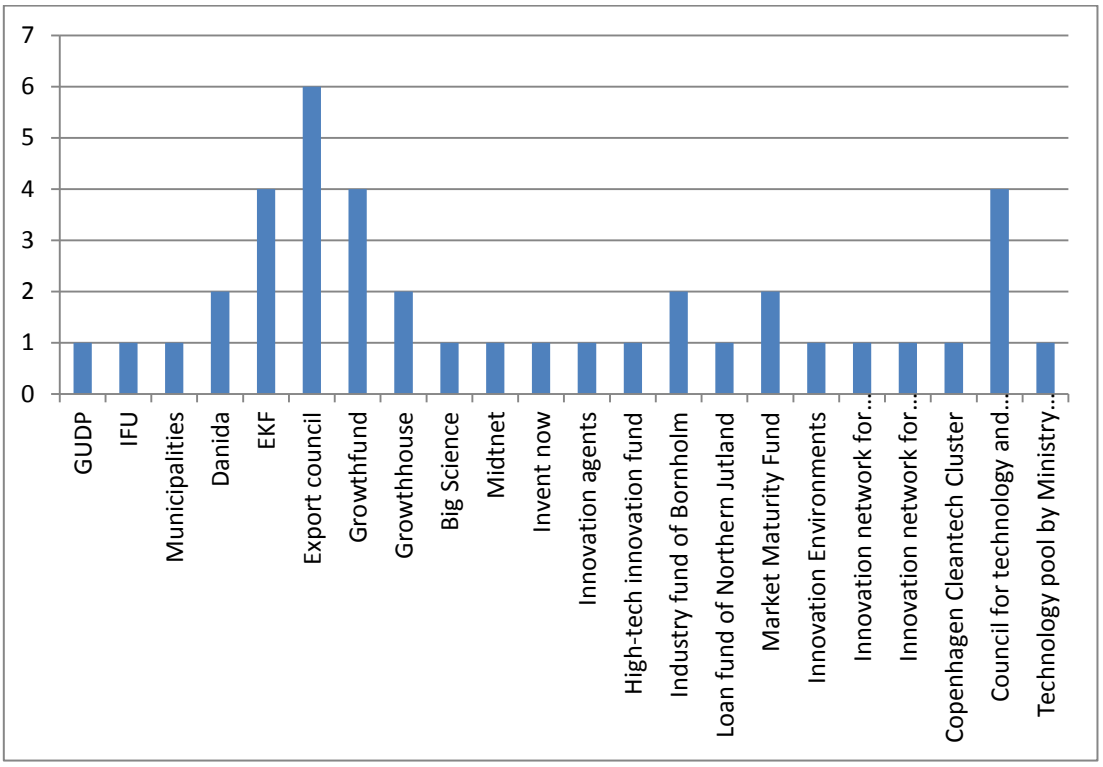


Figure 4: Number of Mechanisms by Agency in Denmark (Appendix 1)

Each mechanism targets specific actors within each country. For example, one mechanism could target SME companies and another may only be open to academic applicants.

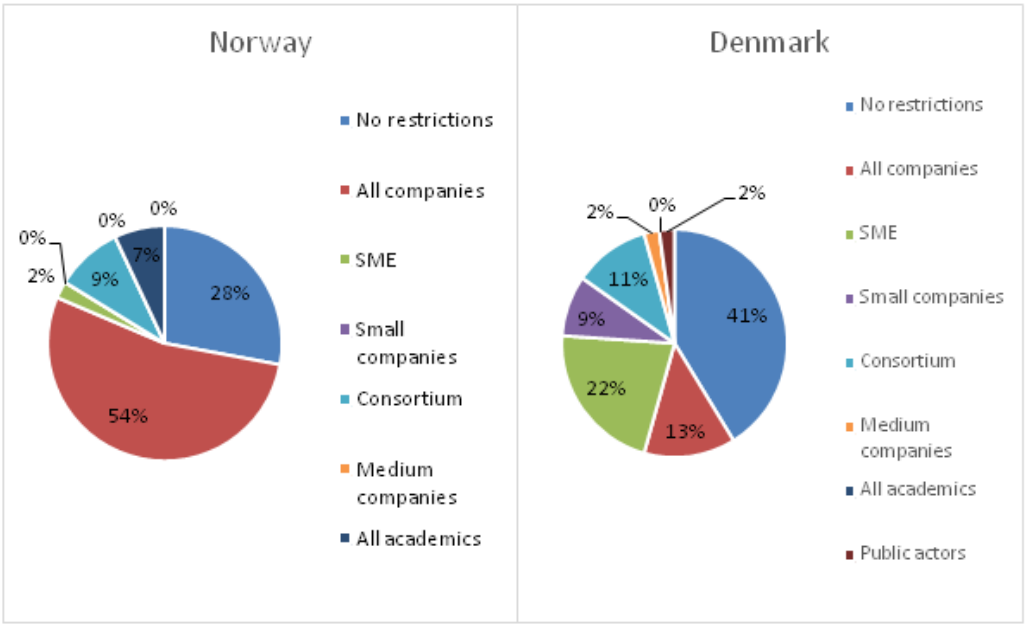


Figure 5: Proportion of Mechanisms Targeting Specific Actors by Country (Appendix 1)

Figure 5 shows the breakdown by country of what types of actors are eligible to apply for support from the various mechanisms available. It appears that Norway provides general support to industry rather than limiting support to small or medium sized companies. Norway also has a greater number of programs catering to academia, though the overall percentage is still quite small overall.

Figure 6 shows the breakdown of where the focus is for Denmark and Norway, it can be seen that Norway has mandatory cooperation before the demonstration sub-process with Denmark having cooperation spread evenly.

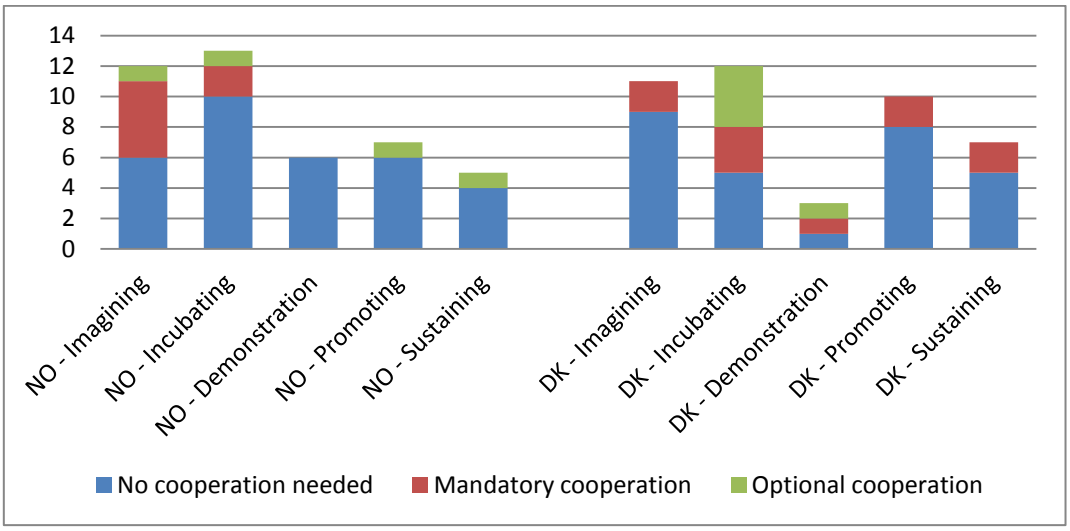


Figure 6: Cooperation breakdown per sub-process (Appendix 1)

Figure 7 shows the breakdown of eligibility by sub-process and it can be seen that Norway is most varied in the first two sub-processes and Denmark has more restrictions from incubating to sustaining.

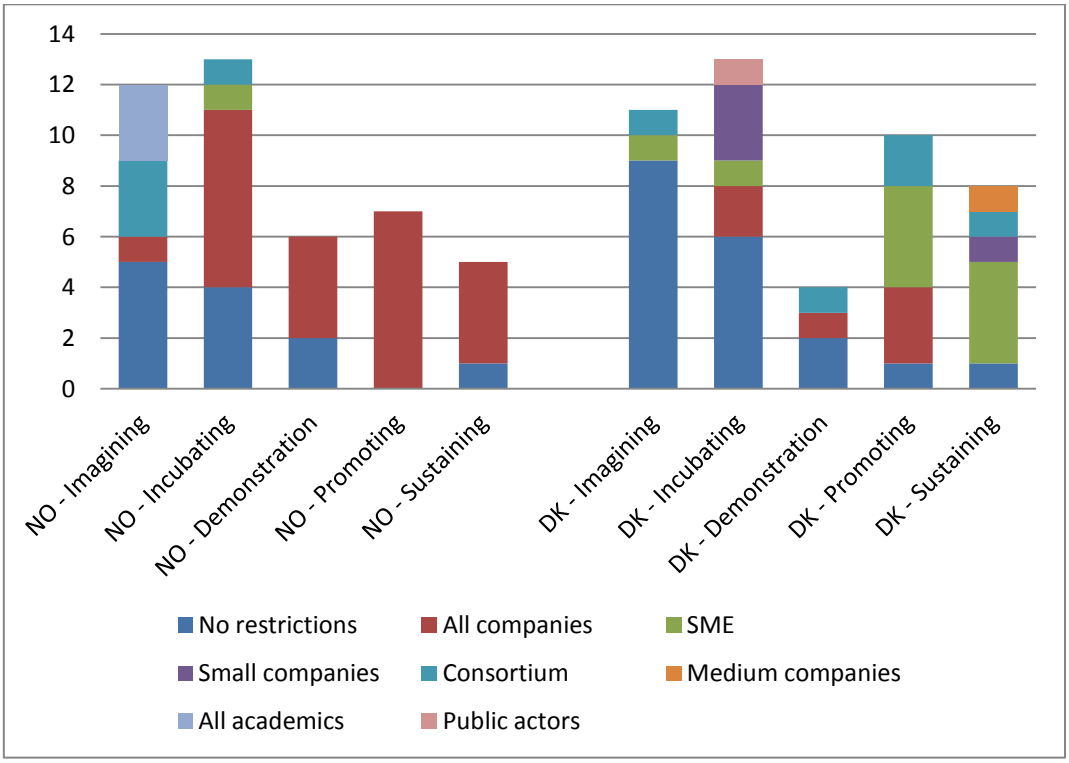


Figure 7: Breakdown of eligibility for sub-processes (Appendix 1)

4.2 Commercialization Process Data

As discussed in the Theory section above, the Jolly commercialization model has five main sub-processes: Imagining, Incubating, Demonstration, Promoting, Sustaining. Each mechanism found was mapped to a sub-process based on what kind of support it provides. Each mechanism could only be mapped to one sub-process.

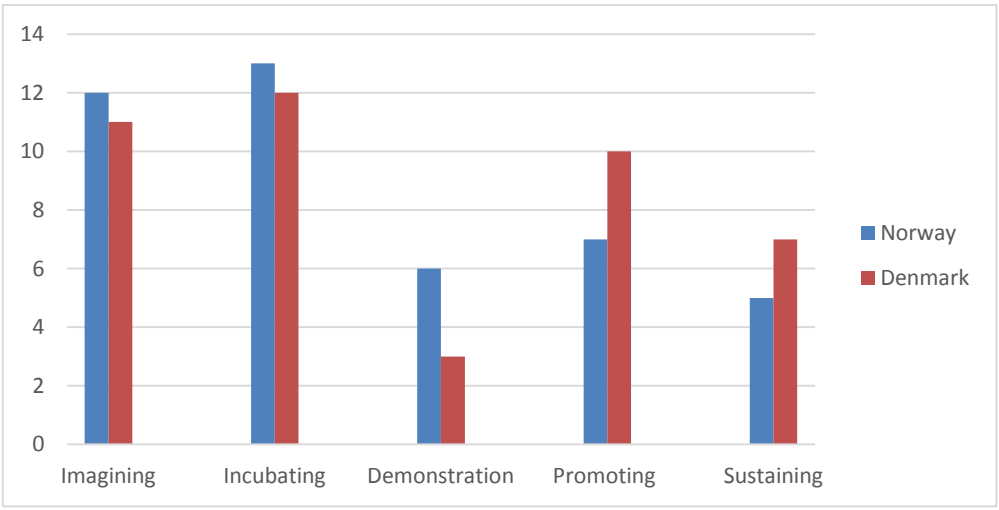


Figure 8: of Mechanisms per Commercialization Sub-process (Appendix 1)

Figure 8 above shows the results of this mapping process. It appears that Norway provides a larger number of programs in the earlier sub-processes of the commercialization process but less programs in the later sub-processes than Denmark.

Once this mapping was complete, the budgets (or money actually spent) for each mechanism was added up and grouped by commercialization stage.

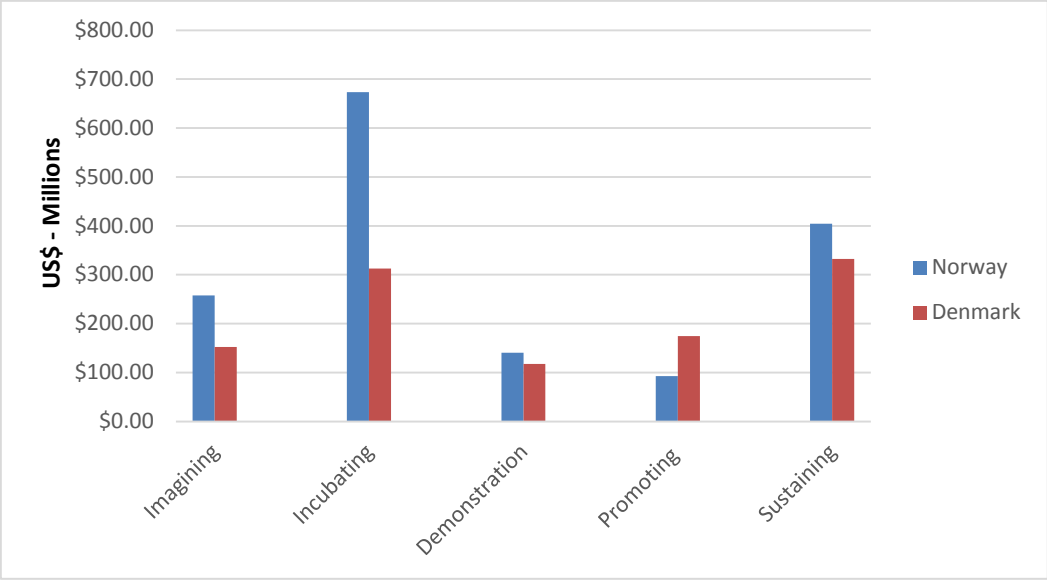


Figure 9: Spending by Commercialization Sub-process (Appendix 1)

Figure 9 shows that Norway outspends Denmark in almost every category except the promotion sub-process. One reason Norway has such a high level of spending in the incubation sub-process, is that the Innovation Norway General Company Support mechanism has a significantly higher level of spending than any other mechanisms. Some of the spending under this program could extend into some of the other sub-processes but its main focus is incubation.

Another issue with this budget analysis that was discovered through discussions with Thomas Alslev Christensen, is that Denmark has a general problem with councils decisively under-reporting the amount of success rates to show that they do not have enough money in regards to the demand in a bid to have more money awarded to their institution.

Both Norway and Denmark have mechanisms that enable the export of products internationally. These mechanisms typically provide export financing or guarantees for Norwegian companies. The spending of these programs was not included in the budget figures above since they are well above spending on other mechanisms and it would unfairly skew the data. Overall, Norway spends more than Denmark on these export-related mechanisms (US$8 billion vs. US$6 billion). However, it should be noted that these mechanisms act across all sectors and not just cleantech.

4.3 Triple Helix Data

The first thing to take into account when looking at mechanisms from a Triple Helix perspective is to consider if the mechanism encourages interaction between the spheres. A mechanism could encourage interaction between government and industry, government and academia, or government and both of the other two spheres. It is possible for a mechanism to fill more than one role.

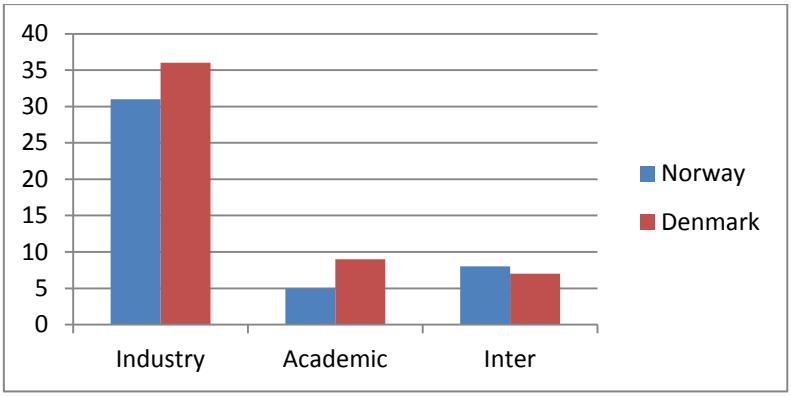


Figure 10: Number of Mechanisms by Encouraged Interactions (Appendix 2)

Figure 10 shows that there is very little difference between Norway and Denmark when it comes to mechanisms that encourage interaction between spheres. The one noticeable difference is that Denmark has nearly double the number of mechanisms that encourage interaction between government and academia.

One feature of the triple helix theory is that a regional focus can be important for the emergence of triple helix systems. Some mechanisms have a greater regional focus such as through a regional research fund and others do not have a specific regional focus.

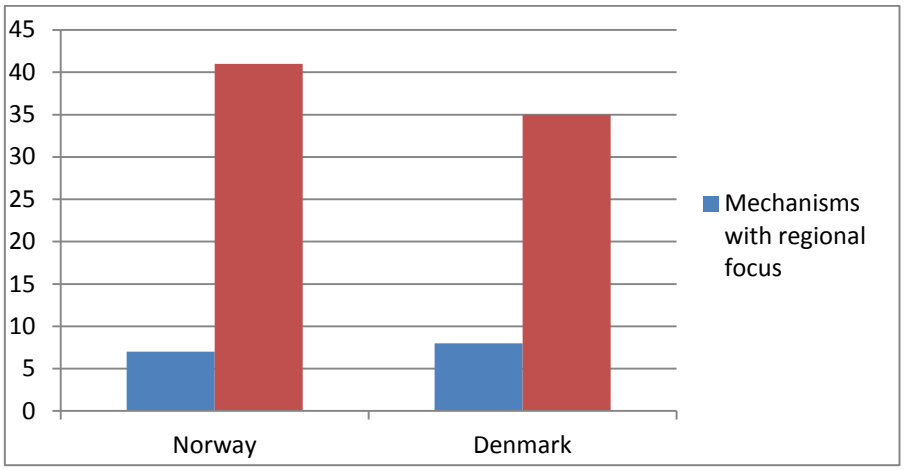


Figure 11: Number of Mechanisms with or without a Regional Focus (Appendix 2)

Figure 11 shows there is little difference between Norway and Denmark in the number of programs that have a regional focus. It should be noted that all regions have their own mechanisms but for clarification has been merged into one major mechanism.

Each mechanism can also help government fulfil its optimum role as identified in the triple helix theory. The five different roles of focus are called empowering industry, entrepreneurial support, basic R&D support, tax incentives and regulatory support.

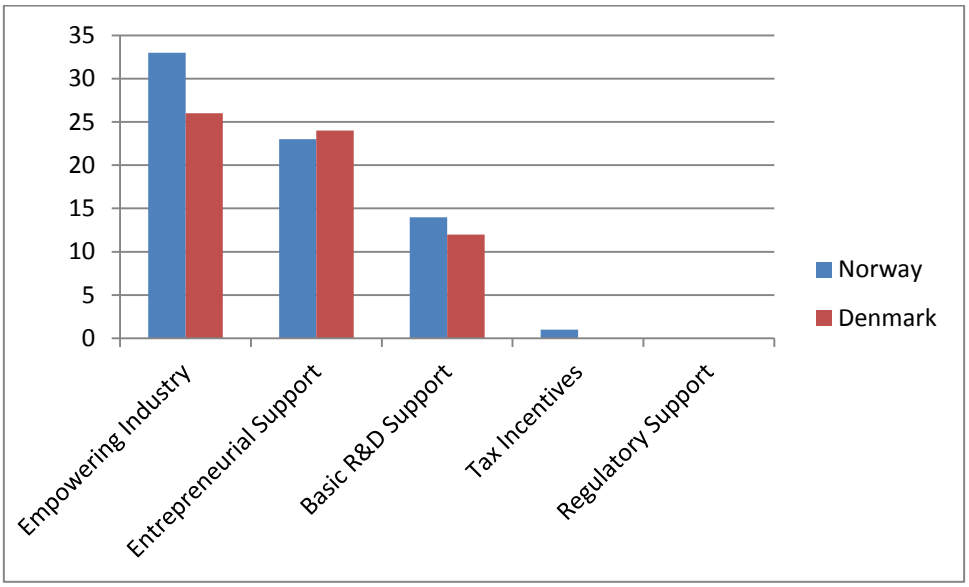


Figure 12: Number of Mechanisms that Support the Optimum Role of Government (Appendix 2)

Figure 12 shows again that there is little different between the two countries . However, the data shows that Norway provides more programs that empower industry to complete projects.

Furthermore, each mechanism can support the creation of new triple helix spaces. As mentioned in the theory there is knowledge, industry and consensus spaces. Each mechanism could potentially support the creation of more than one space or none at all.

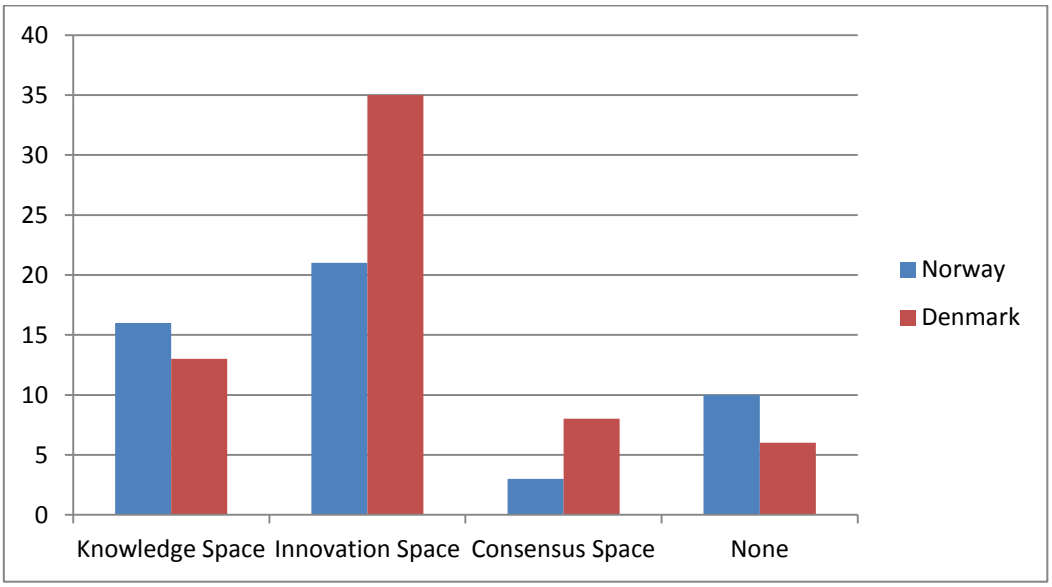


Figure 13: Number of Mechanisms that Support the Creation of Triple Helix Spaces (Appendix 2)

Figure 13 shows that Denmark has a significantly larger number of mechanisms that contribute to both innovation and consensus spaces whereas Norway seems to have more focused on knowledge spaces.

Mechanisms can also require that applicants apply as part of a group of companies or that they must cooperate with academic actors. Figure 14 shows how many mechanisms in each country has the requirement for cooperation or not.

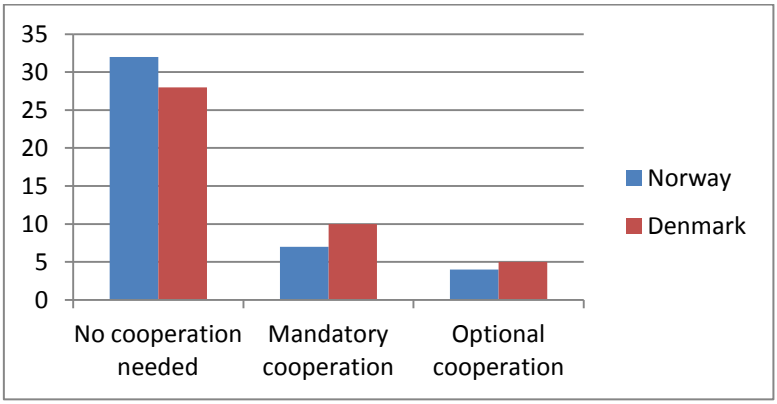


Figure 14: Number of Mechanisms by Cooperation Requirement (Appendix 1)

The majority of mechanisms in both countries do not require cooperation to receive support. However, Denmark does appear to have a higher number of programs that do require support, almost double the amount of those in Norway. Programs categorized as having “optional

cooperation" are those that either recommend it but do not require it or those that explicitly state that a group or consortium can apply.

Lastly, mechanisms can be viewed from what kind of relationships they encourage between the different components in a triple helix system. As discussed in the Theory section these relationships are collaborative leadership, collaboration and conflict moderation, substitution and networking.

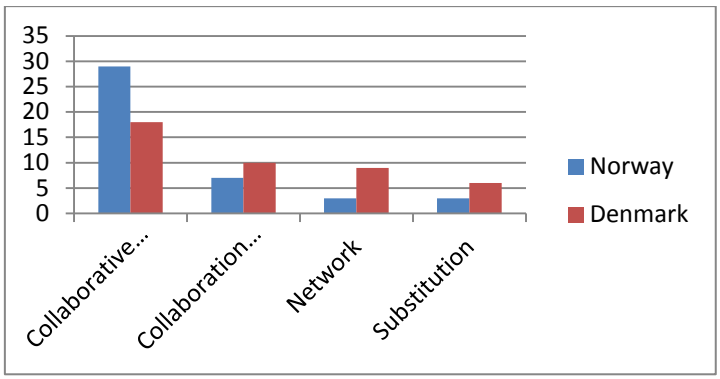


Figure 15: Number of Mechanisms that Encourage Specific Relationships Between Actors (Appendix 2)

Figure 15 shows that Norway has a greater number of mechanisms that have a collaborative leadership style of relationship whereas the Denmark has more mechanisms in the other categories.

5 Discussion

The results of this study are discussed in the following order. First, the implications of the national statistics and structure of the governmental agencies are discussed. Next, the data from the linear commercialization process are discussed followed by the data from the triple helix analysis. Lastly, some general observations and additional findings are discussed. The section ends with a summary, bringing the study together.

5.1 National Innovation Statistics and Agencies

5.1.1 Inputs to Research and Development

One of the first observations that can be made is that spending on research and development in Norway is substantially lower than Denmark. However, the Norwegian government contributes a larger part of the overall spending than the Danish government on a national basis across all sectors. This indicates that the lack of spending on research in development is likely due to a lack of spending by industry in Norway.

Further findings indicate that large industry actors in Norway do not contribute enough to research and development in comparison to Denmark. The large industry in Norway only contributes 35% of the overall spending from industry on research and development with the remaining expenditure coming from small and medium sized companies. In comparison, large companies in Denmark contribute 72% of research and development expenditures by industry. Ane Brunvoll at the Norwegian Research Council further confirmed this when she said:

"The situation in Norway is the difference in our structure compared to other countries. In Norway, we have more small and middle sized companies that actually do more research and fewer large companies doing a lot of research in comparison than the average in Europe."

This scenario is part of what is termed the "Norwegian Paradox", which describes Norway's notoriously low spending on research and development coupled with its unexpectedly high economic performance (Christensen et al., 2014). Fagerberg et al. (2008) explain that this is partially to do with the adaptability of its system, an innovative resource-based sector such as oil and gas, and policy focused on supporting the resource-based sectors. They suggest that

the focus on resource-based industry is one reason why other non-resource related industries have not been as successful in the country.

The level of spending on research in Norway is on the rise as is evidenced by the high compound annual growth rate of the GERD in Norway. However, it is not possible to say if government, industry, or both are increasing its spending or if this increase is also seen in cleantech related research. This indicates that the situation in Norway is improving and that they may see improvements in the future.

Both Jolly's commercialization model and the triple helix theory imply that simply increasing spending on research and development is not enough. An innovation system and the commercialization of technology requires interaction between a number of different actors as well as a strong ecosystem to support them. A good example of why simply spending more money is not enough is the case of Sweden. In 2010, Sweden spent 3.39% of its GDP on research and development but only received a 17.3% return on its investment in cleantech, which pales in comparison to 34.2% in Denmark and 22.7% in Norway (Christensen et al., 2014).

Another factor that affects the productiveness of the research system is the number of researchers and related personnel available in the country. Norway trails behind Denmark in this regard. One obvious reason could be that Norway has a lower total population than Denmark and therefore a smaller number of researchers available. Other factors that affect the attraction of researchers could include research funding levels, quality of research environment and programs for attracting researchers (Salmi, 2012). Overall, this indicates that Norway needs to improve its attraction of researchers to work in the country either through increased spending or through other means.

Similar to the spending numbers above, the number of researchers and related personnel is increasing in Norway. This also indicates that the system in Norway is improving and therefore better results may be seen in the future. Although, this is across all sectors and may not be the case in cleantech.

5.1.2 Outputs from Research and Development

Norway produces less than half the number of patents than Denmark. Potential reasons for this low value could be the low levels of spending or researchers mentioned above, a lack of high quality research facilities, cultural differences that do not incentivize patenting or a focus on research that is not easily patented. It is not clear why Norway has such low patenting numbers but this could be an area for further improvement and research.

The rate of return on private research and development in cleantech in Norway is significantly lower than that in Denmark. This indicates that overall, Denmark is a more attractive place to invest in cleantech.

5.1.3 Innovation Agencies and Programs

An interesting observation that can be made by looking at the various agencies that provide mechanisms in Denmark and Norway is that the Danish system is more decentralized than the Norwegian system. There is a wider range of agencies providing mechanisms in Denmark and they have a wider range of restrictions on who can apply to programs. Some of the Danish mechanisms are run directly out of a government ministry and others have their own board with a mandate from ministry. In comparison, the majority of Norwegian agencies have their own board and operate based on government mandate. At first glance, this would indicate that the decentralized model would be a better approach to providing mechanisms, however, during the course of this study it was discovered that Denmark is now moving closer a centralized model by consolidating three agencies into a single agency. The triple helix theory points out that "most [triple helix] initiatives take place at the regional level" and emphasizes that an innovation system is in a constant state of "creative renewal" and needs to reinvented on an ongoing basis (Etzkowitz, 2008). Having a larger number of organizations focused on different regions or different sectors makes it easier for triple helix initiatives to take shape. However, having too many organizations can also lead to coordination issues and result in conflicts. Constantly evaluating the system that is in place and making changes as necessary to minimize these issues, as Denmark is now doing, is critical. Overall, this indicates that Norway should evaluate their current system and make changes to encourage a small addition of decentralized, regionally focused organizations that aids the larger organizations by having the flexibility to adapt to changing circumstances.

The Danish system is more prescriptive in identifying who is eligible to apply to programs and mechanisms, with most of them being targeted at SMEs. The Norwegian mechanisms are generally open to all industry actors or have no restrictions as to who can apply. Both countries have an almost identical portion of mechanisms that require a consortium of industry and academic actors with restrictions to the type of project approved and the type of support given. Having requirements that are more restrictive indicates that Denmark is more focused on what they are trying to achieve but it also indicates a lack of flexibility. According to Bergny Dahl, many of the programs and mechanisms in Innovation Norway are purposely made to be flexible so that they are able to help companies in more than one way. Instead of restricting by company type, they are more concerned with supporting companies that have growth potential, particularly into international markets. Due to the uncertainty faced by many early-stage technologies, flexibility is a necessary feature of governmental support and Norway's system may be at an advantage here albeit there is a lack of focus on SMEs which is considered to be the source of more disruptive and lucrative technologies (OECD, 2014c). It is important to not just target any SME but specifically "young companies that have already demonstrated ambition" (Mazzucato, 2013).

There are also a greater proportion of mechanisms in Norway that are targeted at academia. This indicates that Norway has a greater focus on supporting the research side of the commercialization process than Denmark does. This is further supported by interview with Miriam Meling:

> *"We have a very strong engineering environment in Norway and in relation to these exciting technologies engineers and technical people they get really excited, but they only focus on the technology part and then forget… to have a realistic view on the time it takes to develop a certain technology before you get money on the table. So what we usually spend a lot of time talking about is the importance of finding the application that is closest to market."*

What this shows is that there is a greater focus on the early phases of technology development and there is a limited focus on market application and customer needs in Norway in comparison to Denmark. While having a focus on technology is important, Jolly (1997) indicates that it is also very important to be able to access a market and mobilize the necessary resources to both access that market and stay there. This suggests that Norway needs more programs and mechanisms that have a greater focus on the market and that the industry in Norway is weaker in this area than in Denmark.

5.2 Analysis Based on Commercialization Process

In this section, the results of mapping all of the programs and mechanisms in each country and their associated budgets to the different sub-processes in Jolly's commercialization model are discussed.

Based on the results, Denmark has better support at the later stages of the commercialization process than Norway, particularly in the Promoting and Sustaining sub-processes. This is confirmed by previous observations and indicates that Norway could do a better job at supporting companies that have already entered the market by helping them enter new markets or by supporting company growth plans.

Norway seems to spend more money overall than Denmark in almost every stage but particularly in the early stages of commercialization, which is expected based on the fact that the Norwegian government contributes a higher percentage of the overall spending on research and development than the Danish government. As discussed in the case of Sweden, greater spending does not guarantee better results. This indicates that Norway is lacking some form of either infrastructure or support that is not related to government spending.

Information gathered during the interviews with Rune Holmen from Enova and Ane Brunvoll further supports this finding. According to Ane Brunvoll there is a lack of home market and consequently a lack of need for areas where to demonstrate the technology. Rune indicated that their problem was not the lack of funding for the demonstration sub-process, but a lack of qualified projects as applicants applying for support often did not sufficiently consider the market perspective:

> *"... we have been struggling to spend our budget in exactly that phase so there hasn't been a budget limitation. But the limitation have been projects that have had a sufficient maturity and… an organization that is able to carry out the projects so we have been turning down some of the projects… this is a field which is very attractive for a lot of entrepreneurs and some of them, they have maybe a good idea but they don't really understand the necessity of going through the phases by starting out with a small scale [project] and building on that, to get some attention from customers, for instance, building their organization. They don't understand that, they come to us with more or less a PowerPoint and a good idea and would like for us to support them with often hundreds of millions of kroner."*

The lack of a suitable environment to conduct demonstration projects is detrimental to the development of any new technology. According to Jon Wulff from TTO AS, one way that

Norway could create this environment is by setting up relevant testing facilities for the new technologies which was also indicated was a critical factor for the development of wind technologies in Denmark. This is supported by a study conducted by Lewis and Wiser (2007) into different policy support mechanisms for the wind industry in Denmark.

5.3 Analysis Based On the Triple Helix Theory

This section discusses the results of comparing the programs and mechanisms in both countries based on a number of different factors identified in the triple helix theory. The factors include encouraging interaction between spheres, regional focus, supporting the optimal role of government, supporting the creation of triple helix spaces, collaboration between actors and types of relationships between actors.

From a triple helix perspective, both Denmark and Norway are comparable in a number of measures used to analyse each country. Both countries have a similar amount of mechanisms that encourages interaction with industry, academia or both at the same time. There seems to be a slight bias in Norway towards academia and a slight bias towards industry in Denmark. Both countries have a comparable quantity of programs with a regional focus, though the Danish programs are more industry focused and less research focused like those in Norway. This supports previous findings that, in general, Norway seems to be more technology focused than Denmark.

Little difference also exists when it comes to how each mechanism helps the government perform its optimal role as dictated by the triple helix theory. Although the data indicates that Norway provides a greater amount of programs that empowers industry in comparison to Denmark.

Denmark is stronger than Norway when it comes to mechanisms that encourage the development of innovation and consensus spaces. The triple helix theory states that “the consensus space is a key factor for catalysing the interaction between the Knowledge and Innovation Spaces when they are present, or for speeding up their development when they are weak or absent” (Ranga and Etzkowitz, 2013). To that end, Norway should consider mechanisms that help support both innovation and consensus spaces since they already appear to be strong in supporting the development of knowledge spaces.

Another area where Denmark is strong is that it has more mechanisms that require cooperation between industry and/or academic actors. The triple helix theory states that the ideal environment for innovation is where all three actors interact with each other in a constructive manner. It is at the intersection between the spheres that triple helix spaces form (Ranga and Etzkowitz, 2013). Mechanisms that encourage collaboration or require it are more likely to provide better innovation results. This indicates that Norway should consider adding the requirement to collaborate to more of its programs and mechanisms.

Finally, the mechanisms in Denmark are better at creating a variety of relationships between actors than those in Norway. For example, Denmark has more mechanisms that provide network relationships or substitute the role of another sphere than those in Norway. Networking relationships "reflect the growing non-linearity and interactivity of innovation processes and provides several benefits" (Ranga and Etzkowitz, 2013). Substitution relationships are when an actor takes on a role of another either in another sphere or within their own sphere and help strengthen the performance of the system as a whole. This indicates that Norway should try to develop new programs that encourage different types of relationships between actors, particularly networking and substitution relationships.

5.4 Detailed Comparison by Sub-Process

The following section discusses some of the similarities and differences between program and mechanism offerings at each stage of the commercialization process and identifies areas for improvement in Norway. Where applicable, the triple helix theory is also used to discuss differences or similarities between the two systems.

5.4.1 Imagining

Both countries have mechanisms for constructing national centres of excellence, which are a perfect example of triple helix integration. Organizations like this are important for bringing all three actors together in the innovation system.

Both countries also have mechanisms that focuses on strengthening the imagining sub-process at the regional level and not just national. This is done through the regional research funds in Norway and among others in Denmark through subsidies for initiatives that promotes employment and guidance for companies. Having a regional focus is important since this is the level where the majority of triple helix initiatives form.

Norway has mechanisms that enables researchers to travel to a university abroad to gather knowledge and build networks through the international stipend mechanism. Similarly, Denmark has developed networks within European research facilities through the BigScience mechanism, for example CERN. With the main difference, being that the Danish mechanism is limited to Europe only and Norway is limited by acceptance of specific universities worldwide.

Denmark has a unique mechanism in which actors can achieve subsidies through a collaboration project with academia. It is mandatory that they work together and this promotes the action. Collaboration within sphere and with the other spheres is critical to the formation of triple helix systems and Norway could potentially benefit from implementing a similar program.

Denmark also has a large amount of mechanisms that are dedicated solely to providing guidance and counselling for the actors in different fields who are currently in the imagining sub-process.

Norway has a unique program that focuses solely on Carbon Capture Storage (CCS) and everything related through the imagining sub-process. ENERGIX is a continuation of a research and development program that focuses on cleantech. The triple helix theory indicates that focusing on specific technologies that are suited to the goals of the country and the innovation environment is more effective than providing broad based support to all technologies. The support for CCS technology in Norway is a good example of pursuing a technology that is well suited to the country's strengths since it requires knowledge that overlaps significantly with the knowledge present in the oil and gas industry.

5.4.2 Incubating

Both countries have mechanisms in this sub-process that allows actors from the academic circle to work with the industry on mutually agreed upon projects.

Denmark has three separate mechanisms that incorporate different aspects of cleantech. The energy technology-, green-, and environmental- development and demonstration mechanisms (EUDP, GUDP & MUDP) are used to support industry actors in verifying ideas and building test facilities. As mentioned previously, Jon Wulff Petersen highlighted this as one of the strengths of Denmark over Norway; namely, the apparent accessibility and quality of test-facilities where technologies could be tested.

In comparison, Norway has FORNY2020, which enables actors to conduct proof of concept or verification funding, with the possibility to obtain further funding if needed. Unfortunately, this program is limited only to technologies that are the result of publically funded research.

Denmark has two mechanisms that function as an obtainable coupon that can be redeemed at a university in exchange for information or knowledge. By empowering the industry, it gives them the flexibility to identify their own needs and purchase the knowledge and technology required to address those needs.

Denmark has two mechanisms focused on the regions of mid-Jutland and Bornholm. These mechanisms provide support in both the imagining and the incubating sub-processes. Both mechanisms aim to stimulate further development in their respective regions.

Further focus on CCS a mechanism that is unique for Norway, which takes the technology from the imagining sub-process into the proof-of-concept phase to prepare it for an eventual

commercial launch. It is important to the success of a technology that the support for that technology continues through the imagining sub-process into the incubation and demonstration sub-processes and beyond into the promoting and sustaining sub-processes.

5.4.3 Demonstrating

Both countries have programs that support the entry of a first generation technology into the market. One Danish mechanism provides guarantees to companies who will be the first buyer of a new technology. Another Danish mechanism provides grants to test or demonstrate a new technology to improve its commercial potential. The Norwegian mechanism is a broad program focused on supporting projects that will be demonstrate new technology in a real working environment and typically requires the cooperation with a customer. These projects are examples of government taking on the role of industry by providing public venture capital, which is a necessary function of government in the commercialization of technology (Etzkowitz, 2008, Mazzucato, 2013)

The majority of mechanisms in Norway are related to the direct construction of energy efficient facilities or infrastructure for electric vehicles. These programs support the installation of new technologies in the market. This is a critical step in the development in any technology because this is where it can be proven in practice and act as a reference for later customers.

The unique Danish mechanism in this category focuses on providing support for companies to enter developing countries. This provides support for companies to access new markets and to test their technology in what is likely a challenging foreign market.

5.4.4 Promoting

Both countries have guarantees and loans available to support the export of goods to foreign countries. This is an enabler for companies to access new markets and expand abroad.

Furthermore, they both have mechanisms available that focus on international networks and support for companies that needs the assistance in either going or staying abroad. International market access is critical to the growth of innovative companies in countries like Norway and Denmark where the home markets are relatively small.

Norway has incentives focused on biogas production, district heating and bio-energy programs. This is to promote existing industry actors to direct focus towards a more environmentally stable production and market. Again, this is an example of Norway focusing on an area where they are already strong and which requires further development.

Denmark has mechanisms for companies to join forces and do a shared push into a market abroad. Furthermore, they also have the same assistance abroad with a unique focus on SMEs solely. This is one way Norway could consider researching further in order to both increase the amount of collaboration within the industry sphere and the amount of mechanisms that focus on smaller companies.

5.4.5 Sustaining

Both countries have mechanisms for industry actors to conduct green investments such as energy efficiency projects, renewable energy projects or others. However, Denmark's programs provide a wider range of coverage than those in Norway, which focus primarily on reducing energy use in buildings.

Denmark focuses mostly on having companies continue their activities, grow, go abroad or expand into new markets in special projects orchestrated together with all three actors. Providing this type of support to small, high technology companies is important to ensure they have the resources and opportunity to grow, especially if industry is unable or unwilling to perform this role themselves. This is an example of government "taking on the role" of industry, which is an important step in the formation of a strong triple helix system (Etzkowitz, 2008).

5.5 Other Observations and Additional Findings

Additional findings were made throughout the study that are out of scope of the main research question. Nevertheless, they provide interesting insights that are used for further evaluation of the data. First, industry and market issues that exist in Norway are examined. Second, the role that competition from other countries plays is discussed, which gives an example of how subsidies and infrastructure must be present in order to capture industry effectively.

5.5.1 Industry Issues

A common theme throughout all of the interviews and hinted at by some of the statistics is that Norway does not have a strong industry sphere or home market to support the commercialization of cleantech.

The interview with Rune Holmen from Enova also pointed out that they have trouble finding enough projects to qualify for funding under their new technology program. He states that part of the reason for this is that many of the applications are considered immature or do not have enough financial support from private industry. This is not isolated to only Norway, as shown in the Annual Global Survey by the Global Research Society (Batelle, 2012) which identified four critical areas that projects fail: lack of external financing, limited internal budgets, lack of long term budgets and lack of time to be creative and innovative. (Research Council of Norway, 2013b)

Even the mechanisms in Norway that do require industry collaboration are not as successful at engaging industry as expected. One specific example of this is the Centres for Environmentally-friendly Energy Research program. In the recent evaluation of the program, one of the findings was that the interaction with industry was inadequate and should be improved (Research Council of Norway, 2013a). Some of the reasons cited for this were:

- Low or decreasing interest in commercializing the specific technology
- Unforeseen changes in the market
- Lack of understanding of the rationale behind conducting long-term research
- Unclear expectations for their involvement with the centres
- Need for better knowledge transfer practices and expectations
- Need to document activities that happened outside of the centre but were based on

activities that occurred within the centre.

Norway also has the lowest percentage of innovative companies of all of the Nordic countries at 35%. In comparison, Denmark has 47% of companies that fall into this category. Of these innovation companies in Norway, only 19% actively participate in innovative collaboration, whereas 34% of the companies in Denmark do the same. (Christensen et al., 2014).

In addition, Norway tends to have a lack of private capital. Siva provides some funding through seed funds and venture capital funds but overall there is a lack of risk willing capital. Which is verified by Bergny Dahl in terms of how much they can fund of new ventures and the availability of venture capital:

> *"We can only do 25% or 45% and for environmental technology it is very very hard to get the other 55%... It was easier in 2009. More people wanted to try this new thing. But now it is very hard. The venture capitalists they have used their money."*

This lack of capital also affects the viability of projects and can make it difficult to secure public funds as well. There is potentially a role for public venture capital to fill this void, however, there are limitations to how much public capital can be used for a given project as set by the EU.

The above issues are consistent with observations regarding the high scientific output of Europe in general coupled with the inability to translate this output into profitable market products. One theory as to why this problem exists is that Europe has a weaker scientific research system coupled with the presence of weak and non-innovative companies. Another explanation is the lack of a good balance of speculation and investment from venture capitalists. (Mazzucato, 2013)

5.5.2 Market Issues

A common theme through all of the interviews in Norway is that Denmark and Norway have a very different end-user market for energy focused cleantech products. One major indicator for the success of Denmark is due to the strong home market, which provides a solid base for the Danish companies upon which they can expand internationally. Unfortunately, Norway does not have the same amount of support from their home market. Some of the main reasons for this is that Norway already generates over 95% of its electricity from renewable sources (NVE, 2009) and the cost of that electricity is relatively low. In addition, the presence of the

oil industry in Norway is a strong competitor to the development of a strong cleantech market. Bergny Dahl states this clearly when she says that:

> *"After finding more oil in 2011, money and knowhow tends to go to the offshore industry. But it's true the money goes back faster and in bigger chunks than if you invest in environmental [technologies]."*

Jon Wulff Petersen stated that having a strong home market coupled with good regulatory and public support is what let the wind industry thrive in Denmark. According to him, this process took 20 years and the patient support from the public is what prevented the government from cutting back support. Thomas Alslev also commented on how the market competition affects commercialization of cleantech:

> *"It is fundamentally the competition on the markets which on a long-term will decide the payoff for the investment of a company, only the companies which can obtain a high payoff and therefore become internationally competitive, will survive on a medium and long-term basis.*
> *Due to the Danish costs with high salaries, the companies are forced to have a high rate of commercialization of their research investments in order to survive in the global competition. This is luckily also the case. Measured in relation to surplus on the payment account, Denmark is one of the countries with the highest turnover in relation to GDP. This is also a way to see how the Danish companies are able to commercialize their investment in research, innovation, materials etc."*

Based on this, it appears that Norway needs to find a way to build a strong home market and regulatory framework to support the development of a technology while at the same time encouraging the public to embrace the technologies over the long-term.

5.5.3 Competition from Other Countries

Jon Wulff Petersen raised an interesting point that Denmark and Norway were not the only countries providing incentives for the commercialization of cleantech. One particular example was the German province of Saxony-Anhalt, which has very favourable conditions for establishing high-tech companies. Among the subsidies they offer beyond money is land for free, construction of any building they would need for free, favourable rent, ten million euros in grants to start production and an additional 10 million euros in loan which does not have to be paid back if the company files for bankruptcy.

The countries might successfully attract new companies but the moment the subsidies expire or are no longer as attractive as in other countries, the companies would move to countries with more favourable conditions. One way of preventing this from happening is to either have, or focus on building, a working environment to make it more attractive for the companies to stay in the country, despite better subsidies in other countries. Jon Wulff Petersen gave practical examples of Ireland and Scotland 10-15 years ago when they offered lucrative subsidies and attracted big companies such as Intel. Unfortunately, the countries had a heavy loss afterwards as the companies left when another country became more attractive, since they had no further reasons to stay. This is a prime example of what the triple helix theory also dictates in terms of having a working environment as a better playing field for companies than pure subsidies. Since Norway is an expensive country, it faces even more challenges when trying to compete at an international level. To compete, Norway will have to develop an environment that is attractive to companies either to develop internally or to attract companies from abroad. Options here could include acting as a buyer of technology to create a home market (Mazzucato, 2013) or developing test facilities and related infrastructure as acquired from the interview with Jon Wulff Petersen.

Jon Wulff Petersen also gave an interesting insight to the future development of innovation environments across the EU:

> *"Many of the things we are dealing with here, the regulation is now becoming supernational...When the regulation moves from being national to be supernational then of course you lose some degrees of freedom."*

This implies that it will be much harder in the future for countries and regions to compete against each other since they will have limited freedom in creating more attractive regulations than their competitors.

6 Recommendations and future research

This section provides the combined recommendations and points for further research based on the research question. A total of three recommendations have been gathered from this study. The first recommendation is in regards to the findings of the commercialization theory, the second being the Triple Helix findings and the third is a recommendation gathered from the additional findings acquired throughout the project.

The areas identified for future research are divided into three different themes presenting interesting areas for expanding the theory, expanding on the topic and acquiring more information on how Norway could improve commercialization.

6.1 Recommendations based on Commercialization process

Overall, the programs and mechanisms in Norway are found to be slightly more focused on the early stages of commercialization in comparison to those in Denmark. In addition, Denmark has a greater number of programs requiring collaboration between actors throughout every commercialization sub-process whereas these only exist in the early phases in Norway. This implies that Denmark has a theoretically better environment for encouraging cooperation and Norway should consider adding the requirement to collaborate to a greater number of mechanisms in the demonstration, promotion and sustaining sub-process.

Norway could improve the demonstration and promotion sub-process by making programs or mechanisms that enable industry and academia actors to search for market opportunities abroad and collaborate with actors in the recipient country to solve the challenge.

Norway could furthermore improve the promotion sub-process by constructing a program or mechanism that enables industry actors to join together for a shared export push. Innovation Norway purposely seeks out companies which are born global and by having a mechanism for a shared export push, it enables the industry actors to take advantage of their capabilities and push into new markets for profits.

The sustaining sub-process could be improved by constructing programs or mechanisms that enable industry aimed knowledge collaboration with trade foreign trade partners. This sounds similar to the demonstration phase described above albeit the difference is that this covers companies that are already fully established and seeking measures to stay competitive in the market.

6.2 Recommendations based on Triple Helix

From a triple helix perspective, Denmark is better at supporting the creation of innovation and consensus spaces that Norway. Consensus spaces are of particular importance as they can lead to the creation of both innovation and knowledge spaces. All three spaces are necessary for a productive triple helix system to function. Therefore, Norway could develop more mechanisms that will help lead to the creation of more innovation and consensus spaces.

During the analysis of agencies, it was found that the Norwegian agencies have clearly defined the different aspects of commercialization and have a high level of collaboration. Denmark has a mixture of centralized and many minor decentralized agencies even with the recent consolidation of three main agencies into one. Assuming the Danish system is better and based on the Triple Helix's concept of "creative renewal" Norway should review its agencies and identify areas where it would be ideal to create some independent, regionally focused organizations to support the innovation system.

A recurring theme throughout the study was that the industry actor was not sufficiently strong in Norway. The Triple Helix theory suggest the best way to remedy that is for the other two spheres to take on the industry's role until at a time the industry is strong enough to do it itself. A possible way for Norway to cover the power of the industry is through the agencies and engage more resources into what the research council is already doing. The Research Council probes SINTEF for areas of interest and subsequently releases calls for proposals into those areas. The recommendation is then that all three agencies could collaborate and construct calls that covers the entirety of the commercialization process to give the optimal conditions for industry. As Mazzucato (2013) dictates "*It is more effective to commission the technologies that require innovation than to hand out subsidies in the hope that innovation will follow.*"

6.3 Recommendations based on additional findings

It was acquired through the project that the public, what some researchers label the fourth helix (Carayannis and Campbell, 2009), from the Triple Helix regime had a high impact on the success of commercialization, which was highly present in Denmark in terms of the wind industry. Even though technology could be commercialized, the fourth actor has a high impact in the promotion and sustaining sub-process as their contribution can turn the venture into a commercial success which Norway lacks for cleantech. The public actor has the ability to persuade/coerce the other actors to either stay in or leave a certain sector and thus holds a significant amount of power. Thus, the recommendation for Norway is to instigate programs and mechanisms that could motivate the public actor. Norway could implement its experiences in areas where they have success with the public with the introduction and implementation of the electric vehicle.

Competition from other countries and regions was also uncovered as a challenge for Norway. Being one of the most expensive countries in the European Union makes it very difficult for Norway to compete on a financial basis. The recommendation is thus that Norway could mitigate the impact of high prices by creating an attractive environment with relevant infrastructure, seeking inspiration from the Danish development mechanisms and build test facilities.

6.4 Expanding the snapshot

This theme concerns taking the theory further into new areas to give new insight into the whole picture and construct more encompassing findings

Some areas that could be researched would be complementary to this study. The first way it can be expanded is to include the implications of the new Innovation foundation Denmark and their plans for the future development of the Danish government commercialization. By looking to the future the past can also be researched and a history of Norway and Denmark could be built that can give view over the different mechanisms, their evolution and impact.

The area of research of the project has focused on technology push. The relationship between Demand pull and technology push makes it interesting to investigate further and include the demand pull as well. Jolly's model used in this project takes both technology-push and

demand-pull into consideration and is thus prepared for this area. Furthermore, it was acquired that the public actor holds a significant amount of influence in the whole process of commercialization which opens up for a new area of research of evaluating the Triple Helix versus the Fourth Helix theory and use it to gain more knowledge.

There has additionally been found that there is a difference between the agencies in Norway and Denmark. There is a difference between having a centralized and decentralized structure and thus this research could be deepened to include how the innovation structure affects the commercialization aspects of cleantech.

The perceptions provided by the interviewed people can be expanded by interviewing more people from the organizations as to conduct further data triangulation. This also includes the users of the cleantech environment which could be polled to provide a view of how the mechanisms and programmes are being utilized practically. TTO's attached to universities could also be contacted as they are working with commercialization of technology and might provide valuable insight. Additionally, the agencies in both countries could be further probed to learn how they operate and interact with the other actors to yield a more complete picture of the part they play in the innovation system.

The last area of future research could be to include the Swedish innovation system and compare that to the existing findings. Sweden provides its own unique insight to the commercialization process as it has over twice the population of Norway albeit a cleantech environment that is not as efficient as the Danish. Sweden places itself in the middle and serves as a different scenario that can be analysed for Norway to improve the commercialization of cleantech.

6.5 Further Research market and industry findings

This theme covers how the research can be adjusted to include market- and industry issues

The Norwegian government spends more money overall than the Danish and does not perform as well. This indicates there are other factors than pure expenditure that affects the commercialization of cleantech. The project had the focus of explaining it through Triple Helix analysis of technology push mechanisms albeit some areas were uncovered throughout the project that gives rise for other ventures to research.

It was learned that the industry actor is weak in Norway, which is a difference between Norway and Denmark. The presence of a weak industry actor presents a new area of study that can be used. The existing industry can be interviewed to further learn how they experience the environment and how they would like the government to improve the commercialization of cleantech. Furthermore, the government could be analyzed on how to improve in terms of the Triple Helix theory by improving the mechanisms for both SMEs and large industries and/or taking on the role of the industry. Another area is in the intellectual knowledge generation since Norway generates less intellectual property than Denmark.

Furthermore, the national statistics indicates that the R&D contribution from the Norwegian industry consists primarily of SMEs in comparison to Denmark, and other Nordic countries, where it is large companies. There has not been found any conclusive information on how this situation affects cleantech commercialization and presents a new area for study.

The focus on this study has been on the interactions and effort from the government towards the academia and industry sphere. A logical next step is to consider the other two spheres and inquire on how they perceive and use the mechanisms available, their opinions on the findings, how they use the mechanisms for themselves or for inter-relationships and their input on how to improve the innovation system.

The last point raised is the impact that the home market allegedly has on commercialization of cleantech versus going abroad to the international market. It was acquired that both Norway and Denmark collaborates with other countries for commercialization of cleantech and as such it presents an interesting study to research if markets abroad could substitute the Norwegian lack of home market and if so, how.

7 Conclusion

The purpose of this report was to evaluate if Norway could do to improve the commercialization of cleantech through the use of technology-push mechanisms offered by the state. This was done by benchmarking the Norwegian innovation system with Denmark system through an exploratory and descriptive study that analyzes its finding with the Triple Helix theory by Henry Etzkowitz on how to optimize innovation systems and the commercialization model of Vijay Jolly. This theoretically based analysis and comparison seeks out to answer the research question:

> *"How can Norway improve the innovation and commercialization of cleantech from the government's perspective?"*

The analysis has found that Norway and Denmark focus almost equally across the whole commercialization spectrum except that Norway focus more on the early stages of the commercialization process with Denmark focusing more on the later stages. The most challenging stage for Norway is the demonstration phase where they have a limited number of successful projects.

In regards to the triple helix theory, Denmark has a balance of mechanisms that encourage the formation of innovation, consensus and knowledge spaces than Norway. Norway's focus is skewed towards knowledge and innovation spaces. The Danish mechanisms have a higher criteria and demand for collaboration between all three actors than Norway and had a higher tendency to restrict some of the actors from accessing mechanisms. Furthermore, some of the industry focus in Denmark is targeted specifically towards Small-Medium-Enterprises.

Additional findings indicate that Norway has both a weak industry sphere and a weak home market, which has a negative influence on the commercialization process.
Thus, to answer the research question of how Norway could improve the commercialization of cleantech: Norway could improve by having the state find ways to take on the role of the industry actor until at a time where the industry is able to take up the mantle themselves. Furthermore, Norway could focus on encouraging the development of more consensus and innovation spaces. Lastly, Norway could focus on creating more mechanisms that require collaboration between the three actors and that directly support young SMEs with a demonstrated ambition for growth.

References

ALMEIDA, M. 2005. The evolution of the incubator movement in Brazil. *International Journal of Technology and Globalisation,* 1**,** 258-277.

ALMEIDA, M., MELLO, J. M. C. D. & ETZKOWITZ, H. 2012. Social innovation in a developing country: invention and diffusion of the Brazilian cooperative incubator. *International Journal of Technology and Globalisation,* 6**,** 206-224.

ARCHER, G. L. 1971. *History of Radio to 1926*, Arno Press.

ARROW, K. J. 1962. The economic implications of learning by doing. *The review of economic studies***,** 155-173.

ARTHUR, W. B. 2007. The structure of invention. *Research Policy,* 36**,** 274-287.

AUDRETSCH, D. B. 2003. Standing on the shoulders of midgets: The US Small Business Innovation Research program (SBIR). *Small Business Economics,* 20**,** 129-135.

BATELLE 2012. 2013 Global R&D Funding Forecast R&D Magazine

BERGEK, A., JACOBSSON, S., CARLSSON, B., LINDMARK, S. & RICKNE, A. 2008. Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy,* 37**,** 407-429.

BIERNACKI, P. & WALDORF, D. 1981. Snowball Sampling: Problems and Techniques of Chain Referral Sampling. *Sociological Methods & Research,* 10**,** 141-163.

BRIGHT, J. R. 1978. *Practical technology forecasting: Concepts and exercises*, Industrial Management Center.

BUSH, V. 1945a. As we may think.

BUSH, V. 1945b. Science, the endless frontier: A report to the President. US Govt. print. off.(Washington).

CARAYANNIS, E. G. & CAMPBELL, D. F. 2009. 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management,* 46**,** 201-234.

CHIDAMBER, S. R. & KON, H. B. 1994. A research retrospective of innovation inception and success: the technology-push, demand-pull question. *International Journal of Technology Management,* 9**,** 94-112.

CHRISTENSEN, T. A., FROSCH, H., JENSEN, D. B., MARK, M. & KNUDSEN, A. B. 2014. Economic impacts of business investments in R&D in the nordic countries - a microeconomic analysis

COOPER, R. G. 2001. *Winning at new products: Accelerating the process from idea to launch*, Basic Books.

COPENHAGEN, U. O. 2014. *Definition of Cleantech* [Online]. Available: http://erhverv.ku.dk/english/ccc/cleantech_definition/ [Accessed 25/04 2014].

DOSI, G. 1982. Technological paradigms and technological trajectories: a suggested interpretation of the determinants and directions of technical change. *Research policy,* 11**,** 147-162.

DUTTA, S. & LANVIN, B. 2013. *The Global Innovation Index 2013: The Local Dynamics of Innovation*.

EDQUIST, C. 2005. Systems of innovation. *The Oxford handbook of innovation***,** 181-208.

ENERGI21. 2014. *Forside - Energi21* [Online]. Available: www.energi21.no [Accessed January 2014].

ENVIRONMENT, M. O. C. A. 2014. *Climate Change* [Online]. Available: http://www.regjeringen.no/en/dep/kld/Selected-topics/climate.html?id=1307 [Accessed 25/04 2014].

ETZKOWITZ, H. 2008. The triple helix: university-industry-government innovation in action. *London and New York: Routledge*.
ETZKOWITZ, H. & LEYDESDORFF, L. 2000. The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research policy*, 29**,** 109-123.
ETZKOWITZ, H. & RANGA, M. A triple Helix system for knowledge-based regional development: From "spheres" to "spaces". VIII Triple Helix Conference, Madrid, October, 2010.
EUROPEAN COMMISSION 2014. Investing in research European commision Euro.
FAGERBERG, J., VERSPAGEN, B. & MOWERY, D. C. 2008. Innovation-systems, path-dependency and policy: The co-evolution of science, technology and innovation policy and industrial structure in a small, resource-based economy.
FRANKEL, M. 1955. Obsolescence and technological change in a maturing economy. *The American Economic Review***,** 296-319.
FREEMAN, C. 1987. *Technology policy and economic performance: lessons from Japan*, Pinter Publishers London.
FREEMAN, C. 1994. The Economics of Technical Change. *Cambridge Journal of Economics*, 18**,** 463-514.
FREEMAN, C. & LOUÇA, F. 2001. *As time goes by: the information revolution and the industrial revolutions in historical perspective*, Oxford University Press.
GEOGHEGAN-QUINN, M. 2012. From Innovation Emergency to Economic Growth. Innovation Lecture. The Hague.
GREENBERG, D. S. 1966. " Hindsight": DOD Study Examines Return on Investment in Research. *Science*, 154**,** 872-873.
GRILICHES, Z. 1957. Hybrid corn: An exploration in the economics of technological change. *Econometrica, Journal of the Econometric Society***,** 501-522.
HICKS, J. R. 1963. The Theory of Wages. (1932). *and*, 245**,** 117.
HOWARD, W. G. 2010. *Profiting from innovation: the report of the three-year study from the National Academy of Engineering*, Simon and Schuster.
IIT 1968. Technology in retrospect and critical events in science (project TRACES). Illinois Institute of Technology (IIT) – National Science Foundation.
JOLLY, V. K. 1997. *Commercializing new technologies: getting from mind to market*, Harvard Business Press.
JONES, C. I. & WILLIAMS, J. C. 1998. Measuring the social return to R&D. *The Quarterly Journal of Economics*, 113**,** 1119-1135.
KLEINKNECHT, A. & VERSPAGEN, B. 1990. Demand and innovation: Schmookler re-examined. *Research Policy*, 19**,** 387-394.
KLEVORICK, A. K., LEVIN, R. C., NELSON, R. R. & WINTER, S. G. 1995. On the sources and significance of interindustry differences in technological opportunities. *Research policy*, 24**,** 185-205.
KLINE, S. J. & ROSENBERG, N. 1986. An overview of innovation. *The positive sum strategy: Harnessing technology for economic growth*, 275**,** 305.
LEWIS, J. I. & WISER, R. H. 2007. Fostering a renewable energy technology industry: An international comparison of wind industry policy support mechanisms. *Energy Policy*, 35**,** 1844-1857.
LICHTENBERG, F. R. 1986. Energy prices and induced innovation. *Research Policy*, 15**,** 67-75.
LUBAR, S. 1993. Technological Winners. *Science*, 260**,** 1166-1168.
MAZZUCATO, M. 2013. *The Entrepreneurial State: Debunking public vs. private sector myths*, Anthem Press.

MOWERY, D. & ROSENBERG, N. 1979. The influence of market demand upon innovation: a critical review of some recent empirical studies. *Research Policy,* 8**,** 102-153.
MYERS, S. & SWEEZY, E. E. 1978. Why innovations fail. *Technology Review,* 80**,** 40-46.
NELSON, R. R. & WINTER, S. G. 1977. In search of useful theory of innovation. *Research policy,* 6**,** 36-76.
NEMET, G. F. 2009. Demand-pull, technology-push, and government-led incentives for non-incremental technical change. *Research Policy,* 38**,** 700-709.
NVE. 2009. *Norwegian Water Resources and Energy Directorate* [Online]. Available: http://www.nve.no/en/Energy/.
OECD. 2014a. *Gross domestic product (GDP) MetaData* [Online]. Available: http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE1.
OECD. 2014b. *Main Science and Technology Indicators MetaData* [Online]. Available: http://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB.
OECD 2014c. Small businesses, job creation and growth: Facts, obstacles and best practices.
OVERGAARD, S. 2014. *Norway Takes The Lead In Electric Cars (With Generous Subsidies)* [Online]. NPR. Available: http://www.npr.org/blogs/parallels/2014/03/11/288611696/norway-takes-the-lead-in-electric-cars-with-generous-subsidies.
PENMAN, D. 2003. *First power station to harness Moon opens* [Online]. NewScientist. Available: http://www.newscientist.com/article/dn4188#.U2-HuSi2XwZ.
PERNICK, R. & WILDER, C. 2009. *The Clean Tech Revolution: Winning and Profiting from Clean Energy,* HarperCollins.
POPP, D. 2001. Induced innovation and energy prices. National Bureau of Economic Research.
RANGA, M. & ETZKOWITZ, H. 2013. Triple Helix systems: an analytical framework for innovation policy and practice in the Knowledge Society. *Industry and Higher Education,* 27**,** 237-262.
RESEARCH COUNCIL OF NORWAY 2013a. Midterm Evaluation of Centres

for Environment-friendly Energy Research (FME).
RESEARCH COUNCIL OF NORWAY 2013b. Report on Science & Technology Indicators for Norway.
ROSENBERG, N. 1969. The direction of technological change: inducement mechanisms and focusing devices. *Economic Development and Cultural Change***,** 1-24.
ROSENBERG, N. 1974. Science, invention and economic growth. *Economic Journal,* 84**,** 90-108.
ROSENBERG, N. 1994. *Exploring the black box: Technology, economics, and history,* Cambridge University Press.
SALMI, J. 2012. Attracting talent in a global academic world: How emerging research universities can benefit from brain circulation. *BRAIN CIRCULATION* Volume 2,.
SCHERER, F. M. 1982. Demand-pull and technological invention: Schmookler revisted. *The Journal of Industrial Economics***,** 225-237.
SCHMOOKLER, J. 1962. Economic sources of inventive activity. *The Journal of Economic History,* 22**,** 1-20.
SCHMOOKLER, J. 1966. Invention and economic growth.
SCHUMPETER 1942.
SCHUMPETER, J. A. 2013. *Capitalism, socialism and democracy,* Routledge.
SHERWIN, C. W. & ISENSON, R. S. 1967. Project hindsight. *Science,* 156**,** 1571-1577.
SIMON, H. A. 1959. Theories of decision-making in economics and behavioral science. *The American economic review***,** 253-283.

SINTEF. 2002. *Saline Aquifer CO2 Storage (SACS) - an offshore demonstration at the Sleipner field* [Online]. Available: http://www.sintef.no/Projectweb/IK-23430000-SACS/.
SOLOW, R. M. 1956. A contribution to the theory of economic growth. *The quarterly journal of economics,* 70**,** 65-94.
USHER, A. 1954. A history of mechanical inventions.
VERNON, R. 1966. International investment and international trade in the product cycle.
VINCE KNOWLES, S. H., RICHARD YOUNGMAN & AMANDA FAULKNER 2013. Coming Clean: The Global Cleantech Innovation Index 2012.
WALSH, V. 1984. Invention and Innovation in the Chemical Industry: Demand-pull or Discovery-push? *Research policy,* 13**,** 211-234.
WILSON, J. 2010. *Essentials of business research: A guide to doing your research project*, Sage.
YIN, R. K. 2009. *Case study research: Design and methods*, sage.

Appendix 1 - Commercialization Analysis

Consists of:

Appendix 1.1 Table with commercialization comparison

Appendix 1.2 Programmes overview for each sub-process

Appendix 1.3 Programmes per sub-process & budget

Appendix 1.4 Programmes application & Cooperation eligibility

Appendix 1.5 Programmes guarantee numbers

Appendix 1.6 Programmes by agency

Appendix 1.7 Breakdown of programmes application & cooperation eligibility by Sub-process

Mechanism Name	Imagining	Incubating	Demonstration	Promoting	Sustaining	Year	Budget ($)	Budget (NOK)	Eligible Applicants	Collaboration	Comment
Norway								0,17			Currency converter from NOK to $. Used at 30/04-2014
FORNY2020		P				2013	$20 696 469,29	NOK 121 743 937	No restrictions	No cooperation needed	
Continuation or escalation of ongoing or completed verification projects (FORNY2020)		P				2013	$1 190 000,00	NOK 7 000 000	No restrictions	No cooperation needed	
SkatteFUNN		P				2012	$340 000 000,00	NOK 2 000 000 000	All companies	No cooperation needed	
ENERGIX	P					2013	$65 110 000,00	NOK 383 000 000	No restrictions	No cooperation needed	
User-driven Research-based Innovation (BIA)	P					2012	$64 090 000,00	NOK 377 000 000	No restrictions	No cooperation needed	
INNOMOBI – Invitation to send in project ideas Part of the BIA program	P								* All companies	No cooperation needed	
CLIMIT-FoU (Forskningsrådet)	P					2012	$9 426 500,00	NOK 55 450 000	No restrictions	Optional cooperation	
CLIMIT-Demo (Gassnova)		P					$9 426 500,00	NOK 55 450 000	No restrictions	Optional cooperation	
Call for proposals for natural gas power plants and CO2 capture prototype and demonstration projects (CLIMIT)		P				2013			* No restrictions	No cooperation needed	
Support for the development of researchers and PhD students in CCS (CLIMIT)	P					2013			* All academics	Mandatory cooperation	
Support for events and conferences related to CCS (CLIMIT)	P					2013			* No restrictions	No cooperation needed	
FRIPRO	P					2013	$30 260 000,00	NOK 178 000 000	All academics	No cooperation needed	Only the budget for the FRITEK subprogram under FRIPRO was used since the other subprograms are not relevant to cleantech
Regional Research Funds	P					2012	$32 088 350,00	NOK 188 755 000	No restrictions	No cooperation needed	
Centres for Environment-friendly Energy Research (FME)	P					2012	$32 980 000,00	NOK 194 000 000	Consortium	Mandatory cooperation	
Industry-based PhD		P				2012	$19 380 000,00	NOK 114 000 000	Consortium	Mandatory cooperation	
International Stipend (IS)	P					2012	$3 570 000,00	NOK 21 000 000	All academics	Mandatory cooperation	
Support for pilot projects regarding energy use in industry (ongoing)		P				2013	$1 530 000,00	NOK 9 000 000	All companies	No cooperation needed	
Support for energy initiatives in industry					P	2013	$24 990 000,00	NOK 147 000 000	All companies	Optional cooperation	
Support for energy initiatives in facilities					P	2013	$680 000,00	NOK 4 000 000	No restrictions	No cooperation needed	
Support for energy efficient new buildings			P			2013	$63 750 000,00	NOK 375 000 000	No restrictions	No cooperation needed	

Support for energy initiatives in existing buildings				P	2013	$49 640 000,00	NOK 292 000 000	All companies	No cooperation needed	
Central heating from renewable sources				P	2013	$7 820 000,00	NOK 46 000 000	All companies	No cooperation needed	
Biogas Production			P		2013	$6 800 000,00	NOK 40 000 000	All companies	No cooperation needed	
District Heating			P		2013	$76 160 000,00	NOK 448 000 000	All companies	No cooperation needed	
Support for the use of new energy and climate technology in industry		P			2013	$15 810 000,00	NOK 93 000 000	All companies	No cooperation needed	
Support for the introduction of new technology		P			2013	$8 755 000,00	NOK 51 500 000	All companies	No cooperation needed	
Support for the use of new technology in "future buildings"		P			2013	$5 270 000,00	NOK 31 000 000	All companies	No cooperation needed	
General company and project support	P				2012	$251 431 715,30	NOK 1 479 010 090	All companies	No cooperation needed	
Establishment Grants	P				2012	$4 188 290,00	NOK 24 637 000	All companies	No cooperation needed	
Research and development grants	P				2012	$16 396 055,28	NOK 96 447 384	All companies	Mandatory cooperation	
Bioenergy program – bio-heat, biogas and wood chip production			P		2012	$9 860 000,00	NOK 58 000 000	All companies	Optional cooperation	
Environmental scheme: Grant program for future solutions		P			2012	$43 690 000,00	NOK 257 000 000	No restrictions	No cooperation needed	
International office support			P				*	All companies	No cooperation needed	
Mentor services	P					$4 981 000,00	NOK 29 300 000	SME	No cooperation needed	
National Centers of Excellence (with Norwegian Research Council and Innovation Norway)	P				2012	$13 022 000,00	NOK 76 600 000	Consortium	Mandatory cooperation	
Arena Program (with Norwegian Research Council and Innovation Norway)	P				2012	$7 140 000,00	NOK 42 000 000	Consortium	Mandatory cooperation	The Arena and NCE programs were provided 140 mill NOK in 2013 from the state. This amount was assumed to be split evenly between the programs.
Siva International Networks			P				*	All companies	No cooperation needed	
Export credits and guarantees			P		2013		NOK 24 169 000 000	All companies	No cooperation needed	Will be compared in a separate chart along with similar mecanisms due to sheer size.
Export Credits Norway			P		2012		NOK 24 217 000 000	All companies	No cooperation needed	Will be compared in a separate chart along with similar mecanisms due to sheer size.
Competence Grants – Sustainable housing and buildings	P				2013	$2 821 660,00	NOK 16 598 000	All companies	No cooperation needed	
Grants for developing charging stations for electric cars		P			2014	$3 060 000,00	NOK 18 000 000	All companies	No cooperation needed	

Support for projects that further climate friendly transport solutions		P				2013	$1 620 375,40	NOK 9 531 620	All companies	No cooperation needed
Norad - Application support to businesses					P	2012	$321 300 000,00	NOK 1 890 000 000	All companies	No cooperation needed
Number of P	12	13	6	7	5	43				
Denmark								0,19		Currency converter from DKK to $. Used at 30/04-2014
1. Financing of projects in developing countries.				P		2013	$121 030 000,00	DKK 637 000 000	All companies	No cooperation needed
2. Guarantee which makes it easier to obtain loan and credit.					P	2013	$61 180 000,00	DKK 322 000 000	SME	No cooperation needed
3. Loan which supplements risk-willing capital.		P				2013	$9 310 000,00	DKK 49 000 000	Small-companies	No cooperation needed
4. Loan for green investments					P	2013	$18 620 000,00	DKK 98 000 000	SME	No cooperation needed
5. Subsidies for hightechnological industrial postdoc projects		P				2013	$121 600 000,00	DKK 640 000 000	All companies	Mandatory cooperation
6. Subsidies for initiatives which promote employment in Bornholm	P					2013	$76 000,00	DKK 400 000	No restrictions	No cooperation needed
7. Subsidies for test and adjustment of innovative products.			P			2013	$25 650 000,00	DKK 135 000 000	All companies Consortium	Optional cooperation
8. Subsidies for development of cleansing technology to soil pollution		P				2013	$1 064 000,00	DKK 5 600 000	All companies Public actors	Optional cooperation
9. Subsidies for development and demonstration in the food industry		P				2013	$34 580 000,00	DKK 182 000 000	No restrictions	Optional cooperation
10. Guidance for cleantech companies in region Zealand.	P					2013	$27 170 000,00	DKK 143 000 000	No restrictions	No cooperation needed
12. Risk-willing capital to innovative entrepreneurs - innovation environments.		P				2013	$1 140 000,00	DKK 6 000 000	Small-companies	No cooperation needed
13. Network for companies who works with cleantech.	P					2013	$2 660 000,00	DKK 14 000 000	No restrictions	No cooperation needed
14. Network for Transport companies	P					2013	$14 440 000,00	DKK 76 000 000	No restrictions	No cooperation needed
16. Subsidies and guidance for partnerships in developing countries.				P		2013	$48 830 000,00	DKK 257 000 000	Consortium	Mandatory cooperation
17. Subsidies for collaboration on innovation projects	P					2013	$19 000 000,00	DKK 100 000 000	Consortium	Mandatory cooperation
18. Guidance for companies and entrepreneurs.	P							*	No restrictions	No cooperation needed
19. Guidance on growth and business development		P						*	Small-companies	No cooperation needed
20. Counselling on export, stakeholder management and trade policy.				P				*	No restrictions	No cooperation needed
21.Subsidies to employ a highly educated employee.					P	2013	$10 070 000,00	DKK 53 000 000	Small-companies Medium companies	Mandatory cooperation
22. Subsidies to employ a Ph.D student		P				2013	$23 902 000,00	DKK 125 800 000	No restrictions	Mandatory cooperation

23. Subsidies for research collaboration and purchase of knowledge.		P			2013	$4 750 000,00	DKK 25 000 000	SME	Mandatory cooperation	
24. Industry aimed knowledge collaboration between region Mid-Jutland and Shanghai				P	2013	$570 000,00	DKK 3 000 000	Consortium	Mandatory cooperation	
25. Counselling on export			P				*	SME	No cooperation needed	
26. Counselling on export for SMVs			P				*	SME	No cooperation needed	
27. Subsidies for shared export push.			P				*	Consortium	Mandatory cooperation	
28. Loan and financing for commercial development on Bornholm		P			2013	$20 520 000,00	DKK 108 000 000	No restrictions	No cooperation needed	
29. Loan and financing for innovation and developments projects in region Northern Jutland		P			2013	$11 400 000,00	DKK 60 000 000	No restrictions	No cooperation needed	
30. Loan for finance of growth plans.				P	2013	$218 500 000,00	DKK 1 150 000 000	SME	No cooperation needed	
31. Network for companies and large European research facilities	P				2013	$2 090 000,00	DKK 11 000 000	No restrictions	Mandatory cooperation	
32. Guidance for inventors	P				2013		*	No restrictions	No cooperation needed	
33. Guidance on innovation and technology	P				2013	$3 800 000,00	DKK 20 000 000	SME	No cooperation needed	
34. Counselling on growth opportunities abroad.			P				*	SME	No cooperation needed	
35. Guarantee for innovative products.			P		2013	$25 650 000,00	DKK 135 000 000	No restrictions	No cooperation needed	
37. Grant for growth in Midt-Jutlandic companies				P	2013	$23 085 000,00	DKK 121 500 000	SME	No cooperation needed	
39. Subsidies for financing of projects in developing countries.			P		2013	$66 500 000,00	DKK 350 000 000	No restrictions	Mandatory cooperation	
40. Guarantee for credit for SMVs.			P		2013	$4 750 000,00	DKK 25 000 000	SME	No cooperation needed	
41. Re-assurance of export companie's credit.				P	2013		DKK 8 400 000 000	No restrictions	No cooperation needed	Will be compared in a separate chart along with similar mecanisms due to sheer size.
42. Hotline - Guidance about export.	P						*	No restrictions	No cooperation needed	
43. Guarantee for credit and guarantees for export.			P		2013		DKK 8 400 000 000	All companies	No cooperation needed	Will be compared in a separate chart along with similar mecanisms due to sheer size.
44. Loan for export companies			P		2013		DKK 20 000 000 000	All companies	No cooperation needed	Will be compared in a separate chart along with similar mecanisms due to sheer size.
Danmarks Grundforskningfond	P				2013	$83 220 000,00	DKK 438 000 000	No restrictions	No cooperation needed	
MUDP		P			2013	$13 300 000,00	DKK 70 000 000	No restrictions	Optional cooperation	

EUDP		P				2013	$71 250 000,00	DKK 375 000 000	No restrictions / Optional cooperation
Number of P	11	12	3	10	7	43			
Comparison									
Norway						Total			
Number of P	12	13	6	7	5	43			
Denmark									
Number of P	11	12	3	10	7	43			

* Denotes that no currency was available to be found

Notes

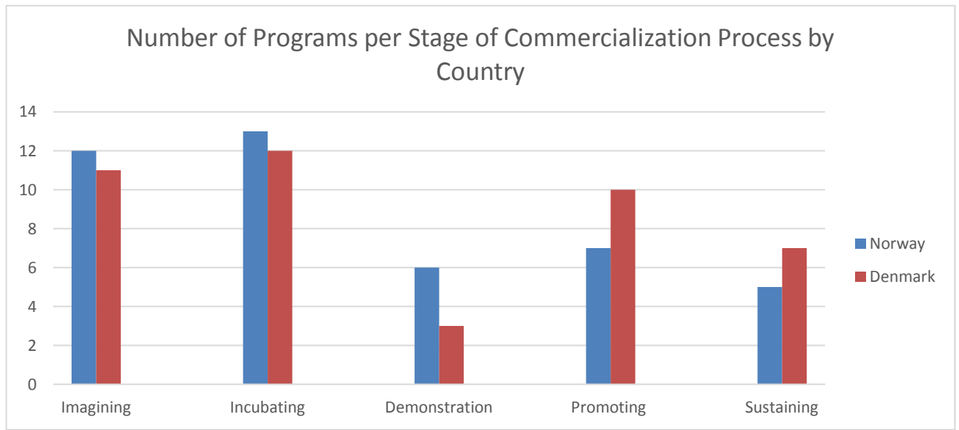
Mechanisms category by sub-process

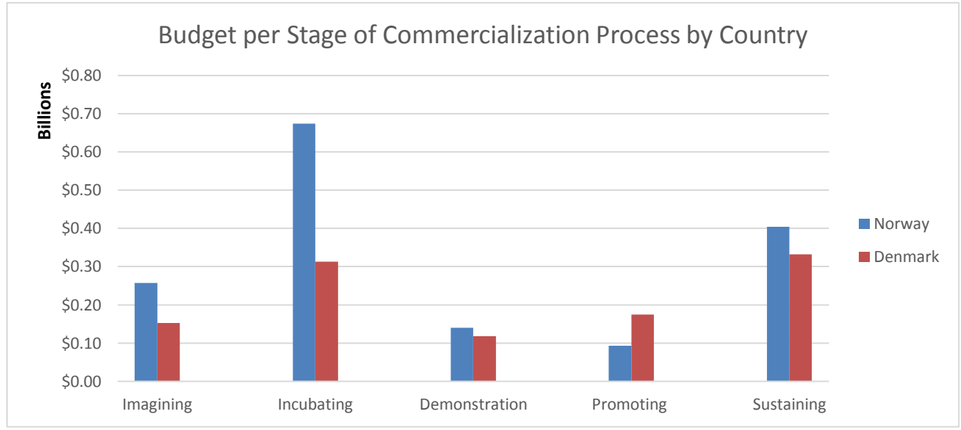
Country	Imagining	Incubating	Demonstration	Promoting	Sustaining
Norway	ENERGIX	FORNY2020	Support for energy efficient new buildings	Biogas Production	Support for energy initiatives in industry
	User-driven Research-based Innovation (BIA)	Continuation or escalation of ongoing or completed verification projects (FORNY2020)	Support for the use of new energy and climate technology in industry	District Heating	Support for energy initiatives in facilities
	INNOMOBI – Invitation to send in project ideas Part of the BIA program	SkatteFUNN	Support for the introduction of new technology	Bioenergy program – bio-heat, biogas and wood chip production	Support for energy initiatives in existing buildings
	CLIMIT-FoU (Forskningsrådet)	CLIMIT-Demo (Gassnova)	Support for the use of new technology in “future buildings”	International office support	Central heating from renewable sources
	Support for the development of researchers and PhD students in CCS (CLIMIT)	Call for proposals for natural gas power plants and CO2 capture prototype and demonstration projects (CLIMIT)	Environmental scheme: Grant program for future solutions	Siva International Networks	Norad - Application support to businesses
	Support for events and conferences related to CCS (CLIMIT)	Industry-based PhD	Grants for developing charging stations for electric cars	Export credits and guarantees	
	FRIPRO	Support for pilot projects regarding energy use in industry (ongoing)		Export Credits Norway	
	Regional Research Funds	General company and project support			
	Centres for Environment-friendly Energy Research (FME)	Establishment Grants			
	International Stipend (IS)	Research and development grants			
	National Centers of Excellence (with Norwegian Research Council and Innovation Norway)	Mentor services			
	Arena Program (with Norwegian Research Council and Innovation Norway)	Competence Grants – Sustainable housing and buildings			
		Support for projects that further climate friendly transport solutions			
Denmark	6. Subsidies for initiatives which promote employment in Bornholm	3. Loan which supplements risk-willing capital.	7. Subsidies for test and adjustment of innovative products.	1. Financing of projects in developing countries.	2. Guarantee which makes it easier to obtain loan and credit.
	10. Guidance for cleantech companies in region Zealand.	5. Subsidies for hightechnological industrial postdoc projects	35. Guarantee for innovative products.	16. Subsidies and guidance for partnerships in developing countries.	4. Loan for green investments
	13. Network for companies who works with cleantech.	8. Subsidies for development of cleansing technology to soil pollution	39. Subsidies for financing of projects in developing countries.	20. Counselling on export, stakeholder management and trade policy.	21.Subsidies to employ a highly educated employee.
	14. Network for Transport companies	9. Subsidies for development and demonstration in the food industry		25. Counselling on export	24. Industry aimed knowledge collaboration between region Mid-Jutland and Shanghai
	17. Subsidies for collaboration on innovation projects	12. Risk-willing capital to innovative entrepreneurs - innovation environments.		26. Counselling on export for SMVs	30. Loan for finance of growth plans.
	18. Guidance for companies and entrepreneurs.	19. Guidance on growth and business development		27. Subsidies for shared export push.	37. Grant for growth in Midt-Jutlandic companies
	31. Network for companies and large European research facilities	22. Subsidies to employ a Ph.D student		34. Counselling on growth opportunities abroad.	41. Re-assurance of export companie's credit.
	32. Guidance for inventors	23. Subsidies for research collaboration and purchase of knowledge.		40. Guarantee for credit for SMVs.	
	33. Guidance on innovation and technology	28. Loan and financing for commercial development on Bornholm		43. Guarantee for credit and guarantees for export.	
	42. Hotline - Guidance about export.	29. Loan and financing for innovation and developments projects in region Northern Jutland		44. Loan for export companies	
	Danmarks Grundforskningfond	MUDP			
		EUDP			

Appendix 1.3

Programs per stage + Budget

	Imagining		Incubating		Demonstration		Promoting		Sustaining	
	Norway	Denmark	Norway	Denmark	Norway	Denmark	Norway	Denmark	Norway	Denmark
Number	12	11	13	12	6	3	7	10	5	7
Budget (millions)	257686850	152456000	673662065	312816000	140335000	117800000	92820000	174610000	404430000	3.3E+08
Percentage of total budget	0.16424328	0.1399055	0.4293757	0.28706432	0.08944609	0.1081025	0.059161192	0.160235733	0.2577738	0.30469

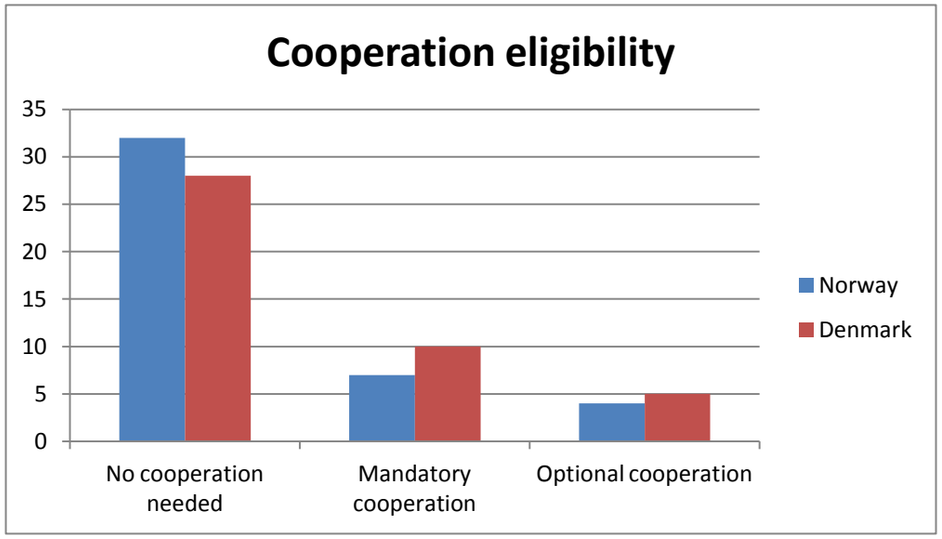


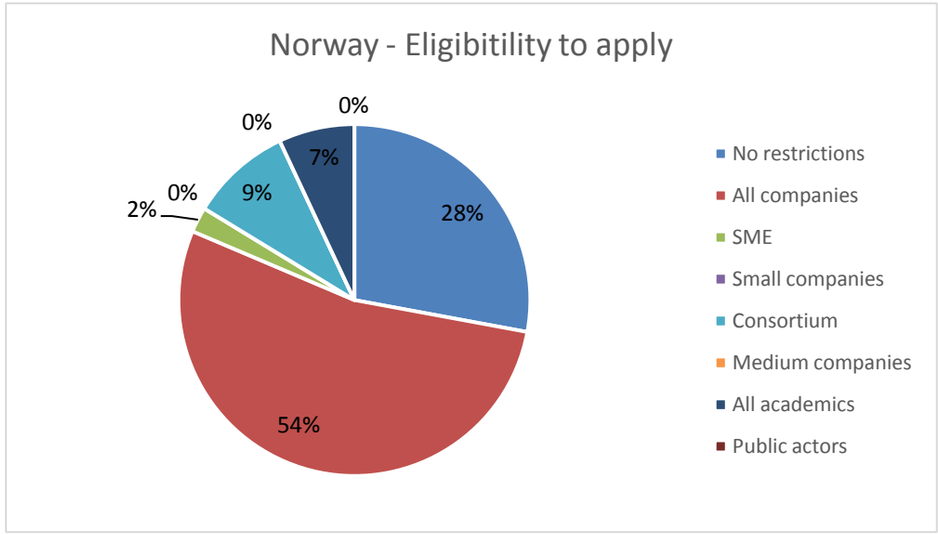


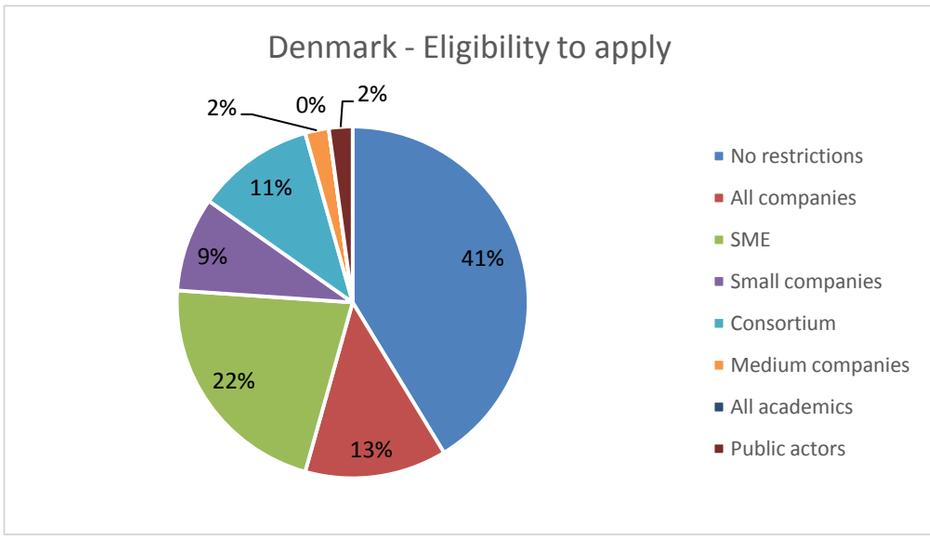
Eligibility + Cooperation

Eligibility to apply	Norway - Eligibitility to apply	Denmark - Eligibility to apply
No restrictions	12	19
All companies	23	6
SME	1	10
Small companies	0	4
Consortium	4	5
Medium companies	0	1
All academics	3	0
Public actors	0	1

Cooperation eligibility	Norway	Denmark
No cooperation needed	32	28
Mandatory cooperation	7	10
Optional cooperation	4	5







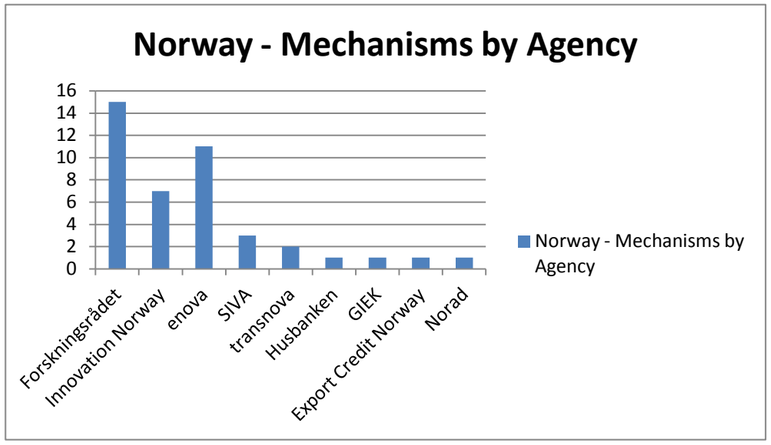
Name	Budget	Commercialization stage
Export credits and guarante	NOK 24,169,000,000	Promoting
Export Credits Norway	NOK 24,217,000,000	Promoting
Total	NOK 48,386,000,000	0.17
Dollars	$ 8,225,620,000.00	Currency converter used from "Primary data"
41. Re-assurance of export (	DKK 8,400,000,000	Sustaining
43. Guarantee for credit an(	DKK 8,400,000,000	Promoting
44. Loan for export compan	DKK 20,000,000,000	Promoting
Total	DKK 36,800,000,000	0.19
Dollars	$ 6,992,000,000.00	Currency converter used from "Primary data"

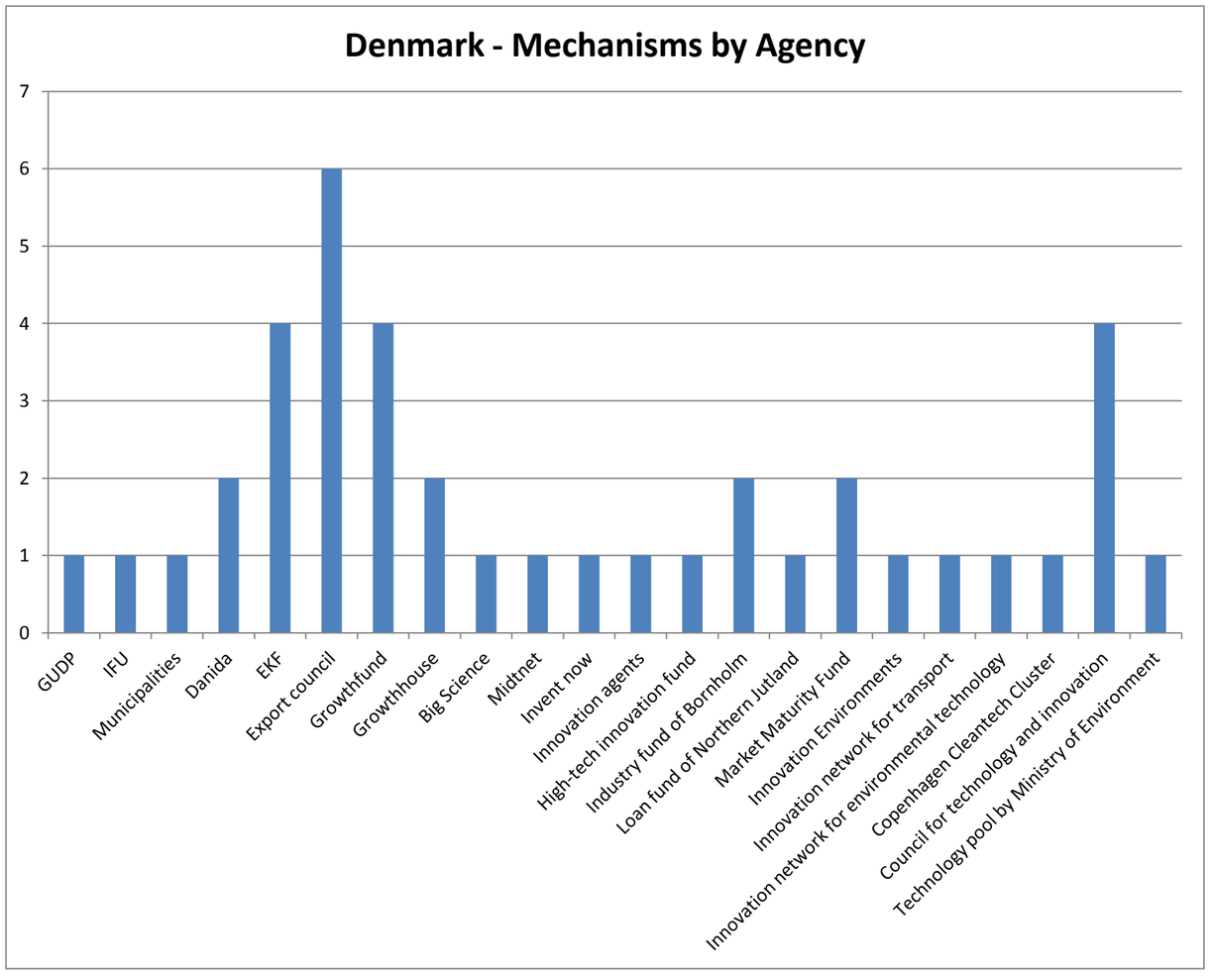
Appendix 1.6

Mechanisms by agency

Norway - Mechanisms by Agency	
Forskningsrådet	15
Innovation Norway	7
enova	11
SIVA	3
transnova	2
Husbanken	1
GIEK	1
Export Credit Norway	1
Norad	1

Denmark - Mechanisms by Agency	
GUDP	1
IFU	1
Municipalities	1
Danida	2
EKF	4
Export council	6
Growthfund	4
Growthhouse	2
Big Science	1
Midtnet	1
Invent now	1
Innovation agents	1
High-tech innovation fund	1
Industry fund of Bornholm	2
Loan fund of Northern Jutland	1
Market Maturity Fund	2
Innovation Environments	1
Innovation network for transport	1
Innovation network for environmental technology	1
Copenhagen Cleantech Cluster	1
Council for technology and innovation	4
Technology pool by Ministry of Environment	1

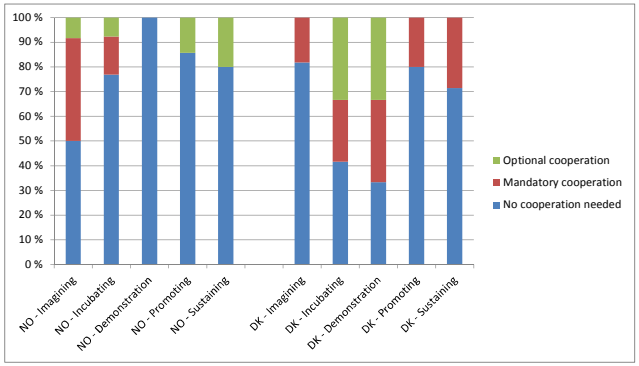


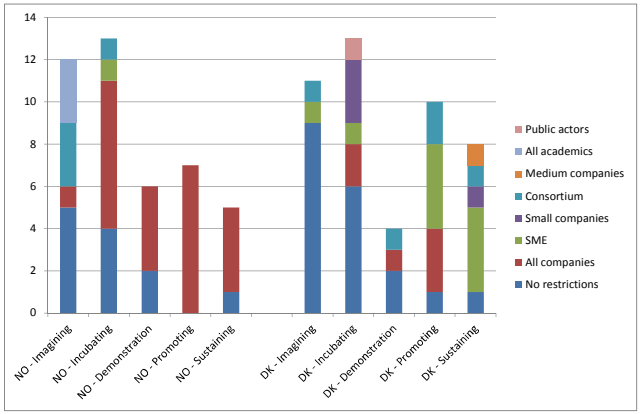


Breakdown of Programme Application and Cooperation Eligibility

	No restrictions	All compar	SME	Small com	Consortiur	Medium c	All acaden	Public acto		No cooper	Mandaton	Optional c	
NO - Imagining	5	1	0	0	3	0	3	0	NO - Imag	6	5	1	
NO - Incubating	4	7	1	0	1	0	0	0	NO - Incub	10	2	1	
NO - Demonstration	2	4	0	0	0	0	0	0	NO - Dem	6	0	0	
NO - Promoting	0	7	0	0	0	0	0	0	NO - Prom	6	0	1	
NO - Sustaining	1	4	0	0	0	0	0	0	NO - Susta	4	0	1	
								43					43

	No restrictions	All compar	SME	Small com	Consortiur	Medium c	All acaden	Public acto		No cooper	Mandaton	Optional c	
DK - Imagining	9	0	1	0	1	0	0	0	DK - Imagi	9	2	0	
DK - Incubating	6	2	1	3	0	0	0	1	DK - Incub	5	3	4	
DK - Demonstration	2	1	0	0	1	0	0	0	DK - Demo	1	1	1	
DK - Promoting	1	3	4	0	2	0	0	0	DK - Prom	8	2	0	
DK - Sustaining	1	0	4	1	1	1	0	0	DK - Susta	5	2	0	
								46					43





Appendix 2 - Triple Helix Analysis

Consists of:

Appendix 2.1 Triple Helix Analysis table

Appendix 2.2 Triple Helix roles taken by programs

Appendix 2.3 Triple Helix spaces related to programs

Appendix 2.4 Triple Helix programs with regional focus

Appendix 2.5 Triple Helix interactions from government

Appendix 2.6 Triple Helix relationships for programmes

Mechanism	Type of Action	Governmental Interaction	Regional Focus	Field of Focus	Related Space	Relationships
Norwegian Research Council (Forskningsrådet) FORNY2020	Empowering Industry Entrepreneurial Support	Direct interaction with industry in order to support the commercialization of technology.	No specific regional focus	All technologies	Knowledge Space Innovation Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Continuation or escalation of ongoing or completed verification projects (FORNY2020)	Empowering Industry	Direct interaction with industry to support ongoing demonstration or verification projects.	No specific regional focus	All technologies	Knowledge Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) SkatteFUNN	Tax Incentives	Interaction with industry in order to encourage increased R&D in industry.	No specific regional focus	All technologies	None	Collaborative leadership
Norwegian Research Council (Forskningsrådet) ENERGIX	Basic R&D Funding Empowering Industry Entrepreneurial Support	Interaction with academia and industry in order to support R&D projects in the field of cleantech. Either industry or academia can apply or both can apply together.	No specific regional focus	The main priority areas are renewable energy, smart energy systems, energy use and conversion, new energy concepts and energy policy, society and economics.	Knowledge Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) User-driven Research-based Innovation (BIA)	Basic R&D Funding Empowering Industry Entrepreneurial Support	Interaction with academia and industry in order to support R&D projects in general. Either industry or academia can apply or both can apply together.	No specific regional focus	No priority area, supports projects not already supported under other programs.	Knowledge Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Innovation counselling and mobilisation (INNOMOBI) – Invitation to send in project ideas Part of the BIA program	Empowering Industry	Interaction with academia and industry to support the development of interesting ideas into viable R&D projects.	No specific regional focus	No priority area	None	Collaborative leadership
Norwegian Research Council (Forskningsrådet) CLIMIT	Basic R&D Funding Empowering Industry Entrepreneurial Support	Interaction with academia and industry in order to support R&D projects in carbon capture and storage (CCS). Either industry or academia can apply or both can apply together.	No specific regional focus	The program is focused on new innovative solutions that can yield considerable cost reductions and increased safety; areas where Norway or Norwegian players have advantages in CCS; and CCS in Norwegian industry for major carbon dioxide point sources.	Knowledge Space Innovation Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Call for proposals for natural gas power plants and CO2 capture prototype and demonstration projects (CLIMIT)	Empowering Industry Entrepreneurial Support	Interaction with industry to support the development of CCS demonstration projects.	No specific regional focus	Demonstration projects for CCS technology	Innovation Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Support for the development of researchers and PhD students in CCS (CLIMIT)	Basic R&D Funding Empowering Industry	Interaction with academia to support the development of knowledge.	No specific regional focus	CCS technology and research	Knowledge Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Support for events and conferences related to CCS (CLIMIT)	Basic R&D Funding Empowering Industry	Interaction with both academia and industry supporting networking of all three spheres at new events.	No specific regional focus	CCS technology and research	Knowledge Space	Network
Norwegian Research Council (Forskningsrådet) FRIPRO	Basic R&D Funding	Interaction with academia to allow individual researchers to pursue quality research.	No specific regional focus	All technologies	Knowledge Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) Centres for Environmentally-friendly Energy Research (FME)	Basic R&D Funding	Actively requires the interaction of academia, government and industry in a single centre where research and demonstration projects are conducted.	No specific regional focus	Environmentally-friendly Energy and CCS	Consensus space Knowledge Space	Collaboration and conflict moderation

Norwegian Research Council (Forskningsrådet) Industry-based PhD	Basic R&D Funding Empowering Industry	Encourages the interaction of industry and academia.	No specific regional focus	All technologies	Knowledge Space Innovation Space	Collaborative leadership
Norwegian Research Council (Forskningsrådet) International Stipend (IS)	Basic R&D Funding	Encourages the development knowledge and networks with the academic sphere	No specific regional focus	All technologies	Knowledge Space	Network
Regional Research Funds	Basic R&D Funding Empowering Industry	Encourages partnerships with industry, government offices and academic actors.	Control of the funds is given to the boards for each of the seven research funds. They set their own strategies. Forskningsrådet reviews the performance of each fund annually.	The field of focus is dependent on each region's strategy. For example, the Oslofjord fund focuses on energy and environment; welfare, health and care; education and learning; travel; and technology.	Consensus space Knowledge Space	Collaboration and conflict moderation
enova Support for pre-projects regarding energy use in industry (ongoing)	Empowering Industry Entrepreneurial Support	Encourages the start of energy efficiency initiatives within the industry sphere	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaboration and conflict moderation
enova Support for energy initiatives in industry	Empowering Industry Entrepreneurial Support	Encourages industry to take action to reduce energy use.	No specific regional focus	Technologies that can help reduce energy use in industry and industrial processes	Innovation Space	Collaborative leadership
Enova Support for energy initiatives in facilities	Empowering Industry Entrepreneurial Support	Encourages industry to take action to reduce energy use.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Support for energy efficient new buildings	Empowering Industry Entrepreneurial Support	Encourages industry to take action to reduce energy use.	No specific regional focus	Technologies that can be used in the construction of energy efficient buildings	Innovation Space	Collaborative leadership
enova Support for energy initiatives in existing buildings	Empowering Industry Entrepreneurial Support	Encourages industry to take action to reduce energy use.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Central heating from renewable sources	Empowering Industry Entrepreneurial Support	Encourages industry to take action to use central heating facilities that reduce energy use and greenhouse gas emissions.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Biogas Production	Empowering Industry Entrepreneurial Support	Encourages industry to take action to develop biogas related facilities .	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova District Heating	Empowering Industry Entrepreneurial Support	Encourages industry to take action to use or install district heating facilities.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Support for the use of new energy and climate technology in industry	Empowering Industry Entrepreneurial Support	Encourages the testing and use of new, unproven technologies to reduce energy use or greenhouse gas emissions.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Support for the introduction of new technology	Empowering Industry Entrepreneurial Support	Encourages the testing and use of new, unproven technologies to reduce energy use or greenhouse gas emissions.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
enova Support for the use of new technology in “future buildings”	Empowering Industry Entrepreneurial Support	Encourages the testing and use of new, unproven technologies to reduce energy use or greenhouse gas emissions.	No specific regional focus	Technologies that can help reduce energy use in buildings	Innovation Space	Collaborative leadership
Innovation Norway General company and project support	Entrepreneurial Support	Encourages industry to take on new projects in order to grow or reach international markets.	No specific regional focus	All technologies	Innovation space	Substitution
Innovation Norway Establishment Grants	Entrepreneurial Support	Encourages the creation of innovative, high growth firms (Industry)	No specific regional focus	All technologies	None	Collaborative leadership
Innovation Norway Research and development grants	Basic R&D Funding Empowering Industry	Encourages small and medium sized companies to conduct research and development projects with the intention of eventually entering an international market. Also encourages the partnership between multiple companies.	No specific regional focus	All technologies	Knowledge Space	Collaborative leadership

Innovation Norway Environmental scheme: Grant program for future solutions	Basic R&D Funding Empowering Industry	Encourages industry to undertake cleantech demonstration or pilot projects. Collaboration with other companies is encouraged.	No specific regional focus	Environmental technologies	Knowledge Space	Collaborative leadership
Innovation Norway Bioenergy program – bio-heat, biogas and wood chip production	Empowering Industry	Encourages industry, specifically agricultural and forestry actors, to undertake bioenergy projects.	No specific regional focus	Bioenergy	Innovation Space	Collaborative leadership
Innovation Norway International office support	Entrepreneurial Support	Provides support to industry actors regarding international markets including networking and information.	No specific regional focus	All technologies	None	Collaboration and conflict moderation
Innovation Norway Mentor services	Entrepreneurial Support	Provides support and mentorship to new companies to increase their chances of success.	No specific regional focus	All technologies	None	Collaboration and conflict moderation
SIVA National Centers of Excellence (with Norwegian Research Council and Innovation Norway)	Basic R&D Funding Empowering Industry Entrepreneurial Support	Actively requires the interaction of academia, government and industry in a single centre where research and demonstration projects are conducted.	No specific regional focus	All technologies	Consensus space Knowledge space Innovation space	Collaboration and conflict moderation
SIVA Arena Program (with Norwegian Research Council and Innovation Norway)	Basic R&D Funding Empowering Industry Entrepreneurial Support	Actively requires the interaction of academia, government and industry in a single centre where research and demonstration projects are conducted.	No specific regional focus	All technologies	Knowledge Space Innovation Space	Collaboration and conflict moderation
SIVA Siva International Networks	Entrepreneurial Support	Helps industry actors get a foothold in other countries, build networks and generally learn about the new market.	No specific regional focus	All technologies	None	Network
GIEK Export credits and guarantees	Empowering Industry	Supports industry actor's access to international markets.	No specific regional focus	All technologies	None	Substitution
Husbanken Competence Grants – Sustainable housing and buildings	Empowering Industry	Encourages partnerships between industry and government in order to construct sustainable houses and buildings.	No specific regional focus	Technologies related to sustainable buildings	Innovation space	Collaborative leadership
Export Credit Norway	Empowering Industry	Supports industry actor's access to international markets.	No specific regional focus	All technologies	None	Substitution
transnova Grants for developing charging stations for electric cars	Empowering Industry	Encourages the construction of infrastructure that will support the use of electrical cars in Norway. Only industry actors are eligible to apply.	No specific regional focus	Electric Cars	None	Collaborative leadership
transnova Support for projects that further climate friendly transport solutions	Empowering Industry	Encourages the testing and demonstration of new transportation technologies by industry with the aim of reducing GHG emissions from transportation sector.	No specific regional focus	Transportation related technologies	Innovation space	Collaborative leadership
Norad Application support to businesses	Empowering Industry	Encourages to expand to or invest in projects in developing countries.	No specific regional focus	All technologies	None	Collaborative leadership

IFU Ministry of foreign affairs of Denmark Financing of projects in developing countries.	Entrepreneurial Support Empowering industry	A private-public industry interaction with investment partners in which the applicant bears co-responsibility	No specific regional focus	All technologies	Consensus space Knowledge space Innovation space	Collaborative leadership
Danida Ministry of foreign affairs of Denmark Subsidies for financing of projects in developing countries.	Empowering Industry Entrepreneurial Support	Industry and academia relations. Both actors can apply to obtain finance for projects in developing countries.	No specific regional focus	All technologies	Knowledge Space Innovation Space	Collaborative leadership
Danida Ministry of foreign affairs of Denmark Subsidies and guidance for partnerships in developing countries.	Entrepreneurial Support Empowering industry	A private-public industry interaction.	No specific regional focus	All technologies except within the field of alcohol, tobacco and weapon industry.	Consensus space Knowledge space Innovation space	Collaborative leadership
Export council Ministry of foreign affairs of Denmark Counselling on export, stakeholder management and trade policy.	Entrepreneurial support	Industry relations for companies to gain knowledge about market abroad.	No specific regional focus	All technologies	Innovation space	Collaboration and conflict moderation

Export council Ministry of foreign affairs of Denmark Counselling on export	Entrepreneurial support	Industry relations for companies to gain knowledge about market abroad.	No specific regional focus	All technologies	Knowledge space Innovation space	Collaboration and conflict moderation
Export council Ministry of foreign affairs of Denmark Counselling on export for SMVs	Entrepreneurial support	Industry relations for companies to gain knowledge about market abroad.	No specific regional focus	All technologies albeit only for SMV companies	Knowledge Space Innovation Space	Collaboration and conflict moderation
Export council Ministry of foreign affairs of Denmark Subsidies for shared export push.	Entrepreneurial Support Empowering industry	Industry relations. Companies can apply for subsidies to enact activities abroad.	No specific regional focus	All technologies, minimum 25% must be SMV.	Knowledge space Innovation space	Collaborative leadership
Export council Ministry of foreign affairs of Denmark Counselling on growth opportunities abroad.	Entrepreneurial support	Industry relations for companies to gain knowledge about growth opportunities abroad.	No specific regional focus	All technologies, must be SMV.	Knowledge space Innovation space	Collaboration and conflict moderation
Export council Ministry of foreign affairs of Denmark Hotline - Guidance about export.	Entrepreneurial support	Industry relations. Companies can contact and obtain information on "the next step".	No specific regional focus	All technologies	None	Network
High-tech innovation fund Ministry of higher education and Science Subsidies for high technological industrial postdoc projects	Basic R&D Funding Entrepreneurial Support Empowering industry	Industry and academia inter-relations. Both apply for collaboration and will be co-funded by state.	No specific regional focus	All high-tech technologies	Innovation space	Collaborative leadership
Innovation environments Ministry of higher education and Science Risk-willing capital to innovative entrepreneurs - innovation environments.	Entrepreneurial support	Industry relations. State invests in companies where private investors are unwilling.	No specific regional focus	All technologies	Innovation space	Substitution
Innovation network for environmental technology Ministry of higher education and Science Network for companies who works with cleantech.	Entrepreneurial support	Industry and academia relations. Both can apply to network and gain benefits	No specific regional focus	All technologies	Knowledge Space Innovation Space	Network
Innovation network for transport Ministry of higher education and Science Network for Transport companies	Entrepreneurial support	Industry and academia relations. Both can apply to network and gain benefits	No specific regional focus	All technologies	Knowledge Space Innovation Space	Network
Council for technology and innovation Ministry of higher education and Science Subsidies for collaboration on innovation projects	Basic R&D Funding Empowering industry	Industry and academia inter-relations. Both can apply to make a consortium from scratch to product	No specific regional focus	All technologies	Consensus space	Substitution
Council for technology and innovation Ministry of higher education and Science Subsidies to employ a highly educated employee.	Basic R&D Funding Entrepreneurial support	Industry and academia inter-relations. Industry can apply to have financed a academic employee.	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Council for technology and innovation Ministry of higher education and Science Subsidies to employ a Ph.D. student	Basic R&D Funding Entrepreneurial support	Industry and academia inter-relations. Industry can apply to have financed a academic employee.	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Council for technology and innovation Ministry of higher education and Science Subsidies for research collaboration and purchase of knowledge.	Basic R&D Funding Empowering industry	Industry and academia relations. Companies apply to get vouchers to purchase knowledge and/or technology	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Big Science Ministry of higher education and Science Network for companies and large European research facilities	Empowering industry	Industry relations. Companies apply to get in contact with large European science facilities	No specific regional focus	All technologies	Innovation space	Network
Inventnow Ministry of higher education and Science Guidance for inventors	Entrepreneurial Support	Industry and academia relations. Inventors can obtain knowledge on their possibilities	No specific regional focus	All technologies	Knowledge space Innovation space	Network
Innovation agents Ministry of higher education and Science Guidance on innovation and technology	Entrepreneurial Support	Industry relations. Companies can obtain knowledge on improving innovation and business opportunities	No specific regional focus	All technologies	Innovation space	Network
Growthfund Ministry of Business and Growth Denmark Guarantee which makes it easier to obtain loan and credit.	Empowering industry	Industry relations. Subsidies for realising growth plan.	No specific regional focus	All technologies	None	Collaboration and conflict moderation

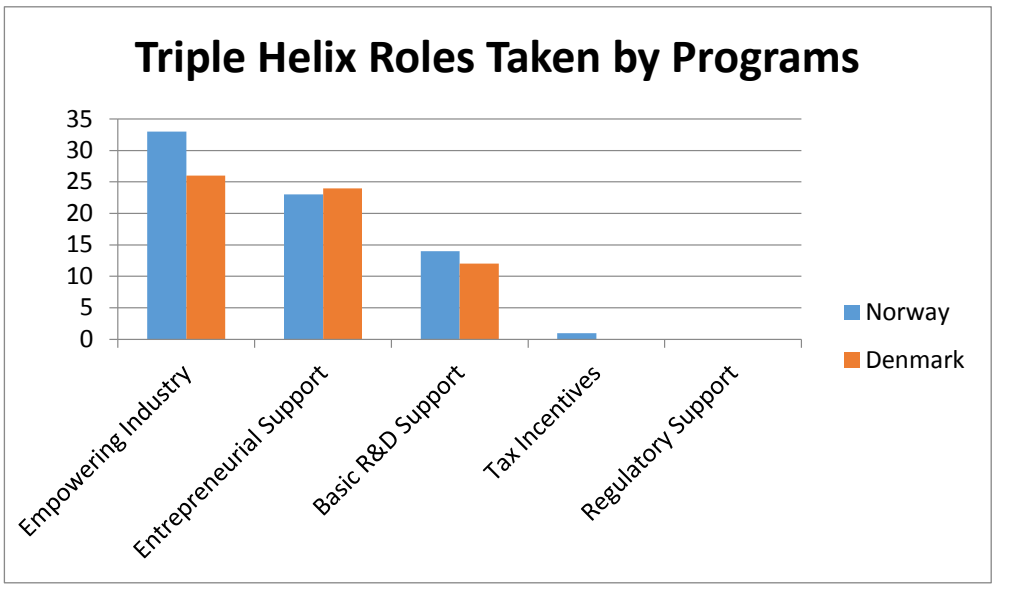
Growthfund Ministry of Business and Growth Denmark Loan which supplements risk-willing capital.	Empowering industry	Industry relations. Company can obtain subsidies from government if they have private investor present.	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Growthfund Ministry of Business and Growth Denmark Loan for green investments	Entrepreneurship industry	Industry relations. Companies obtain loan for implementers and suppliers of solutions.	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Growthfund Ministry of Business and Growth Denmark Loan for finance of growth plans.	Empower industry	Industry relations. Companies can obtain funds to realise growth plans.	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Market maturity fund Ministry of Business and Growth Denmark Subsidies for test and adjustment of innovative products.	Basic R&D Funding Empowering industry	Industry relations. Companies can obtain funds to demonstrate / test solutions	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Market maturity fund Ministry of Business and Growth Denmark Guarantee for innovative products.	Empower industry	Industry relations. Companies obtain guarantee for products	No specific regional focus	All technologies	None	Collaboration and conflict moderation
EKF Ministry of Business and Growth Denmark Guarantee for credit for SMVs.	Empower industry	Industry relations. Companies obtain guarantee for customers abroad, covers 100%	No specific regional focus	All technologies	None	Collaboration and conflict moderation
EKF Ministry of Business and Growth Denmark Re-assurance of export companies' credit.	Empower industry	Industry relations. Companies will have services insured in risk-filled markets.	No specific regional focus	All technologies	None	Collaboration and conflict moderation
EKF Ministry of Business and Growth Denmark Guarantee for credit and guarantees for export.	Empower industry	Industry relations . Company will obtain export guarantee to secure continued export of Danish goods.	No specific regional focus	All technologies except agriculture and fishing.	None	Collaboration and conflict moderation
EKF Ministry of Business and Growth Denmark Loan for export companies	Empower industry	Industry relations. Companies are able to sell products and offer credit to consumers abroad.	No specific regional focus	All technologies except agriculture and fishing.	Innovation space	Collaborative leadership
GUDP Ministry of Food, Agriculture and Fisheries of Denmark Subsidies for development and demonstration in the food industry	Basic R&D funding Empower industry	Industry and academia inter-relations. Companies can answer the call, obtain funds and co-work with knowledge institutions	No specific regional focus	All technologies	Innovation space Consensus space	Collaborative leadership
Technology pool by ministry of environment Danish Ministry of the Environment Subsidies for development of cleansing technology to soil pollution	Basic R&D Funding Empower industry	Industry relations. Companies will answer a call, obtain funds and co-work with municipality	No specific regional focus	All technologies	Innovation space	Collaborative leadership
Municipalities Municipalities Guidance for companies and entrepreneurs.	Entrepreneurial support	Industry relations. Companies will obtain knowledge for development, match, growth and directions for private and public offers.	Specific regional focus for each municipality	All technologies	Innovation space	Network
Danish regions - Region Capitol, Region Zealand Copenhagen Cleantech cluster Guidance for cleantech companies in region Zealand.	Entrepreneurial support	Industry and academia relations. Both actors can obtain access to a cluster, courses and events to enhance network.	Regional focus on Zealand.	All technologies	Innovation space knowledge space	Network
Industry fund of Bornholm Danish regions - Industry foundation of Bornholm Loan and financing for commercial development on Bornholm	Empowering industry	Industry relations can apply to gain loan to realise activities in region.	Regional focus on Bornholm	All technologies	Innovation space	Substitution

Industry fund of Bornholm Danish regions - Regional municipality Bornholm Subsidies for initiatives which promote employment in Bornholm	Empowering industry	Industry and academia relations. Both can apply to gain access to courses and more in region. Self-finance of 50%.	Regional focus on Bornholm	All technologies	Innovation space	Substitution
Loan fund of Northern Jutland Danish regions - Region Northern Jutland Loan and financing for innovation and developments projects in region Northern Jutland	Empowering industry	Industry actors with a large development potential can obtain co-loan (50%) to realise new plans.	Regional focus on Northern Jutland	All technologies within the sector of business service and tourism.	Innovation space	Collaborative leadership
Midtnet Danish regions - Region mid-Jutland Industry aimed knowledge collaboration between region Mid-Jutland and Shanghai	Basic R&D Funding Empowering industry Entrepreneurial support	Industry and academia relations. Both actors can apply to be a co-part of doing commercially oriented knowledge work.	Regional focus on Mid-Jutland	All technologies	Consensus space Knowledge space	Collaborative leadership
Growthhouse Danish regions - Region mid-Jutland Subsidies for growth in Mid-Jutlandic companies	Entrepreneurial support	Industry actors can apply to obtain a governmental consultant to aid their growth.	Regional focus on Mid-Jutland	All technologies	Innovation space	Collaborative leadership
Growthhouse Municipalities Guidance on growth and business development	Entrepreneurial support	Industry relations. Directs companies to the appropriate private and public offers.	Specific regional focus for each municipality	All technologies	Innovation space	Network
EUDP	Basic R&D Funding Empower industry	Industry and academia inter-relations. Companies can answer the call, obtain funds and co-work with knowledge institutions	No specific regional focus	All technologies	Innovation space Consensus space	Substitution
MUDP	Basic R&D Funding Empower industry	Industry and academia inter-relations. Companies can answer the call, obtain funds and co-work with knowledge institutions	No specific regional focus	All technologies	Innovation space Consensus space	Substitution
National Research Foundation	Basic R&D Funding Empowering Industry Entrepreneurial Support	Actively requires the interaction of academia, government and industry in a single centre where research and demonstration projects are conducted.	No specific regional focus	All technologies	Innovation & Knowledge & Consensus Space	Collaboration and conflict moderation

Appendix 2.2

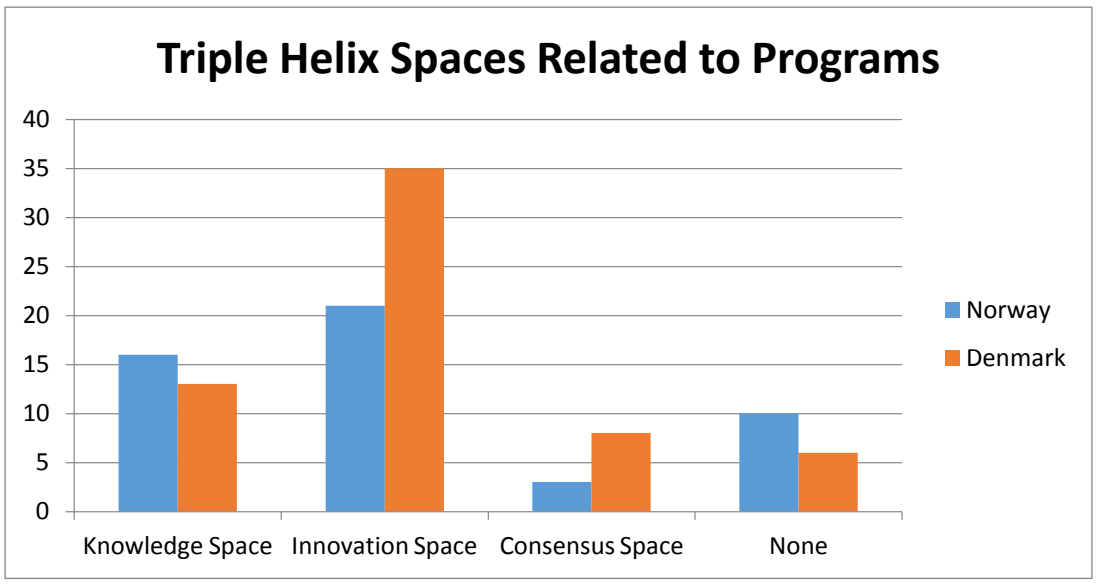
Triple Helix Roles Taken by Programs

Triple Helix Roles Taken b	Norway	Denmark
Empowering Industry	33	26
Entrepreneurial Support	23	24
Basic R&D Support	14	12
Tax Incentives	1	0
Regulatory Support	0	0



Appendix 2.3 Possible creation of Triple Helix Spaces

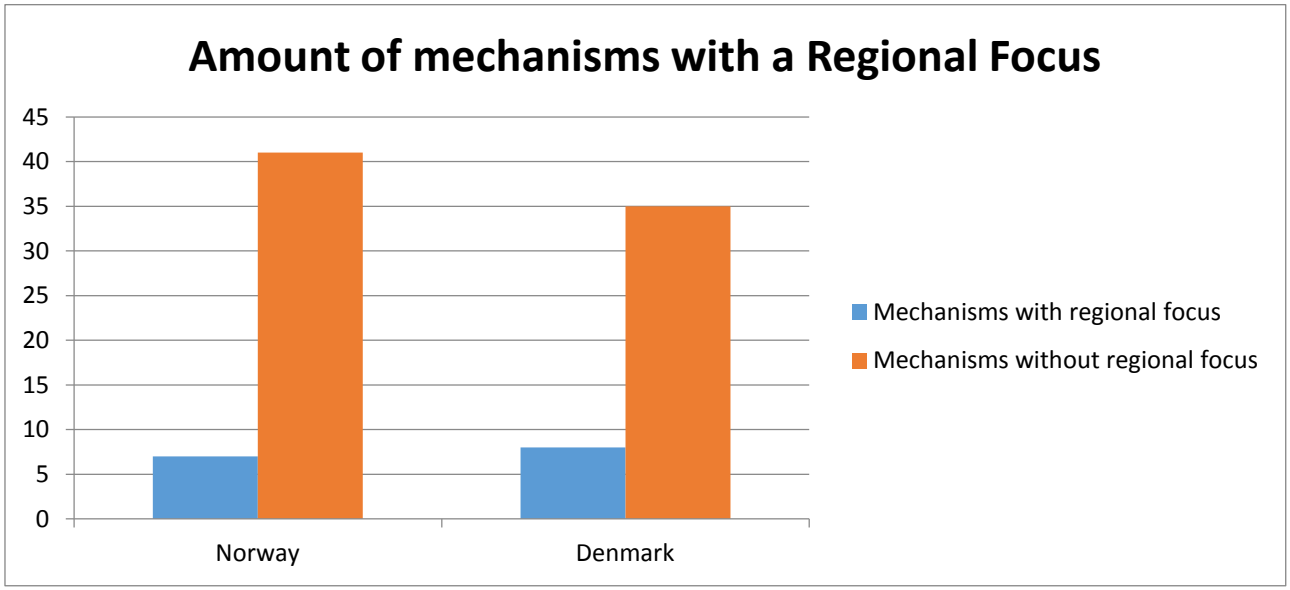
	Norway	Denmark
Knowledge Space	16	13
Innovation Space	21	35
Consensus Space	3	8
None	10	6



Appendix 2.4 Amount of programmes with Regional Focus

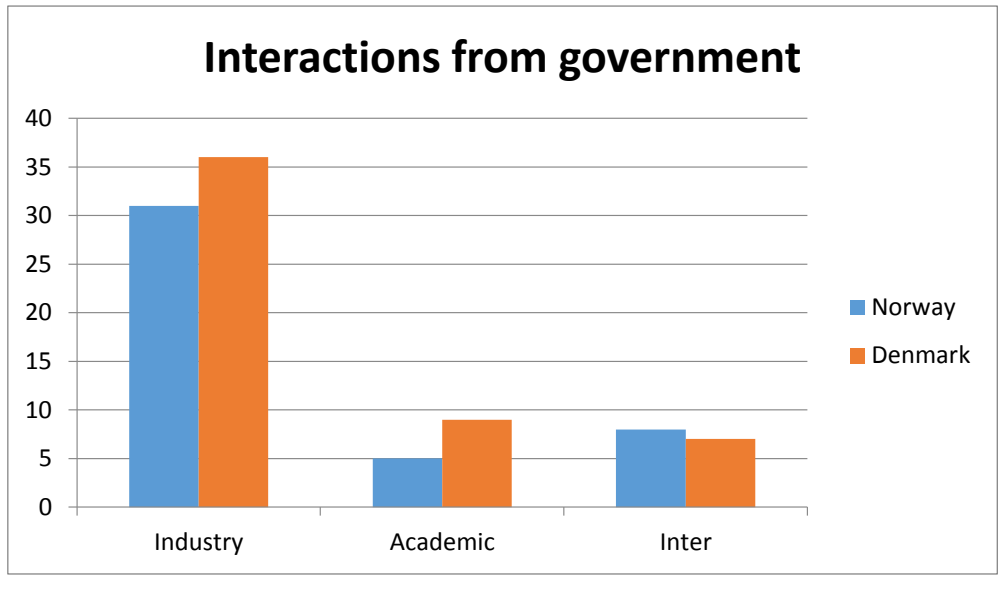
	Norway	Denmark
Mechanisn	7	8
Mechanisn	41	35

*"Yes" category for Norway adjusted to account for the 7 regional research funds which are represented by one entry in the Triple Helix table



Appendix 2.5 Triple Helix interactions from Government

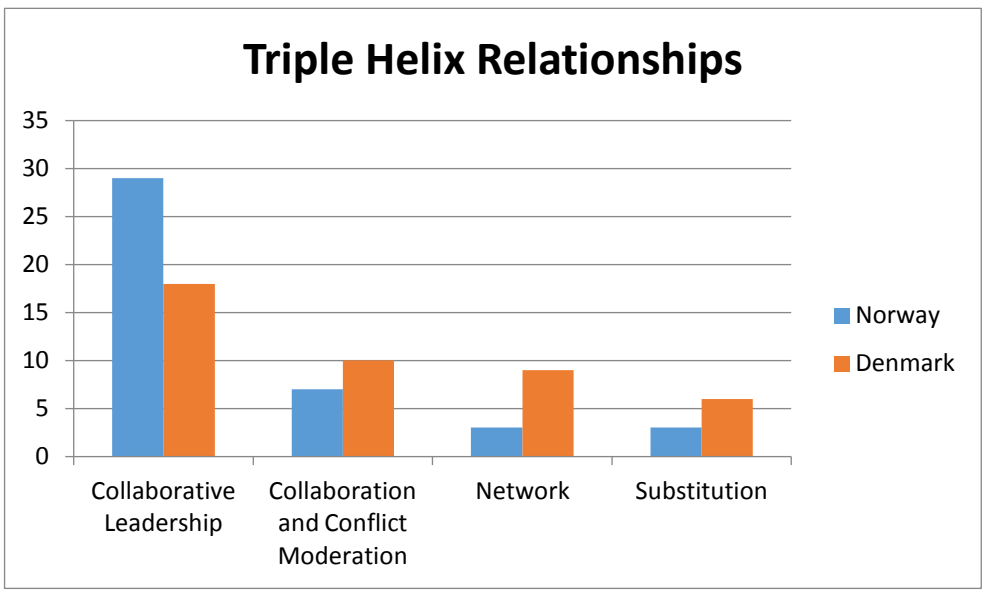
Interaction	Norway	Denmark
Industry	31	36
Academic	5	9
Inter	8	7



Appendix 2.6

Triple Helix Relationships

	Norway	Denmark
Collaborative Leadership	29	18
Collaboration and Conflict Moderation	7	10
Network	3	9
Substitution	3	6



Appendix 3 - Danish Programmes and Mechanisms

Consists of:

Appendix 3 Danish programmes and mechanisms

Programmes

What follows is a list of all the actors and programmes they offer.

the first column lists the actor and the name of the programme/mechanism. The second is the purpose of said programme, third is who is targeted or can apply and last is the types of support they give.

The first column is used to find actors to be used in Triple Helix analysis and the other three are to be used place them in terms of Commercialization theory.

Actor/mechanism	Purpose	Who is eligible/targeted	Types of support available
Industrialization fond for developing countries - IFU **1. Financing of projects in developing countries.**	Companies can obtain financing for projects in developing countries through the industrialization fond for developing countries and the Arabian investment-fond, if the projects are rentable and also has positive development effect on the hosting country.	All private companies registered in Denmark can apply for funding at IFU. All private companies which is registered in Denmark can apply for financing through IFU. The applicant must present a convincing business plan for the project the company wishes to enact in the chosen host country. The project must be carried out in one of the many host countries that qualify to IFU's investments.	IFU offers access to further financing though a private-public cooperation between PKA and PBU together with IFU in the foundation "IFU investment partners". IFU will also supply with counseling in regards to the establishing relations for the host countries. The company must as a minimum match the investment IFU provides. Often contribute themselves with support in terms of co-responsibility for leadership, technique, technology transfer and more and have documented knowledge and experience within the project's business area and document or convince that they have the necessary resources to conduct the project.
Growthfund **2. Guarantee which makes it easier to obtain loan and credit.**	You can obtain growth guarantee to realize your growth plans. It can for example be within a new company, develop your existing company or change of ownership.	Loan with growth guarantee can be awarded to companies which: Has up to 250 employees Has a turnover beneath 372 mio DKK or a balance under 320 mio DKK Independent of larger	Growth guarantee covers financing up to 2 mio DKK. The guarantee covers 75% of losses after security and other guarantees.

		companies.	
Growth fund **3. Loan which supplements risk-willing capital.**	Knowledge intensive and capital heavy growth companies can obtain a syndicate loan at "Vækstfonden" if they simultaneously obtains a risk-willing capital at same size from one or more private investors. the loan ranges from 2 - 7,45 mio DKK.	The company must: Be under 6 years old. Be registered in Denmark. Have less than 50 employees. The loan may not be used to finance activities which has already been done at the day the loan is received.	Syndicate loans can improve access to capital for growth companies in the early stages. At the same time the syndicate loan makes it more attractive for venture investors to invest in the very early company development. Syndicate loans gives the investors opportunity to spread out their investments to more companies by investing smaller amount and supply with loans from the state.
Growth fund **4. Loan for green investments**	Loan for green investments can be used by companies to finance commercial service offerings as well as products and processes which optimize usage of resources and benefits the environments. Loans is granted to both companies who wishes to implement new green solutions and to suppliers who develops and implements the solutions.	Loan for green investments can be awarded for established companies with a healthy economy and which has up to 250 employees.	The company can obtain a loan for green investment on minimally 2 mio DKK as a supplement to other means of financings.
Hightech-Innovation fund **5. Subsidies for hightechnological industrial postdoc projects**	Companies can obtain co-financing to complete a high-technological commerce postdoc-project. With a commercepostdoc-project. a research educated person must spend some of their time in a company and	All companies within all high-technological areas can apply. There are three main criteria: The idea must: Have a commerce potential. Have a sufficient level of research abstraction. Must be possibility for cooperation between the partners.	The company can obtain financing for a commerce postdoc-project. The company must co-finance 2/6 of the project budget, the public institution must co-finance 1/6 of the budget and the "high-technology foundation" will fund the last 3/6. SMV's can obtain a better support and only need to co-

	the rest at the research institution to solve specific research and development assignments. The project must have a commerce potential and be developed by usage of new high-technology. The project must furthermore be built upon a targeted cooperation between one or two companies and a public research institution. The project must have focus on creating a specific result.		finance 1,6/6 of the total budget. Through a commercepostdoc-porject the partners will achieve: The commerce post doc student will receive an unique competency rise in career development by combining its research competencies with experiences and mind-set from business. The company will get the opportunity to solve some specific research and development tasks in a new way and simultaneously have established new contacts for new collaborative partners in the university environment. The public research institution will have its relations to commerce strengthened and new fundament for new research.
Industry fund of Bornholm **6. Subsidies for initiatives which promote employment in Bornholm**	Companies can obtain support from Business center Bornholm to new initiatives which either creates new jobs (entrepreneurs) or which is perceived to have a positive job-effect.	The support can be given to people as well as teaching facilities, organizations and companies. No special criteria other than a beneficial effect on jobs.	Grant for consultation aid presenters Materials Participation at conventions Study trips Knowledge and technology transfer. News examinations. Patents and patent examinations. Applicant normally provides a self-financing of 50% to approved expenses.
The Market Maturity Fund **7. Subsidies for test and adjustment of innovative products.**	Private companies with at least two full-time employees can apply for grants to test a prototype or a concept which functions in a realistic environment at	Project leader must be a private company with at least two full-time employees. Private companies can apply singularly or in consortiums with other companies and/or public actors.	The size of the grant depends on the size of the company and range of cooperation. Small companies can obtain up to 60% in grants Medium-large companies can obtain up to 50% in grants. Large companies can obtain

	potential customers. The offer can also be used to adjust the prototype or concept. The aim is to strengthen the solution's commercial possibilities on the market.	The prototype or service offering must be successfully tested in a demonstration facility, lab testing or similar. At the time of application there must be an existing deal with the first test user in the project. The total budget of the project must be minimum three million DKK. The project must be finished within maximally three years. Applicants will be judged in terms of six criteria: News-value. Market and business model. Competencies and relevant cooperation partners. Growth and employments effects. derived effects Encouraged effects.	up to 40% in grants. Public actors can join as collaborative partners and obtain 50% in grants.
Technology pool by Ministry of environment **8. Subsidies for development of cleansing technology to soil pollution**	Companies can obtain grants to test and develop new cleansing and deflection technologies on earth and ground water pollution areas. The aim is to create a fundament to conduct more effective cleansing of polluted areas.	Following can apply: Regions who are responsible for the public clean-up initiative. Companies who work with examining and cleaning of polluted soil and groundwater has the opportunity to apply for grants. Singular companies can apply, but projects who collaborates with the municipalities are preferred. The ministry of environment will start roughly half of all projects within the mentioned areas of interest. The rest of the projects are made as collaborative projects with the municipalities.	The company can obtain grants to develop and test prevention and cleansing technology in connection with pollution of soil. Furthermore the offer gives grants to projects that defines the border for the technically possible within among other: Cleansing levels Treatment technology Cheapening and documentation. The technology pool for soil and groundwater pollution can give up to 100% grants albeit in some instances demands for co-financing exists. For example for projects tied to a specific prevention project.

		The aim of the project must be made in accordance with "Teknologiprogrammet".	There is no maximum or minimum for grants albeit most of them are in the order from 100.000 to 1.5 mio DKK. Project will be evaluated by: Relevancy in relations to the project descriptions which has been described in " Teknologiprogrammet". Potential to contribute to significant optimizations within cleansing or examinations of polluted soil or ground water. Technological news-worthiness.
Green development and demonstration program – GUDP **9. Subsidies for development and demonstration in the food industry**	Companies can obtain grants for projects which contributes to a competition and sustainable food and non-food production that is a pat in developing commercial potential, growth, employment, work environment and development of a market driven ecological sector. The projects must develop and demonstrate business oriented thinking within the sector of food for example through energy optimization, reduction of nutrition washing, usage of pesticides and climate influence.	The following can apply for grants to complete projects within the areas that has been specified in the call for applications. • company registered people. • companies • branch organizations • organizations • selv-owned institutions. • public research institutions. There is an emphasis on the projects where it is relevant will be carried out as cross-disciplined and cross-professional collaborative projects between research institutions and companies. Grants will be given in accordance to the state support rules. Conditions to apply for grants under GUDP depends of the single application rounds.	The company can obtain grants for: • development; development of prototypes. • carrying out the necessary tests under practical situations. • usage oriented research when it is a necessary means to obtain development demonstratory goals. • Demonstration activities whose purpose is to spread knowledge of usage of the research and/or development activities. • Network projects whose aim is to map barriers and commercial perspectives and potentials to develop in a restricted area within the given

			challenges food commerce faces. The size of the offer and grant percentage is made based on a total valuation of the company type, project type and project activities.
Copenhagen cleantech cluster **10. Guidance for cleantech companies in region Zealand.**	Companies and research- and knowledge institutions who works with cleantech can obtain help to innovation, national and international matching with other companies, access to test- and demonstration facilities and acess to relevant knowledge.	All large as small companies, knowledge institutions and public units whom works with cleantech can apply. The criteria depends on the activity that is applied for. there are no criteria to become a part of the cluster generally and gain access to the knowledge that is distributed on the webpage. Furthermore most events are open access for members.	Through the cluster the company can obtain: • contact with relevant cooperation partners • Be included in a larger or smaller network. • Continuously updated with new legislations initiatives supports, events and more. • Follow in foreign cleantech trends and market opportunities. • take part of conferences and go-home-meetings about cleantech related topics. • Be host at events with the aim reveal their own organizations competencies and distributed. • meet with representatives from foreign delegations • participate in entrepreneur start-up projects. It is planned that down the road membership will be paid, albeit for the moment it is free.
Innovation environments **12. Risk-willing capital to innovative entrepreneurs -**	Through the innovation environments the researchers and science based	Innovative entrepreneurs can apply. By innovative entrepreneurs is meant one or more singular people	Researchers and knowledge based entrepreneurs can through the innovation environment obtain help to start their own company in

innovation environments.	entrepreneurs can obtain help to create their own company. The innovation environments counsels entrepreneurs and invests on behalf of the state to risk-willing capital to new innovative companies in the very early phase where ordinary market investors are reluctant.	(entrepreneur or inventor) or a newly created company that is considering commercialization of a new service or products idea. In order to get into consideration to the before-project capital the recipient must at the first handout maximally have been registered for 12 months from when the binding agreement takes place and maximally have a turnover of 50.000 DKK. By subsequent handouts of pre-project capital the recipent must: maximally employ 50 employees, have a revenue and/or a yearly balance on less than 75 million. DKK in the accounted year, maximally have been registered in the CVR register for 6 year, minimally have expenses in the established year on 15% to research and development from the operational budget or at least have expenses to R&D on 15% in one of the three years prior to receiving the pre-project capital.	the form of counselling and risk-willing capital. There will be granted help for the three steps: 1. Pre-examinations: when the researchers or entrepreneurs ideas for commercialization has been judged on potential and risk they can be screened to go through an actual pre-examination which means that the projects viability and relevancy will undergo a professional and market related evaluation. Primary pre-project capital 2. Primary pre-project capital: The first investment in the knowledge based entrepreneur will be primary pre-project capital. The innovation environments can on behalf of the state invest up to maximally 3.5 million. DKK. 3. Secondary pre-project capital: Commercialization projects with specially promising potential and a further need for risk-willing capital can obtain further support in the way of a secondary pre-project capital. The innovation environment can on behalf of the state invest up to 2.5 million DKK. One prerequisite is a private financing which will equal minimally 60% of the total supplied financing. The pre-project capital can among other things be used for: • Sparring and counselling.

			• Technological examinations. • Development work • Laboratory experiments. • news examinations. • identification of collaboration partners. • Stipendiums which allows the innovative entrepreneur to focus on developing the project.
Innovation network for environmental technology **13. Network for companies who works with cleantech.**	Companies, universities and knowledge institutions can through the innovation network for cleantech exchange knowledge and commit collaborative projects with other companies and researchers in the Danish cleantech sector. Innovation network for works on finding new and innovative products and services across the sectors, earth, water, air and trash. All network activities are created to realize the mission of pushing the cleantech innovation in the Danish cleantech sector with a special focus on SMVs.	There are no criteria to join an innovation network. Innovation networks are open for all interested companies and other actors.	Through conferences, events, professional network and workshops the innovation network for cleantech creates meeting places and platforms for companies, researchers and developers for inspiration, idea generation and possible business development. Furthermore the companies can through the network obtain support to new ideas, applications and complete innovation projects. The companies will receive: • Help for matchmaking. • Help to start specific innovation projects and to complete them. The innovation network for cleantech is one of 22 national innovation network and partnerships which offers companies help for matchmaking, access to relevant knowledge and research alongside with help to realize projects. The innovation network for

			cleantech is approved by the educational ministry and receives co-financing from here to strengthen the companies' innovation and growth.
innovation network for transport **14. Network for Transport companies**	Companies, universities, education institutions, organizations, municipalities and entrepreneurs can through the transport innovation network share knowledge and enter into collaborative projects. The transport innovation network gathers actors in the transport chain across boundaries and domains. Through the collaboration activities are created which, based upon new knowledge, develops new possibilities which exploited will generate more value for one or more links in the transport chain. The transport innovation network will assist by identifying needs for new technologies and test the viability through various means of cooperation.	There are no restrictions to take part in the innovation network's activities. The innovation network is open for all interested companies and other actors.	Through conferences, events, professional network and workshops the innovation network creates meeting places and platforms for companies, researchers and developers for inspiration, idea generation and possible business development. The companies can through the network, obtain support to formulate ideas, applications and complete innovation projects. There is also help for the administrative work that is associated with collaborative projects. The companies will receive through the different areas: • Help with matchmaking. • Distribution of company relevant knowledge and exchange of experience in the relevant field. • Help to start specific innovation projects and complete them. • Sparring, idea generation, contacts, inspiration and business development. • Access to The transport innovation networks national and

			international network. The transport innovation network is one of 22 national innovation network and partnerships which offers companies help for matchmaking, access to relevant knowledge and research alongside with help to realize projects. The Transport innovation network is approved by the educational ministry and receives co-financing from here to strengthen the companies' innovation and growth.
Danida Business partnership **16. Subsidies and guidance for partnerships in developing countries.**	Danish companies can with Danida Business partnerships obtain assistance and receive economical support to establish long-term sustainable relation with commercial purpose with Danida's partnering countries and Egypt.	All partnerships consisting of at least one Danish privately owned company and a local partner can apply. Companies within alcohol, tobacco and weapon industry are the exception. Products with dual-use are subjected to a special screening. Partnerships must support to the partnership country's development as described in a list of development criteria and take part in creating jobs in the developing countries and have a positive influence for the development for the local populace. The partnership's business model must be within sectors as described in the local Danish embassy's Business development profile. The Danish main partner must be a private Danish company, credit worthy, and	Through Danida Business partnerships the Danish companies and organizations can receive help to develop partnerships with local cooperation partners who will yield access to new markets, improved products, new products, deliverance security, production capabilities and more. The local partners will receive capacity upgrades through access to Danish know-how and technology, more independent work slots and sustainable growth which benefits the local society. Danida Business supports partnerships with up to 75% or 50% dependent on the phase of expenses tied to transfer of knowledge and competencies from Danish to local partners. The partners must plan all expenses associated with the partnership which will be refunded with respectively

		have sufficient funds and manpower to conduct the partnership. The company must not be a one-man company or listed in RKI. The local partner must be registered locally, credit worthy and manpower to complete the partnership.	75% and 50% in preparation phase and implementation phase based on an approved budget.
Council for technology and innovation **17. Subsidies for collaboration on innovation projects**	Companies will obtain Access to cooperation in a consortium which as a minimum consists of a research institution and an ordinary guidance and knowledge distributor part and at least one other company. The consortium seeks in unison to complete a project which will develop and mature research based knowledge to gain the companies development.	Consortiums can apply. They must consist of research institutes ordinary counselling and knowledge distributor actors and companies. The consortium must identify a project of two to four years of duration.	Innovation consortiums is a framework for cooperation: An innovation consortium must consist of at least two companies, a research institute and an ordinary counselling and knowledge distributor actor. Furthermore the consortium can draft a long list of partners by their own choice. The cooperation for an innovation consortium must be built upon a shared project whose purpose is to develop and mature research based knowledge which can form a basis for Danish companies' innovation in the coming years. The consortium must commercialize the new knowledge from the project to competencies or services which can be spread out to the Danish commerce.
Municipalities **18. Guidance for companies and entrepreneurs.**	Companies and entrepreneurs can contact the closest commerce service centre (known as commerce council or commerce office) for free and independent guidance. The company will	Companies which have actives in or plans to function in the local commercial service centres area can apply. There are no criteria to apply for guidance.	Companies will earn knowledge for own development, match, growth and directions for private and public offers.

	receive knowledge of local relations and possibilities and overview of the municipalities' potential for commerce. The commerce service centres offers free help and personal guidance for start-up and business development of the company alongside with directions for private and public offers. Many commerce offices offers entrepreneurial courses, network, mentor-arrangements, company matching and help to mature ideas for new products/services		
"Growthhouse" The five regions 19. Guidance on growth and business development	Companies can obtain independent and free help to map their growth potential and work out a growth plan at "væksthusene". "Væksthusene" directs to private and public offers that can help realise the growth potential.	"Væksthusenes" target group is new and small companies with growth ambition and potential. The company must have ambitions of growth.	The company can have their growth potential uncovered, work out a growth plan and get directed to public offers and private counselling that can help in realizing the growth potential.
Export council 20. Counselling on export, stakeholder management and trade policy.	Companies can through Global Public Affairs obtain help in relation to the export markets in four categories: Trade policy, dispute resolution, intelligence of areas within policies	All Danish companies can apply and there are no criteria.	Stakeholder Management Companies can obtain assistance to network and relations on export markets. For example embassies can offer to host events or presentations which are targeted towards the local authorities or political

	and legislation and stakeholder management.	decision makers in the relevant export market. Intelligence Export council offers systematic surveillance of legislations on the export markets and mapping out the implementation, public decision processes and actors for example in the environment area in a given market. It can strengthen the companies' basis to make strategic decision in concerns with product development, export or establishment. Trade Policy The foreign ministry can give companies overview over bilateral and multilateral free trade agreements which can have an impact for the company's marketing strategy, supply and Chain management. If companies experience protectionism and market barriers the foreign ministry can offer professional export technical counselling and take the cases up in the EU-system. Dispute Resolution After a specific evaluation the foreign ministry can help companies with solving twists with contacts to public authorities, the political system and also EU delegation in the afflicted country. Companies will pay a fee for all individual services. The fee is calculated on basis of agreed deal of estimated

			time use by hourly fee rate and in compliance with export council's guidelines for user payment.
Council of technology and innovation 21.Subsidies to employ a highly educated employee.	Companies with fewer than 100 employees receive a grant to hire a highly educated employee - a knowledge pilot which will execute a specific development project for the company.	The company and knowledge pilot must fulfil all criteria in order to apply. If the applying company is part of a concern community all criteria must be fulfilled for the whole concern and not just the applying company. Companies are considered in a concern community if a company owns 25% or more of capital or voting right in another company. The company must have had2 - 100 employees for at least 12 months - owners do not count and at least 1 million. DKK in turnover. The company must have maximally 5 highly educated employees previously excluding owners. Although maximally 2 out of 3 of the employees of all employees be highly educated. The company must be a private - commercial company. The company must not have or have had in the last two years an employee with an education corresponding to the knowledge pilot. The knowledge pilot must at least have gone through an education on bachelor level. The knowledge pilot must within the last two years not have worked in the company for pay, awards or other	Through the offer companies with fewer than 100 employees can obtain a grant on 150.000 DKK to hire a highly educated employee - a knowledge pilot. The knowledge pilot must conduct an innovative project which lasts 12 months which will create Significant changes and improvements for the company. A highly educated is a person whom has completed an education at least on bachelor level which is a medium-long higher education and above. It means for example, profession bachelors, diploma engineers and candidates which can become knowledge pilots.

		benefits and must maximally have been 8 weeks as an intern. The project which the knowledge pilot must enact must be evaluated by the following criteria: • Is the company and project clearly described? • Is it likely that the project can give the company a significant innovation or economical push if it succeeds? • Does the project fit to the knowledge pilot's education and perhaps other competencies?	
Council of technology and innovation **22. Subsidies to employ a Ph.D student**	With the commercial-PhD scheme a company can obtain grants to hire a PhD student which can work with a research project and its PhD education in the company and simultaneously be included in a university.	Private companies can apply. The companies can formulate in cooperation with the university and commercial PhD candidate. The company can also seek for support without a known commercial PhD-candidate which will be approved later. The company must be private and have a branch in Denmark. The company must be economically able to support the student through the three year course. The student must have access to a company-counsellor whom will guide the project in the commercial parts. It is not necessary that the company counsellor has a	The company can apply of grants to hire a commercial PhD student in the three year period which a commercial PhD project lasts. The student will work on a research project which has commercial perspectives for the company. The company will receive a salary grant of 14.500 DKK each month in three years from the council of research and innovation to the student's salary. The university The university will receive grants to cover the subscription and guidance of the student, the student's workplaces at the university and evaluation of the PhD-project. The company can also obtain

		research based background. There must be sufficient commercial related environment to facilitate the project, which means at least two to three other people who can take over the company counsellors functionality if necessary The commercial PhD candidate must have an education on candidate level or similar along with a grade average of at least 8, 2 and special grade of at least 10 no 7-grade scale albeit must have a commercial perspective for the company.	grants to the student's project-relevant stays abroad and attendance for conferences.
Council of technology and innovation **23. Subsidies for research collaboration and purchase of knowledge.**	Small and medium-large companies can obtain help to purchase research- innovation- and development activities in the form of cooperation with one or more knowledge institutions.	The following criteria to apply: The applicant must be a private company (SMV). The company must live up to the EU definition for Small and medium-large companies. The company must not receive any other public grant for the project which is financed by "Videnkupon". The company must have existed for at least one year. The company must not be undergoing bankruptcy or payment-stop. A company can only be awarded a "Videnkupon" once. It is only possible to be awarded an expanded "Videnkupon" once. The same company can in extension of an "basis-videnkupon-project" choose to apply for an expanded	A "videnkupon" gives the company a discount on purchase of knowledge or research cooperation with a knowledge institution. The "videnkupon" is used in conjunction with the company requests knowledge from a knowledge institution to a research- innovation- or developmentproject which will contribute to strengthen the company's productivity and innovation- and growthpotential. When purchasing knowledge or cooperation of innovation the "videnkupon" covers up to 40% of the total expenses for the project, although with a maximum of 100.000 DKK..

		"videnkupon". If applied for basic"videnkupon" to purchase knowledge or inovationscooperation the applicant must not have formerly bought any services at a knowledgeinstitution worth more than 50.000 DKK through the last three years counted from time of application. Abovementioned limitation is invalid if the company is seeking for an expanded coupon to a research and development project. It is not possible to apply for both project types at the same time. There must be an agreement of a specific cooperation project at the time of application. The self-financing of the project must be minimum 60% of the total budget.	
Midtnet **24. Industry aimed knowledge collaboration between region Mid-Jutland and Shanghai**	Companies and public actors from Region "Central Jutland" can - through the "Midtnet" programme participate in network and commercially oriented knowledge cooperation with companies and knowledge institutions in Shanghai, China. The companies can apply for up to 250.000 DKK in co-financing to the public actors part of the Danish part of development project.	The companies has to join forces with one or more Danish public actors (knowledge institutions). The grant will be awarded to the/those public partners in the project while the company(ies) will contribute with co-financing in the form of time, equipment and/or monetary grants. Often 3-4 companies join forces for the application. The company must be interested in going together on a business trip to Shanghai.	The companies can have up to 250.000 DKK in grants to purchase services at Danish public actors/knowledge institutions. The grants can be used in conjunction with project maturation - for example to bring light on cooperation-relations, special Chinese relations, scientific documentation, product development, process development, service design etc. The companies can further participate in network activities in food, energy/environment and health/commerce.

			Get help to find the right partner in Shanghai.
Export council 25. Counselling on export	Small and medium-large Danish companies can obtain grants to counselling from Export council's competent advisors on the export markets. The consultation is flexible and tailored to the individual company's needs.	Small and medium-large Danish companies which has an international potential. The company must have less than 100 employees and a yearly revenue under 100 million. DKK.	With Export start Vækst the company can among other things obtain: • Specific advice of one or more export markets. • Market analyses • Help in establishing abroad. • Help for seeking partnerships. • help for recruitment. An export package consists of 50 hours of counselling about markets outside EU, EFTA, North-America and Oceania. One can maximally obtain 3 packages per market and max 6 packages in total. There will be 65% grant to the ordinary hourly rate. The company will contribute with 35% of the "Export start" package value and the remaining 65% will be covered by the foreign ministry. An export start growth package will cost 14.263 DKK. .
Export council 26. Counselling on export for SMVs	Small and medium-large companies can obtain grants for counselling from Exportcouncil's advisors on the export markets. The couseling is flexible and tailored after the applying company's needs.	Small and medium-large Danish companies which has an international potential. The company must: Have under 100 employees and a yearly revenue under 150 million. DKK.	With export start the company can among other things obtain: • Direct guidance about a export market. • Market analyses • Help for seeking partnership • Help for contacting the municipalities. • help for recruitment. Export start is 50-100 hours worth of counselling for an export market.

			One can maximally get approved for Export start to three markets. There will be a grant for 35% on the hourly rate for Export start (935 DKK in 2014)
Export council **27. Subsidies for shared export push.**	Commercial and branch organizations or groups of companies can obtain grants to the shared expenses which is tied to pushing export. The offer furthermore gives the applying companies greater knowledge of market- and business criteria and creates contact to business- and cooperation partners for specific export markets.	Grants can be applied for by a commercial & branch organization or a consultation company which works with export guidance and which applies and coordinates the push on behalf of a group of companies on minimum five. Minimally 25% of the participating companies must be small or medium-large companies (SMV)	The company can get a grant of up to 50% of the shared expenses which is concerned with preparing, seeing through or following up on a shared export push, alongside with shared expenses tied with delegation visits to Denmark. A representative for the company must be present through the execution of the push. The company must themselves finance individual expenses such as plane and hotel. Furthermore the company's own active preparation and follow up on the push will influence the effect of the companies effect of participating in the push.
Industry fund of Bornholm **28. Loan and financing for commercial development on Bornholm**	New or existing companies can obtain support from "Bornholms Erhvervsfond" in the form of loans or eventual subscription of stock shares or private limited with view on strengthening the commercial- and population-development on Bornholm.	New and existing commercial companies on Bornholm which is perceived to strengthen the commercial and population-wise development on the island. There must be produced a collateral to obtain a loan. In most situations there will be a demand of collateral in the facility activities which will be given a loan to buildings and/or operation materials and inventory. Other securities can be conjured if it is necessary.	The foundation can offer loans to invest in material and immaterial activities where one would: • make a new company, • expand an existing company, • diversify a company's production with new products. • Fundamentally change in an existing company's production process. By material establishing activities is to be understood

		Costs to establish securities will be made by debtor.	among earth, buildings, operation funds and inventory. By immaterial activities is to be understood patent rights, licenses and knowhow. The foundation can support for an independent investors overtaking of plant activities, which is directly tied to a company which is closed or would be closed if not such an overtaking would have taken place. The foundation will maximally finance 50% of the investment. Applicant must supply the remaining 50% with bank loans or other funds. It is to be noted that the foundation is a supplement to the banks.
Loan fund of Northern Jutland. 29. Loan and financing for innovation and developments projects in region Northern Jutland	Northern judes entrepreneurs and younger companies with large development potential can obtain a loan at "Nordjysk Lånefond" for innovation and new development projects. The fond supports the Northern Jutland growth companies that due to the crisis experience that they have difficulty in applying the necessary capital from the private cash-market.	Primarily production companies and companies within the sector of business service and tourism can apply for a loan. The fond prioritizes loans for development projects that will increase production in region of northern Jutland. The company must maximally have 250 employees, be 5 years old and must be located in region Northern Jutland.	Loan and financing. Companies can obtain loan to innovation and new development activities. This would include activities which has new technological- or information-wise content. Furthermore the company can obtain a loan to research new export markets. It is not possible to give a loan to ordinary Operations. Newly started entrepreneur companies can loan up to 1,5 million kr. Younger companies which can document their capabilities of growth and income can borrow up to 5 million kroners. The company must co-finance with minimally 50%.

Growth fund **30. Loan for finance of growth plans.**	Growth loan is for companies with a need for financing change of ownership, investment in new production or another business development albeit unable to provide sufficient safeties to obtain normal bank financing.	Growth loan can be granted to established companies with up to 250 employees The company must have a healthy economy. Read more criteria on "Vækstfondens" homepage.	The company can have their growth plans funded with a loan on minimum two million kroners.
Big science **31. Network for companies and large European research facilities**	Danish companies can though Big Science secretariat get in contact with large European research facilities (Big Science facilities). Big Science secretariat also supports companies in preparation to offers and supports consort-formation by matchmaking between Danish or Danish and foreign companies and knowledge institutions for specific assignments from Big Science facilities.	All Danish companies and knowledge institutions can apply. There are no demands to the size, age, turnover, branch or geographical placement.	The company can receive information of possibilities to participate in commercial assignments at Big Science facilities (example; CERN, ESO, ESS & ITER). Mapping out the competencies of the company and matchmaking to relevant assignments. Matchmaking (through consultations) between companies and possible partners. Catalyser for knowledge transfer, innovation and competency building through technology specific competency groups. Participation in inspirational projects (uncover parts of business opportunities in a given competency field) Supply-watch. Participation in studios and promotional trips to Big Science facilities. The company will finance with work-hours for example presentations in terms of meetings and study trips.
Invent now **32. Guidance for inventors**	Ordinary citizens, consumers and employees has through the "inventor	Everyone can utilize the netbased basic counselling. In order to obtain further individual counselling the	Everyone that contacts will be offered a basic advice sessions which builds upon the netbased guidance tool

	guidance" the option of getting counselling on how to realise their ideas to new products, solutions or concepts through sales of license rights to existing companies. virksomheder.	individual must fulfill the demands set by "Opfinderrådgivningen" in terms of preparation. The inventors that will receive further guidance is decided upon by "opfinderrådgivningens" external board. The setting will occur on account of the valuation of the commercial opportunities of the inventions.	"Opfinderes 10 trin" which is developed specifically to "Opfinderrådgivningens" users. Furthermore they offer individual basic counselling after the "Opfinderrådgivningengs" demands to the inventor about preparation has been fulfilled. If special perspective-rich inventions are on the table, "Opfinderrådgivningen" offers a possibility of an expanded counselling with focus to obtain successful commercialization. "Opfinderrådgivningen" has more tools which spreads the act of commercialization in general. Read more at "www.opfind.nu"
Innovation agents 33. Guidance on innovation and technology	Small and medium-large companies can obtain help from an experienced innovation and technology expert to strengthen the company's innovation and business opportunities.	The offer is specially coined to small and medium-large companies which prior to this is not using the public innovationsystem. In order to be eligible minimally two of three criteria must be fulfilled: • Special innovation/growth potential and between 10 to 250 employees. • Company is at least two years old with a positive financial development. • The company has a technological challenge that can be solved based by new knowledge and technology or a	Company can for free get an innovation check by an experienced innovation and technology expert. Through the innovation check the company will: • Get identified specific technological innovation possibilities. • Suggestions for specific technological solutions that can create business in the company. • Possibility for sparring in the introductory phases of a development project. • Possibility for contact to experts and scientists that can add

		combination of new methods to use existing knowledge and technology.	knowledge to the company.
Export council **34. Counselling on growth opportunities abroad.**	Danish companies that wish to partake in growth opportunities in the markets abroad can get counselling about internationalization as well as specific help to set course towards new markets abroad and kick start export quickly and efficiently.	Small and medium-large companies with a large global growth potential can apply In order to be considered the company must have maximally 150 million. kr. in turnover, between 5 to 150 employees, and experience from at least one market they export to.	Companies can with Vitus: Obtain access to growth opportunities on markets abroad. A new export success in just 15 months. Sparring with successful export companies. close partnership with an experienced exportadvisor. Intesive workshops. Fact finding trip to the chosen market. 300 counselling hours. The company pays for participation which is 85.575,- kr. (exclusive personal expenses) Export council covers 65% of expenses for counselling hours as well as 100% of expenses to teachers and workshop facilities.
Market maturity fund **35. Guarantee for innovative products.**	Private companies can apply for guarantees for innovative products. The guarantee will give the customers more security in connection with purchase of first-generation technologies and therefore ease the first sale for the company.	The applicant must be a private company with minimum two full-time employees and it must be an innovative product. The product which is sought covered by the guarantee must be fully developed and ready to be introduced to the market. Applicants will be valued in terms of six criteria: new-factor, market and business model, competencies and relevant cooperation circle. Growth and activity effects, derived effects. encouraged effect. The applicant can be declined if there is not sufficient information for	The frame of guarantee is from three to 12 million. kr. There is a self-risk on 20% for both seller and buyer. The guarantee period is maximal two years from when product is delivered.

		each criteria.	
Growth house -mid-Jutland. **37. Grant for growth in Midt-Jutlandic companies**	With this offer you can have attached an external counsellor with knowledge and experience in for example leadership, globalization, technology or strategy development - and through that kick-start a development process which will improve the company's growth and development possibilities.	The target group is primarily companies with 10-250 employees which has existed in 3 years with export potential or a significant amount of indirect export potential and with primary sales out of the region. Seconday is companies with minimum 5 employees.	The offer will give you opportunity to work with an external advisor over a longer period of time. The external advisor will inject knowledge to the company and will in cooperation with the company conduct development assignments that supports the leadership of the company to secure you a targeted and controlled development of the company.
Danida **39. Subsidies for financing of projects in developing countries.**	Companies or public institutions in developing countries can with DB finance obtain support to secure deliveries to developments projects. The company will obtain grants which will yield the companies grants for the interest on loans in terms of the project. The interest, export-credit-premium and other financial expenses is covered by the foreign ministry throughout the length of the loan, typically 10 years.	Companies and public institutions in foreign countries can apply. The foreign countries must have a pr. capita income which lies beneath the 3.156 USD per citizen (2009/2010)	Grants. Public institutions or companies in developing countries can obtain a grant (interest support with more.) to finance projects with Danish delivery. The support will not go directly to the Danish company but the company will be able to participate in an offer of projects financed by DB finance. Companies can participate in the range of offers throughout the offer. In most scenarios it requires pre-qualification.
EKF **40. Guarantee for credit for SMVs.**	Small and medium sized companies can with an SMV guarantee offer customers abroad long credit time on over half a year and up to five years to pay for specific export orders.	Small and medium sized companies can apply. In order to get a SMV guarantee the company must be credit worthy and have an economical value within Denmark. It will be conducted in a environmental and social	SMV-guarantee can improve the company's competition options if the customer abroad lacks money and wishes to delay the payment for an export order. With SMV-guarantee the company can receive money from the bank when it delivers the

	The bank of the company will give credit to the customer abroad and the SMV-guarantee gives the bank 100% security for the credit risk.	responsible conduit. The company must live up to the EU definition of SMV: Less than 250 employees, less than 50 million. Euro in turnover or a balance on less than 43. million Euro.	goods to the customer simultaneously with the buyer getting credit. The company must supply information to EKF in regards to credit-evaluation. A deductible on 10% to EKF when they have to yield 100% guarantee to a bank.
EKF 41. Re-assurance of export companie's credit.	Re-insurance helps companies with credit-insure their export on risk-filled markets where the private insurance companies does not wish to insure without guarantees. With EKF as a guarantee the risk becomes smaller and insurance should be possible again with private insurance companies.	The company must be a customer at a private insurance company. The re-insurance is only valid for export companies with credit times up to 180 days. The re-insurance agreement will ensure that the companies are risk-willing but not loss-willing. Therefore the agreement contains a couple of other criteria. For example there must not be registered any delay in payment from the purchasers side in the last six months and there must not be any impending risk for losses. trade Cooperation experiences can also weigh in to the decision.	Companies can receive credit-insurance-export-business at a private insurance company which without re-insurance would not insure the export. EKF can offer re-insurance for export to a long list of countries outside the OECD. EU-rules forbids EKF to offer re-insurance for countries within OECD. The company will pay deductibles, premium and must be credit evaluated by the private insurance company.
Export council 42. Hotline - Guidance about export.	Companies can turn to the Export council hotline on telephone "33 92 05 00" and receive answer on introductory questions about export or write to Export mailbox, Export council or to "Ask the expert" on www.Startvækst.dk	Everyone can use the hotline, there are no special criteria.	Companies can get guidance on export opportunities, financing of export, supplement offers and answers to specific export problems from experienced export counselors in the Export council or from one of the foreign ministry's representatives.
EKF 43. Guarantee for credit and guarantees for	Danish export companies and their suppliers can seek EKF (Export Credit Fond) to	All export companies and their suppliers can apply for export guarantee. The so-called primary sector which	Export guarantee can make it easier for the company to get credit in the bank. The company will contribute with

export.	guarantee their work- and process guarantees and also for guarantees from their bank to secure continued export of Danish goods.	covers agriculture and fishing is not covered by the offer due to EU's rules of supporting the state. The company must be credit valuated and approved by the bank. It is a condition for seeking export guarantee that it is on behalf of new guarantees. Existing guarantees which has to be renewed can also be eligible.	information to EKF and/or the credit evaluation from the bank and policy price. Small and medium companies follows the so called "Safe Harbour" policies which is defined by EU. For large companies the policy will be determined on a case basis from EKF on grounds of market relations at the given time.
EKF **44. Loan for export companies**	Danish companies have with Export loans possibilities for selling goods, equipment and project to foreign companies and simultaneously offer them credit. Export loan is typically given to foreign purchasers of Danish goods or their bank, but the loan can also be given directly to the Danish company if they allow their buyer to have credit.	All companies regardless of size and branch can be eligible for an export loan. The credit time for the company has to be minimum two years and maximally 12 years. Although it can go up to 18 years if the project is within renewable energy and water. The Export loan must be covered by an export credit guarantee. There must be a Danish economical interest in the business.	The customers of the company can borrow money to buy the goods of the company. The company will contribute with information to EKF's credit valuation.

Not applicable

These programmes are not applicable anymore as they have either expired, changed throughout the course of the project, part of EU or are a public offering albeit through the academic actor in terms of Triple Helix. Their information has been removed from the project. Red indicates it is either expired or changed, yellow that it is from the academia actor or EU. They are still included as to keep the numerical order of the other programmes.

SDU-industry 11. Guidance from Southern University of Denmark to companies in region Southern Denmark	Companies in the region of Southern Denmark can obtain help by the University of Southern Denmark to commercial innovation and technology projects. SDU commerce harbours enginerial competencies which bridges companies and knowledge at the university. SDU commerce offers to make an action plan for the company and help employees kick off new projects.	All companies that wishes sparring of innovation and technological development can apply. The company must be interested in increased growth innovation and development.	Free advice and guidance. The company will receive: • Help to find foundations and funds. • Sparring to write the optimal project application. • guidance of development actions. • guidance in use of for example commerce PhD and special projects arrangements which can lead to new knowledge and manpower to the company. • Network for new collaboration partners. • Knowledge of the newest technology and research from the university
Enterprise Europe Network 15. Hjælp til at søge partnere og projekter i udlandet	Companies are offered help to obtain most out of the European market. Enterprise Europe Network is a large B2B network which gives free help in seeking for partners, projects and technologies abroad.	Small and medium-large companies, knowledge actors and entrepreneurs can apply.	The company can achieve: Assistance in finding cooperation partners in Europe. Help in terms of legislature. Counselling of EU's grants and support options. Counselling of export opportunities and establishing abroad.
University of	The company can get	Private and public	A company with a relevant

Roskilde 36. Tilskud til forprojekter i samarbejde med Roskilde Universitet	help to convey cooperation between RUC's researchers and students. The company can among other things get help and sparring for applications, matchmaking and network and also get contact with researchers and students in regards to specific projects.	institutions/organizations can apply. The following criteria exists: RUC will only greenlight funds to prepare projects. There must be a speicfic cooperation between researchers/students at Roskilde University before there can be allowed any funds. The project must be anchored in the region of Sjælland and must contribute to commerce development in aforementioned region. Other partners from other regions can contribute to the project. There must be found a relevant research environment at Roskilde University within the project's theme in question. furthermore research-cooperation with companies must take "De minimis" rule into account which means that EU can support a company with up to 200.000 Euro in a period of three accounted years without the participating state must notify the support for the commission.	project can with RUCinnvation in hand get help with first contact between company and researchers/students at RUC and apply for funds to coordinate the cooperation between RUC and the company.
Growth house 38. Capital coaching and financial check of companies.	Companies can receive counselling how to attract finance for their growth plans. Companies which is challenged on capital can get a grant to hire a capital-coach which will help the company acquire capital.	All companies with specific growth plans can apply. In order to establish a capital-coach run the company must have a capital need of minimum 1. million. kr.	Companies will have a capitalcoach for up to 30.000 kr. where the state will cover 50% of the expenses and the company will cover the rest.
Export council 45. Rådgivning om brug af lokale rådgivere på eksportmarkeder	Danish companies can by the foreign ministry be directed to local counselors such as lawyers and accountants in the	Danish companies can apply.	Companies can be directed to relevant lawyers, accountants or other local counselors in the foreign countries.

	foreign countries.		
Export council 46. Vejledning om handelsbarrierer	Companies which encounter trade barriers can obtain the help of the export council to remove trade barriers in the export markets. By trade barriers is meant the decisions governments or authorities outside of EU decide and which puts imported goods and service offerings in a competition-wise worse situation than locally produced goods and services.	All Danish companies can apply.	Danish companies can obtain help to remove trade barriers it can for example be barriers such as: Toll, toll-procedures, technical regulations, standards and certifications, lack of meaningful protection of patents, trademarks and similar limitations in access to unfair state support and subsidies. The aim by reporting trade barriers is to remove the barriers. There is for the time being no guarantee that the target can be reached or that it will happen by a short time frame - regardless of the effort done by the foreign ministry or EU.
Export council 47. Vejledning om håndtering af korruption på eksportmarkeder	Danish export companies which are subjected to corruption can obtain anti-corruption counselling at the "export council". Companies can, depending on the scope of the case, also make a complain-case through EU about the corrupting country.	All Danish tax-registered companies can apply.	The company can obtain guidance counselling about corruption and anti-corruption within (for example) the following areas: • Country specific information about corruption including knowledge about specific vulnerable markets, sectors or regions. • Risk-evaluation of the company's present and future market situation • Help to identify and temporarily screen agents, consultants and distributors.

	• Guidance in connection with public offers. • Access to a network of local organizations which works with challenging situations in regards to corruption. • Information about relvant national and international anti-corruption laws. • Assistance in relation to work with government in the relevant countries.

Source:

1. Startvaekst.dk

Appendix 4 - Norwegian programmes and mechanisms

Consists of:

Appendix 4 Norwegian Programmes and Mechanisms

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
1	Norwegian Research Council (Forskningsrådet) FORNY2020 This programme facilitates innovation and commercialisation of R&D results from publicly-funded research institutions.	Promotes innovation based on publically funded research results. The programme facilitates the commercialisation of results from projects conducted at publicly-funded research institutions and helps to bring the products and services to the market. FORNY2020 does not finance research but supports activities leading to that research results are used. This includes: • To verify and document that research results can be applied • To make research results from publicly funded institutions ready for commercialization • Creating attractive investment objects of research results with commercial potential Commercialization participants FORNY2020 co-financing and co-operates with seven commercial players, often called TTO's (Technology Transfer Offices). Commercialization participants are	• Commercialisation projects that are based, at least partially, on publically funded research and whose main goal is to facilitate commercialisation. • New companies based, at least partially, from public research • Technology Transfer Offices • Other organizations that facilitate commercialization of public research	• Proof of concept or verification project funding. This type of funding encompasses all areas of business and is designed to support verification of concepts that can result in new products, processes and services. The applicant may be required to contribute their own funding as well. Projects are assessed by external parties to ensure priority is given to projects at the forefront of their field. Adequate consideration will be given to both commercial and technical/conceptual aspects. Specific criteria have been established for this evaluation. The project is monitored throughout the process. • Basic funding for TTOs can cover up to 50% of operating costs. Must be matched by the TTO. • Measures to enhance the structure and promote network-building and competence-building at TTOs Budget: 128 million NOK (2013)

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		closely linked to research and collaborate closely with industry.		
2	Norwegian Research Council (Forskningsrådet) Continuation or escalation of ongoing or completed verification projects (FORNY2020)	To provide further funding to verification projects that have been deemed successful so far.	• Start-us and commercialization players who already have a verification project funded by FORNY2020	• Further financing to allow for the continuation or upscaling of verification projects. Budget: 5-7 million NOK (2014)
3	Norwegian Research Council (Forskningsrådet) SkatteFUNN	The SkatteFUNN R&D tax incentive scheme is a government program that is designed to stimulate research and development (R&D) in Norwegian trade and industry. Businesses and enterprises that are subject to taxation in Norway are eligible to apply for tax relief.	• All business regardless of industry or size conducting a research and development project. • Projects must be goal oriented and well defined as well as focused on developing a new product, service or production process that is useful for the company. • The project must demonstrate innovation potential • A clear set of objectives and milestones along with a detailed budget and funding plan is necessary. • The project must be designed to generate new knowledge, information or experience, or to implement findings from industrial R&D to develop improved products, services or production methods. • A detailed research proposal with clear research questions and methodology required.	• Tax incentives up to a max of 5.5 million NOK per year • Up to 11 million NOK can be claimed if all costs in excess of 5.5 million NOK are for the procurement of R&D services from an approved R&D institution. • SMEs qualify for up to a maximum of 20% for expenses related to R&D activities and large companies receive up to 18% Budget: 2 billion NOK (2012) in tax credits
4	Norwegian Research Council (Forskningsrådet)	The ENERGIX programme is designed	• Varies by support type and specific	• Direct funding of research

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
	ENERGIX	to generate new knowledge to support the long-term, sustainable restructuring of the energy system, which will require more renewable energy, more energy-efficient solutions, closer energy integration with Europe, and improved flexibility. The program also hopes to: • To achieve sustainable utilisation and consumption of renewable energy resources; To reduce Norwegian and global emissions of climate gases; • To ensure Norway's security of supply; • To strengthen innovation in Norwegian trade and industry; • To further develop Norwegian research communities. The main priority areas are renewable energy, smart energy systems, energy use and conversion, new energy concepts and energy policy, society and economics. Funding for energy research is intended to reinforce investments in R&D in both the public and private sectors, as well as to support the establishment of and bolster new	call for proposal • Focuses on funding the first stages of innovation/commercialization (fundamental research, industrial research, experimental development) • Norwegian companies, research institutions and universities are targeted by this program • Projects must fall into one of the main priority areas identified by the program. • A wide range of research activities are accepted. This is to allow for new thinking and innovative concepts to emerge. • Funding will be awarded to projects with anticipated major economic benefits. The programme board will support projects with a significant level of risk that would not be realised without this support, or would be realised on a smaller scale. Funding will also awarded to projects that meet the needs of the energy sector and society at large for long-term competence-building. • Long-term objectives and stable framework conditions for companies and research-performing environments are given high priority under the ENERGIX	projects • Knowledge-building projects for industry • Innovation projects for the industrial sectors • Attempting to develop novel approaches and funding instruments to encouraging new ideas and concepts Budget: 383 million NOK (2013)

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		independent research projects on topics not yet prioritised by industry. The ENERGIX programme will enhance the Norwegian research community's awareness of and access to networks by serving in an advisory capacity, providing a meeting place and offering targeted support for researcher mobility. The programme may also facilitate cooperation with leading international research groups. Knowledge generated under the ENERGIX programme constitutes an important component of Norway's knowledge base both in terms of strengthening and exploiting the country's competitive advantages as well as promoting Norwegian industrial development in an international market, and in terms of helping to address global challenges. International cooperation will be an important tool for: • further developing Norwegian research communities of high scientific calibre in an international perspective; • enhancing the level of expertise in industry-oriented and applied R&D;	programme. At the same time, the programme is designed to maintain the flexibility required to adapt to changing needs and opportunities over time. Such flexibility will also be crucial when prioritising funding instruments/types of projects. For example, it may be best to promote long-term competence building in one area for a certain period of time, while promoting industrial innovation in another. The programme board will weigh such considerations on an ongoing basis, while striving to ensure that the need for stability is met. • The ENERGIX programme will actively use communication and dissemination of research findings and knowledge development under the programme as a tool in achieving its objectives. Trade and industry and the research community comprise the main target groups for communication activities, followed by the public administration and the public at large.	

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		• improving the position of Norwegian research communities by highlighting their efforts and increasing their visibility; • participating in and advancing the international research front in areas in which Norway has particular advantages.		
5	Norwegian Research Council (Forskningsrådet) User-driven Research-based Innovation (BIA)	The BIA programme is targeted at industry and has a budget for 2011 of approximately NOK 355 million. Companies may apply for partial funding of R&D projects which are based on their own strategies and challenges, regardless of branch of industry or thematic area. The projects must result in substantial value creation for the companies as well as for society-at-large, and must take an international perspective. The projects are organised in consortia whereby companies and R&D communities cooperate on achieving results. The BIA programme is an open competitive arena designed to promote the ability and willingness of Norwegian trade and industry to generate innovation by providing support to R&D projects based on companies' own strategies and	• Norwegian companies and research groups that want to conduct resource intensive R&D projects not already covered under another Forskningsrådet program. • Focused on R&D projects for which public sector funding will have a trigger effect and which cannot be realised merely on the basis of the SkatteFUNN tax deduction scheme. • Funding will be awarded to ambitious projects that place great demands on the implementation capacity of the project participants. Importance is attached to encouraging cooperation among companies and between companies and research groups, both nationally and internationally. Innovative and experimental methods will be applied under programme as part of the effort to find optimal instruments for	• User-based Innovation Projects ○ funds projects that require the mobilisation of expertise and resources beyond those possessed by the companies, and that entail a higher level of risk than the companies may be expected to take on alone; ○ allows companies to focus on their own strategies and priorities when designing projects; ○ ensures that projects maintain focus on value creation and serve as good examples of research-based innovation. • Knowledge-building projects with User Involvement ○ Priority will be given to projects in which companies have clearly indicated that greater access to knowledge

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		challenges, independent of thematic or industrial focus. Under the programme, projects will be selected for funding primarily on the basis of their research content, level of innovation, potential for value creation, and relevance and benefit to society.	realising the potential for value creation in Norwegian trade and industry. Emphasis will also be given to disseminating research findings and increasing awareness of the significance of user-driven research.	of international calibre is needed within the Norwegian R&D community. • Network-building and mobilisation ○ The programme will provide support to encourage such processes. It will be essential to establish meeting places for players with common interests relating to research-based innovation. Such forums will be organised to promote the exchange of experience, network-building and collaboration. Relevant industry organisations may also be important participants in these forums.
6	Norwegian Research Council (Forskningsrådet) Innovation counselling and mobilisation (INNOMOBI) – Invitation to send in project ideas Part of the BIA program	Encouraging more research in Norwegian businesses by providing support in the evaluation of ideas and development of applications.	All Norwegian companies looking to begin a research project are eligible to submit an idea. To get started, a simple template describing the project concept should be filled in. It will be important to include a clear description of: • the concept's innovation potential and benefit to trade and industry as well as to society at large;	All those who submit a project concept will receive feedback from an adviser at the Research Council If the concept can be developed into an R&D project, the applicant will be: • directed to the right programme with information about the application deadline and further activities up until the proposal is submitted; or

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			• the new knowledge and technology that are needed to realise the concept; • the missing elements that are preventing a project from being established, the conditions and assumptions that must be clarified, the contacts that must be established, the collaborators and partners that must be brought on board, etc. •	• invited to receive additional follow-up and advise. • Up to 100,000 NOK is available to cover additional activities necessary to further develop the research idea into a project
7	Norwegian Research Council (Forskningsrådet) CLIMIT	CLIMIT is the Norwegian research programme for accelerating the commercialisation of Carbon Capture and Storage (CCS) by financial stimulation of research, development and demonstration. The program includes CCS in fossil fuel-based power generation and industrial point source emissions. The programme covers both the Research Council of Norway's support programme for research and development (CLIMIT R&D) and Gassnova's support programme for development and demonstration of technology for CO2 capture and storage (CLIMIT Demo). CLIMIT will contribute to:	• The programme is aimed at Norwegian companies, research institutions and universities, preferably in cooperation with international companies and research institutions which can contribute to accelerate CCS commercialisation. CLIMIT supports technology projects in all parts of the development chain up to commercialisation. • Specifically the program is focused on new innovative solutions that can yield considerable cost reductions and increased safety; areas where Norway or Norwegian players have advantages in CCS; and CCS in Norwegian industry for major carbon dioxide point sources. • CLIMIT encourages projects to	• Research projects • Knowledge buildings projects for business and industry • Innovation projects for the industrial sector • Pilot and demonstration projects • Other support such as preliminary project support, international collaboration, participation in international forums.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		• Lower costs and earlier international realisation of CCS. • CCS in Norwegian enterprises. • Realisation of the storage potential in the North Sea. Projects supported by CLIMIT will contribute to: • Knowledge and expertise to close technology gaps and increase safety. • Ground-breaking technologies and service concepts with international potential.	involve international cooperation.	
8	Norwegian Research Council (Forskningsrådet) Call for proposals for natural gas power plants and CO2 capture prototype and demonstration projects (CLIMIT)	Provide funding for demonstration projects related to the construction of carbon dioxide capture and storage (CCS) facilities on natural gas power plants.	• Companies or research organizations aiming to build a prototype or demonstration project related to CCS.	• Funding for all phases of development and commercialization of CCS. Budget: 90 million NOK (2013)
9	Norwegian Research Council (Forskningsrådet) Support for the development of researchers and PhD students in CCS (CLIMIT)	The goal of this program is to strengthen international partnerships in researching CCS technology.	• Researchers and PhD candidates interested in partnerships with universities or institutions in the USA or with the EU Joint Research Centre.	• Financial support for researchers or PhD candidates to travel to overseas institutions to study. Up to 300,000 NOK available per year
10	Norwegian Research Council (Forskningsrådet) Support for events and conferences related to CCS (CLIMIT)	To stimulate relationship building with international and national actors in CCS.	• Anyone planning an event or conference regarding CCS technology within certain guidelines	• Financial support to organize events and conferences. Up to 200,000 NOK available per year
11	Norwegian Research Council (Forskningsrådet) Free project support FRIPRO	The FRIPRO funding scheme provides funding for independent projects in an open national competitive arena on the basis of scientific merit. The FRIPRO funding scheme is designed to	• The FRIPRO scheme comprises a competitive arena open to all research areas and disciplines. There are no thematic guidelines and no requirements relating to	• The FRIPRO scheme provides funding for Researcher projects, Young Research Talents, Postdoctoral fellowships and events.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		promote research of high scientific quality independent of research area and discipline. In addition, it promotes the development of basic theory and methods as well as scientific renewal within disciplines.	the applicability or immediate utility of the research. • The FRIPRO scheme is open to grant applications from universities and university colleges, independent research institutes, and other publicly funded research groups.	• Calls for proposals for independent project are issued in April each year, with application deadline in June. Funds are allocated in November/December, with project start at the earliest in January of the following year. Grant applications will normally be dealt with under the Expert Committee/thematic call to which they have been submitted.
13	Norwegian Research Council (Forskningsrådet) Centres for Environmentally -friendly Energy Research (FME)	The main objective of the Centres for Environment-friendly Energy Research (FME) scheme is to establish time-limited research centres which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the energy sector. The FME scheme seeks to develop expertise and promote innovation through focus on long-term research in selected areas of environment-friendly energy, transport and CO2 management in close cooperation between prominent research communities and users.	Primarily academic institutions, however, private enterprises must be involved as a partner. These partners must identify the commercial potential they foresee for the research. The centres will be selected primarily on the basis of their potential to generate innovation and value creation in the CEER scheme's thematic priority areas and on the scientific merit of their research. FMEs must: • Foster innovation among user partners within the relevant thematic priority area through	It is generally assumed that the centres will be co-financed by the host institution, the centre's partners and the Research Council. User partners must take active part in the centre's management and research activities. The centres will be established for a maximum period of eight years (an initial five-year period with the possibility of a three-year extension). Each centre is provided with between 7-20 million NOK every year.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		The scheme seeks to enhance technology transfer, internationalisation and researcher training.	increased investment in long-term research and make Norway an attractive location for international companies to establish their R&D activities; • Stimulate active cooperation between innovative industry, public administrative bodies and prominent research institutions. • Promote the development of application-oriented research communities which lie at the forefront of international research and which participate in dynamic international networks; • Enhance researcher training in areas of importance for user partners and generate research-based knowledge and technology transfer.	Budget: 1.2 billion NOK over 8 years
14	Norwegian Research Council (Forskningsrådet) Industry-based PhD	The Industrial Ph.D. scheme does not represent a new type of doctoral degree, but is designed to support long-term, industry-oriented research that has the same level of scientific merit as the general doctoral degree education. The Industrial Ph.D. scheme is designed to enhance interaction between companies and research institutions, increase	• Companies wanting to hire a researcher to enhance their capabilities • Requires that candidate be accepted by the institution granting the PhD • There are no limitations to the theme or topic of the research • Each company can have a maximum of two candidates per year.	• 50% of the cost of a research fellowship is paid. • The maximum support that can be provided is 50% of the government set grant support rate. In 2014, this rate is 938,000 NOK and increases 3% annually. • There is a possibility for a stipend given to the researcher

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		research activity in industry, and equip newly-educated researchers with knowledge of relevance to their company. This program is based on a Danish program, "Erhvervs-ph.d", which has existed since 1972.		to spend between 3 to 12 months at an international institution. • Additional stipend available to complete a portion of the PhD at an overseas university (3-12 months) Budget: Enough for around 30 applicants (2013)
15	Norwegian Research Council (Forskningsrådet) International Stipend (IS)	The International Scholarship Section (IS) promotes the exchange of students and researchers within the framework of international mobility and networking programmes.	• Norwegian researchers who wish to work in Europe or another country. • International researcher who want to work at a Norwegian institution.	• Stipends for network building or research building in other countries or within Norway. • The program used 22.9 million NOK in 2012 and supported about 300 projects. • This program supports a number of different stipend programs that target different countries.
16	Regional Research Funds There are seven regional research funds under this program: Agder Hovedstaden Innlandet Midt-Norge Nord-Norge Oslofjordfondet Vestlandet	The regional research funds shall mobilize increased R & D efforts and strengthen research on regional innovation and development. Research funds should support the regional priority areas. Within these areas, they also contribute to long-term, basic capacity building in relevant research. The aim is to develop good and competitive	Eligible applicants varies depending on the specific program offered under the different regional research funds. Applicants have included universities, research institutions, businesses, health institutions, public institutions and others.	Regional qualifying support aim to develop research projects that may qualify for further support from the relevant schemes. Good project ideas in applications that are not considered to be of sufficient quality to be able to award over the other types of applications may be granted regional qualifier support to develop and qualify the project.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
	Each fund has its own budget, areas of focus and strategies.	research in all counties. Funds shall also meet the regions' R & D needs by supporting R & D projects initiated by businesses, government entities, including universities, colleges and research institutions. The support can go to projects located in and outside the region funds geographical area Regional research aims to: • Strengthen research on regional innovation and regional development • Fund research projects of good quality within the regions priority areas. • Contributes to the private and public businesses increase innovation, value creation and competitiveness by initiating and applying the results of research. • Encourage closer cooperation between research institutions and strengthen links with business and the public sector in its region. Mobilize increased R & D efforts in the regions: • Contribute to businesses and government entities highlighting its expertise and innovation by engaging in R&D work.		Target groups for qualification support businesses, public agencies, individual researchers and research institutions. Regional business projects aim to strengthen R&D activities in enterprises within the individual funds' priorities. The target groups are individual companies with R&D experience, individual companies in collaboration with research institutions, consortia of firms or consortia of firms in cooperation with R&D institutions. Regional public projects aim to trigger and enhance R&D activities in the public sector within the individual funds priority areas. The target groups are single entities, single entities in collaboration with research institutions and/or companies, consortia of companies or consortia of companies in collaboration with research institutions and/or companies. Regional research projects will contribute to new knowledge

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		• Strengthen dialogue on the relevance of research to regional needs. Contributing to increased research quality and the development of effective and competitive research environments in the regions • Contribute to long-term, basic skills development in R & D institutions regionally within the regional priority areas. • Linking institutional R & D expertise closer to other regional R & D activities. Creating developmental and learning contexts where regional experiences can be discussed in relation to national and international knowledge and activities Ensure close interaction between activities in the regions and their relationships with other national and international programs and activities. Fund Boards for funds Region Northern Norway and funds in Mid-Norway should also address Sami research interests-needs.		about issues relevant to the region and theme in regional development. The relevance is defined by the Fund's calls for proposals. The target group for the regional research projects are individual researchers or groups of researchers at one or more research institutions (universities, colleges, research institutes, institutions of research as an important activity). Regional institutional projects aim to strengthen the research capability within regional priority areas, through building new skills or develop existing skills. The projects will help strengthen communities of high quality or build new communities in areas of strategic importance. The projects must be based on the applicant institution's strategic plans. The relevance is defined by the Fund calls for proposals. Regional issues in national program. The individual executive committees may decide that part of the fund will be used to strengthen national programs so

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
				that they can advertise projects that are particularly important for the region. Approximately 180 million NOK was appropriated to projects in 2012.
17	enova Support for pre-projects regarding energy use in industry (ongoing)	Aims to encourage an increased number of major investment projects in industry focused on reducing energy use by providing support for gathering the necessary documentation and permits for an energy project.	• End-users of the project can apply for this support. • Projects must have an expected energy use reduction of over 5 GWh per year. • The projects should have an ambitious goal. Projects with a more ambitious target will be awarded higher funding.	• Provides support for analysis of potential energy projects that can reduce energy costs. The projects will obtain up to 50% of documented costs with a cap of 1 million NOK
18	enova Support for energy initiatives in industry	To spur industrial investment in energy efficiency and renewable energy projects. This will be achieved through increasing awareness about energy efficiency potential as well as triggering investments in energy efficiency, waste energy recovery and conversion to renewable energy sources that would not have been conducted without financial support.	• Norwegian industrial companies with projects projected to reduce energy use by over 100,000 kWh per year. • Projects could include energy efficient work programs or processes, energy recovery, or conversion to renewable energy sources. • The applicant must be a single company or a group of companies with the same address. • Projects can consist of simple measures or a portfolio of measures. • The project must use commercially	• Funds are provided based on rules for government aid for energy saving and renewable energy production. Total support from government cannot exceed certain levels. Each application will be assessed individually for support.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			available technology (new technology is covered under a different program) • R&D projects are supported • Projects that would be profitable without the financial support will not be covered.	
19	enova Support for energy initiatives in facilities	Enova will support the energy measures that contribute to environmentally friendly restructuring of energy consumption and production facilities in Norway. The goal of the program is to spur environmentally friendly restructuring of energy consumption and production in plants in Norway. This will be achieved through: • Increased awareness and focus on efficient and environmentally friendly energy consumption and production. • Increased investments in energy efficiency, conversion from electricity and fossil fuels to renewable energy sources and increased renewable energy production	The target group for the program, businesses and organizations located in Norway that has the potential for environmentally friendly restructuring of energy consumption and production. The business can be private, public or an organization. It offers investment support in areas such as: • Road (road lighting, tunnel ventilation etc) • Port facilities • Fish farms • Electric Rail, Tram and Subway • Outdoor sports facilities (football pitches, resorts, etc) • Water, sewage and water treatment plants • Entertainment Construction (Amusement parks, aquariums, water parks, etc) The program includes only permanent facility or facilities of a	Funds are provided based on rules for government aid for energy saving and renewable energy production. Total support from government cannot exceed certain levels. Each application will be assessed individually for support.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			permanent character, and a project must have a total annual energy target of at least 100,000 kWh. Projects must be related to efficient energy use, waste heat utilization through recycling of heat for own use, production or supply to others or converting to renewable energy sources. The same restrictions apply as with the "Support for energy initiatives in industry" program.	
20	enova Support for energy efficient new buildings	The program provides investment support to pilot projects for energy efficient new buildings with high aspirations for both the building structure, technical systems and renewable energy in Norway. Support is given to new construction in all building categories. The program will promote pilot projects for energy efficient new buildings. The program also contribute to cost reduction and market diversification of ambitious energy solutions.	The program is aimed at players who want to go ahead and invest in innovation, and that can simultaneously visualize a market diversification potential. The target audience is developers, contractors and builders who build for themselves or others. The program is technology-neutral and includes new construction in all building categories and sizes. Projects to be supported must have high energy ambitions beyond current regulatory requirements. High energy ambitions can be achieved through measures such as building structure, technical systems and energy supply.	Support is granted as direct investment. The maximum aid intensity is 60% of eligible costs for the project. The program provides support per kWh of energy saved and produced renewable energy beyond the requirements of technical regulations. The additional costs by raising project from TEK10 to the new energy requirements can be calculated on the aggregate level of the application date. Additional costs include: • The project's design and

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
				detailed planning • Project • Purchase of equipment • Construction and installation Ineligible costs include: • Research and development • Concept evaluation / assessment • Finance costs • Purchase of property • Unforeseen costs
21	enova Support for energy initiatives in existing buildings	The program provides investment support for energy measures in existing buildings, commercial buildings and large residential buildings. The investment support given to physical measures that reduce energy use and help transition to renewable energy sources. The support is automatically calculated for measures applied based on the incremental cost of the measures. The program will contribute to: • Highlight opportunities for energy reduction and conversion to heat plants with renewable energy sources. • Promoting best available energy technologies and solutions.	The program is aimed at existing commercial buildings and large existing residential buildings. Applicants must be registered in business register and can be: • building owner, • tenant in commercial or • residential condominium or housing association Projects must be completed within 3 years of the application date. Work must be completed according to relevant standards. Energy savings of at least 10% must be achieved by the initiative. Projects can be a single energy initiative to reduce energy use, a	The funding level is calculated in the application and reporting center based on the type and quantity of measures implemented. Total support from government cannot exceed certain levels. No maximum or minimum amounts were published.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		• Ensuring a high level of ambition in the projects. • Establish pilot projects and contribute to lessons learned.	conversion to a more efficient central heating system or upgrade to a passive or low energy standard.	
22	enova Central heating from renewable sources	Through this program, enova gives investment support for heat production based on renewable energy sources to individual heating plants. Through a similar program, building owners and industry companies can get support to install central heating systems that use renewable energy sources in their own buildings.	The program is aimed at players who want to establish a renewable solution for building heating, cooling and process heat to cover their own needs or for sale to external customers. Only registered companies can apply. Projects that are eligible : • Projects that require up to 1 NOK in aid per kWh to be realized • Systems with minimum 15 years of useful life • Projects based on realistic assumptions • Projects include building heating and cooling as well as heating for production purposes (process heat)	Enova assesses support needs against a similar return to normal return for the heating sector (4.8% real pre-tax), or a maximum of 1.0 NOK/kWh renewable heat. Support is also governed by the rules on state aid for environmental measures. Support for building owners is based on a fixed subsidy rate based on installed capacity in NOK/kW. There is a maximum of 200,000 NOK per project or 40% of costs.
23	enova Biogas Production	The objective is to develop a market for the production and sale of biogas in industry, and contribute to technological development for the production of biogas.	• Businesses supplying biogas to the Norwegian market • Eligible projects include plants that produce biogas from organic waste, energy crops or timber and supplying gas to external customers. • Projects must have an energy production of at least 1 GWh.	• Investment subsidies of up to 30% of eligible costs of the project.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			• Projects with a higher production/cost ratio (kWh/NOK) will be prioritised.	
24	enova District Heating	Through the program for district heating, Enova provides support to companies who wish to establish new or enhance existing district heating. District cooling can also receive funding under the program. The program will promote the development of district heating and cooling. This implies • start of district heating and cooling where both infrastructure and associated heating based on renewable energy sources must be developed • expansion and densification of existing district heating systems with infrastructure for district heating and cooling • conversion to renewable energy production in existing heating plants based on non-renewable energy sources	The program is aimed at players who want to establish and further develop its business in the supply of district heating and cooling. Only registered companies can apply. Projects covered include: • District heating and district cooling plants that supply energy to external customers • District heating plants with combined heat and power. If the power supply is not eligible for green certificates, it will be included in the energy exchange in addition to the heat delivery. • Converting to renewable energy production in existing heating plants based on non-renewable sources of energy, where energy supply have not previously received support from Enova. • Has a useful life measured from the first years of energy supply at least 15 years of energy production, a minimum of 20 years for energy production and distribution, and at least 30 years of distribution. • Is based on renewable energy and /	Program for district heating is an investment scheme. The need for support must be documented through a cash flow analysis. Enova assesses support needs against a similar return to normal return for the heating sector. The final amount of aid is determined on the basis of competitive projects in between.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			or waste heat as base load • Has a defined extent and delivery area • Has a heating license, where required or provided by the developer • Is based on realistic assumptions	
24	enova Support for the use of new energy and climate technology in industry	This program will contribute to energy efficiency and reduced greenhouse gas emissions in industry by supporting the introduction of innovative technologies and solutions for production processes in manufacturing companies in Norway. Increase the introduction of new energy and climate technologies related to production processes along with related competence building in manufacturing companies and the technology environment in Norway	Production Companies in Norway with innovative demonstration projects that introduce new energy and climate technology. The technology must contribute to energy efficiency, energy recovery, conversion from electricity and fossil fuels to renewable energy sources, increased renewable energy production and reduced greenhouse gas emissions from production processes. The program targets investments in tangible physical installations for demonstration. The projects must have defined goals for innovation. For example, in the form of reduced costs, increased efficiency, utilization of new energy sources, reduced specific energy (energy per unit), reduced greenhouse gas emissions, etc. The	Direct investment of up to 50% of eligible costs. Only specific additional costs required to achieve contractual energy and / or climate result from the physical installation covered. Additional costs include: • Design and detailed planning • Project • Purchase of equipment • Construction and installation of equipment • Commissioning and documentation of energy results Not eligible costs include: • Research activity • Finance costs • Purchase of property • Unforeseen costs

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			innovation goal must be documented and must involve a significant step forward compared to established practice or standard. The project must have a defined budget and a clear plan for implementation and financing. The project may involve suppliers and collaboration between multiple parties. Support can be given to demonstration of technology not previously been introduced on a commercial scale in relation to production processes in Norway, including technologies that have previously only been tested on a smaller scale.	
25	enova Support for the introduction of new technology	Enova wants to contribute to energy conversion by supporting the market introduction of innovative energy technologies. This program provides investment to full-scale demonstration projects under real operating conditions. The projects will contribute to energy efficiency and increased renewable energy production in Norway. Increased and accelerated market	All registered companies that are looking to introduce new technologies to the Norwegian energy market. The program is aimed at concrete, physical installations. The project must have a defined budget and a clear plan for implementation and financing. The projects must have defined goals for innovation. This may for example be in the form of reduced	Direct investment of up to 50% of eligible costs. Only specific additional costs required to achieve contractual energy and / or climate result from the physical installation covered. Additional costs include: • Design and detailed planning • Project • Purchase of equipment • Construction and installation of equipment

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		introduction of new technology in the Norwegian energy market.	costs, increased efficiency, utilization of new energy sources and reduce energy consumption. Innovation aim must be documented and must involve a significant step in terms of established practice or standard. Support can be given to technologies that are introduced in the Norwegian market, including technologies that have previously only been tested on a smaller scale. Projects must have a defined energy targets related to energy result from the applied installation. By funding commitments assumed by Enova contract quantification of energy result in annual kilowatt hours either as renewable energy production, conversion or reduction of energy consumption. The installation will be placed in an end user under real operating conditions and operated for at least two years. The project will achieve positive cash flow from operations. This means that revenues from energy production and reduced energy consumption will be higher than the operating and maintenance	• Commissioning and documentation of energy results Not eligible costs include: • Research activity • Finance costs • Purchase of property • Unforeseen costs

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			costs. All government permits licenses, building permits, etc. must be in place before funding commitments can be made.	
26	enova Support for the use of new technology in "future buildings"	Enova want to contribute to environmentally friendly restructuring of energy consumption and production by supporting the market introduction of innovative energy technologies in buildings. Enova provides investment support for innovative demonstration projects to full-scale under real operating conditions. The projects will contribute to energy efficiency or increased production of renewable energy in Norway. The program will contribute to the introduction of new energy-related technology construction.	• End-users who are building owners or project owners The program targets projects consisting of concrete, physical installations. Technology supported must not have been introduced earlier in the Norwegian market. Only technology previously tested in smaller scale projects are eligible. The projects must have defined goals for innovation. This goal must be documented and must involve a significant improvement over established practices or standards. The installation may be in the form of an improved product, more products in conjunction or improved system solutions. The technology must contribute to energy results based on reduced energy, reduced amount of net delivered (supplied) energy or	Direct investment of up to 50% of eligible costs. Only specific additional costs required to achieve contractual energy and / or climate result from the physical installation covered. Additional costs include: • Design and detailed planning • Project • Purchase of equipment • Construction and installation of equipment • Commissioning and documentation of energy results Not eligible costs include: • Research activity • Finance costs • Purchase of property Unforeseen costs

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			conversion of energy supplied by electric / fossil to renewable. The installation will be placed in an end user under real operating conditions and operated for at least five years. The project will achieve positive cash flow from operations. This means that the value of reduced energy, reduced energy consumption or income from energy production will be higher than the installation's operating and maintenance costs. The project must have a defined budget and a clear plan for implementation and financing. All government permits licenses, zoning, etc. must be in place before funding commitments can be made. It is expected that the project will be available as a demonstration object.	
27	Innovation Norway General company and project support	To help small and medium sized companies with a profitable project or further development of the company. This program can provide a wide range of support including grants, guarantees or loans. This is general support that can help a	• Small, medium and large business • Project must have a documented potential for growth • Projects must relate to development, modernization, restructuring, development or market entry. Examples of initiatives that we support can be	• Loans, guarantees and grants (grants are primarily provided to small and medium enterprises) • Can help finance investments in buildings, machinery or equipment • Pre-project support is also

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		business get started or begin growing. This program is a flexible tool that can be applied in a wide range of circumstances.	research and development, technical feasibility studies, training, consultancy and trade show participation. Assessment criteria: • The project will contribute to increased value creation and employment in Norway • The project will contribute to increased profitability for your business • Assumptions, plans and budgets must be realistic • Degree of innovation - how innovative is the project or the company's other activities? • The project's or company's potential for success in an international market • The support must be essential for the project to be completed. For large enterprises must support also contribute to the change in scope, size, execution speed or resource allocation that would not have happened without the support. • The company's ability to complete the project and exploit the results of the • The company's competitiveness • Relation to any partners that are	available (assessments, analysis, document preparation, etc.)

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			critical to your company's existence and ability to deliver, or to provide expertise or funding the project • Security Coverage for loans and the company's ability to service debt	
28	Innovation Norway Establishment Grants	Establishment grants are offered to entrepreneurial enterprises with clear ambitions for growth and a business that represents something new. The grant will contribute to the implementation of corrective actions in an early startup phase.	• Companies registered less than three years ago • Companies with clear ambitions for growth and represent an innovative or new product/service	• Idea clarification funding (ie. user studies, prototypes, test new business models, skill development etc.) • Market clarification (ie. Product development, IPR, brand strategy, branding etc) • Only available for future costs, not already incurred costs • Grant will cover up to 50% of costs with a maximum of 300,000 NOK for each type of funding
29	Innovation Norway Research and development grants	Contributes to the development of new products and solutions that will lead to international market success. This program builds upon the partnership between a supplier (the applicant) and a customer company.	• Small and medium sized companies (max 250 staff) with the capacity and competence to address a development need at a customer/partner. • Large companies can also receive this grant but usually only in exceptional circumstances. • Foreign companies with a Norwegian subsidiary can apply but a significant portion of value creation needs to occur in Norway. • The company must have a clear market objectives	• Industrial research and development contracts help develop competitive products in the international market, and to develop industrial networks and environments. Through a committed relationship, suppliers can access new expertise, global network of strategic partners and international markets. Client companies have access to technology, resources and knowledge they would not

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			• Products must have significant market potential • The grant cannot be given for market launch or marketing activities. • The grant can be used to test the idea for a project prior to launching the main project. • The company must have adequate resources in terms of expertise and finances to complete the project. The company must also be well managed with strong implementation procedures.	otherwise have, and can thus develop more competitive products and services. • Government research and development contracts create a binding agreement between the Norwegian suppliers and a Norwegian government entity, such as municipalities, counties, state agencies, hospitals and defense. Through collaboration, the public activities contribute to the development of new products or services that enhance the quality of public service delivery and streamline the operation of the public sector. • Grants for a preliminary or feasibility project can cover up to 50% of costs (40% for large companies) • Grants for development or prototypes can cover up to 45% of costs for small companies (<50 emp), 35% for medium companies (>50 emp) and 25% for large companies (>250 emp) • Grants can increase by 15% if there is a genuine partnership between two companies and if one of them is an SME. Neither

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
				company can contribute more than 70% of the project costs.
30	Innovation Norway Environmental scheme: Grant program for future solutions	Support the increased development and investment in green technologies as well as to support their success in national and international markets. Environmental technologies are those that directly or indirectly improve the environment. This includes reduction of pollution through cleansing processes, more environmentally friendly products and processes, more effective resource management, and technological systems that reduce environmental impact.	Small, medium and large companies in Norway that will start a pilot or demonstration project in Norway. Only technologies that are close to commercialization and will be built and tested in natural conditions. Projects that are early stages of concept development and lab testing are not prioritised under this scheme. The project should contribute to higher value-added activities in Norway such as increased employment. The higher the impact of the technology on the environment, the better the chances of funding. The expected profitability of the project (economic and social) will be considered when evaluation applications. The innovativeness of the project, the projected growth potential in international markets, the ability to implement the project, and the realism of the assumptions regarding	• Grants or a combination of grants and loans to cover a portion of the costs of the project • Grants for development or prototypes can cover up to 45% of costs for small companies (<50 emp), 35% for medium companies (>50 emp) and 25% for large companies (>250 emp) • Support can be given for the incremental costs of investing in renewable energy facilities: 65%/55%/45%. Incremental is based on the increased cost of building a renewable energy facility instead of a fossil fuel facility with the same capacity. • Support for a new facility that produces sustainable biofuels: 65%/55%/45%. • Support for the incremental cost of technology that is better that the EU environmental standard: 55%/45%/45%. • Grants can increase by 15% if there is a genuine partnership between two companies and if one of them is an SME. Neither company can contribute more

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			the technology will also be considered when evaluating projects.	than 70% of the project costs.
31	Innovation Norway Bioenergy program – bio-heat, biogas and wood chip production	The program is intended to encourage agricultural and forest users to produce, use and supply bioenergy in the form of fuel or heat. In addition to providing increased value creation, the program will emphasise the spillover and competence effects that the program can help support. The program will contribute to land use that can sell heat produced from biofuels, use bioenergy in their own buildings and processes, or sell biofuels.	This program is targeted at farmers and forest owners and related organizations One aspect of the program allows other actors to receive funding if they can show that they will contribute to the programs main purpose.	Grants or a combination of grants and loans to cover a portion of the costs of the following projects: • Facilities for heat sales (40% of costs, max 6 million NOK) • Farm heating facilities (33% of costs, max 400,000 NOK) • Greenhouses (35%, max 1MW project) • Biogas facilities (45% of costs, no max listed) • Biofuel production (25%, max 1.68 million NOK) • Consultant help for preliminary studies (50%, max 50,000 NOK) • Preliminary studies and investigations (50%, max 150,000 NOK) • Competence and information initiatives (50%, max 100,000 NOK) • Cannot receive funding from both Innovation Norway and enova.
32	Innovation Norway International office support	Provide companies with advice and contacts in foreign markets. Innovation Norway has a number of programs that help provide advice,	• All Norwegian companies looking to expand internationally can access these services. • Many services are provided in	• Advice and network building (sometimes at an additional cost) • Companies can receive advice,

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		network development, and skill development.	partnership with other organizations and programs. This includes programs in Europe, New York and in Silicon Valley.	access international market research services, and get support for finding an international partner. • SMEs must pay 50% of the cost of services from Innovation Norway's international offices but the remaining can be covered by public programs. • Other programs can help develop entrepreneurial skills, international business knowledge and other relevant skills.
33	Innovation Norway Mentor services	Provide advice to new companies to increase the chances at success.	• All new entrepreneurs seeking business advice	• Advice regarding business plan writing, business model development, IPR strategy, collaboration opportunities, mentoring with established professionals, network development in Norway, pitching, financing, venture capital and other business related subjects. • Some of the information is available online, some requires a phone call to Innovation Norway and some have a nominal cost.
37	SIVA, Innovation Norway, Norwegian Research Council	SIVAs program activities work to develop and strengthen the innovation environment in Norway.	• Each centre contains actors from academia and research institutes, businesses, public organizations,	• Financial support for development (up to 10 years) The NCE program may partly

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
	National Centers of Excellence	The goal is to encourage innovation and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. NCEs are specific clusters that are focused on the most dynamic industries with the ability to be recognized globally. This program focuses on accelerating development in these clusters and is particularly concerned with increased innovation, targeted internationalization, strengthened attractiveness and access to tailored expertise. The primary goal of the NCE program is to trigger and enhance collaborative innovation and internationalization processes that increase the value added in the cluster companies. Specifically, the program will generate interest and commitment to the development of clusters with growth potential. It will trigger clear effects in the form of better functioning cooperation and infrastructure, increased access to tailored expertise, increased innovation, higher level of	and other clusters. • The primary criteria is that the area can help strengthen the centre in the specific field of interest.	finance the following activities: • Process Management • Analysis and strategy processes • Communication • Networking and forums • Learning Activities • Facilitating early idea and project The total public funding of projects in NCE can be up to 50% of eligible cost basis. NCE can also provide technical support in the form of: • Operating a common, regular forum for dialog and collaboration • Completion of courses or seminars linked to the main topic of the centre • Ongoing dialogue and monitoring of the centre • Connecting the centre to relevant national and international funding offers • Standardized reporting and management tools • Active marketing nationally and internationally through

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		internationalization, increased visibility and international attractiveness. It will also provide important insights into collaborative development processes in regional clusters, with the aim of developing operational models and policy learning.		various channels.
39	SIVA, Innovation Norway, Norwegian Research Council Arena Program	SIVAs program activities work to develop and strengthen the innovation environment in Norway. The goal is to encourage innovation and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. The Arena program provides financial and knowledge based support to the long-term development of regional business environments. It works to stimulate increased innovation and strengthened competitive position based on partnership with other companies, research organizations and development actors.	• All companies in a related field that wish to create or participate in a cluster in a specific field and region.	Financial and professional support to developing regional business environments such as clusters. The Arena program may partly finance the following activities: • Process Management • Analysis and strategy processes • Communication • Networking and forums • Learning Activities • Facilitating early idea and project The total public funding of projects in the Arena can be up to 50% of eligible cost basis. Arena can also provide: • Basic knowledge via the program's website • Manual Arena with working models and tools

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
				• Start-up Seminar for new projects • Meetings for project managers • Academic seminars on specific topics • Study Tours • Project Consulting • Dialogue Seminar on organization and management of cluster projects • Technical assistance from the three program owners • Links to the three program owners' services and programs
40	SIVA Siva International Networks	SIVAs program activities work to develop and strengthen the innovation environment in Norway. The goal is to encourage innovation and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. Siva's international networks work to develop relationships and physical	• Companies looking to expand into other markets	• Access to international markets

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		locations in other countries to support the internationalization of Norwegian companies.		
41	GIEK Export credits and guarantees	Support Norwegian companies to reach new markets by providing guarantees on behalf of the Norwegian government.	• Companies exporting products and services to external markets	• Provides guarantees on behalf of the Norwegian government to help secure funding and export agreements.

42	Husbanken
	
	Competence Grants – Sustainable housing and buildings
		The grant will contribute to more environmentally friendly and universally designed homes, buildings and outdoor areas, and to increase expertise on sustainable qualities.	• Companies conducting projects related to sustainable buildings
			• Projects will be prioritised based on the following:
			  • New solutions and methods with emphasis on challenges in existing buildings in terms of universal design and accessibility, environmentally friendly materials and energy efficiency, life cycle analysis and construction practices.
			  • Pilot and model projects in the priority fields and dispersion of results, knowledge, skills and tools.
			  • Projects that can help the industry easily meet any future regulations and that includes several of the priority fields.
			  • Projects of national and/or regional significance and contribute to cooperation between key players at these levels.
				• Support can be provided in the following ways:
				  • knowledge, support for pilot projects and dissemination of information about energy and environmental and climate friendly solutions in homes and buildings
				  • knowledge, support for pilot projects and dissemination of information on universal design, accessibility and usability in homes, buildings and outdoor areas
				  • knowledge development and dissemination of information on sustainable architectural architecture and living environment
				  • knowledge and support for model and pilot projects with quality that goes beyond the requirements of the Technical Building Regulations

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			• Projects with high transfer value and excellent communication plans • Developers wishing to conduct pilot projects will preferably have a partnership with the local municipality. • Results of development and pilot projects must be made public.	
43	Export Credit Norway	Export Credit Norway helps suppliers who develop climate technology win contracts abroad. Export Credits Norway's predecessor, Export Finance, has partly funded the supply of turbines and electromechanical equipment for hydropower projects in Turkey and Indonesia, modules for solar power plants in the Czech Republic and personnel transport boats specially designed for use in offshore wind farms. To ensure that the company has the capacity and expertise to support these rapidly emerging industries, Export Credits Norway continues a separate business dedicated to renewable energy and environmental technology.	Norwegian companies who are looking to export products to other countries can apply. The buyers of the products can also apply for this financing.	The international agreement regulating the export financing in OECD area allows for particularly favorable financing terms for renewable energy projects. Export Credits Norway can therefore offer fixed CIRR rates up to 18 years maturity. Loans can cover up to 85% of the export contract value and the payback period can be between 2 to 18 years. The maximum of 18 years if for renewable energy projects. Export Credit expects to have a portfolio of up to 50 billion NOK in loans.
44	transnova Grants for developing charging stations for electric cars	This program is aimed at further developing the national infrastructure for supporting electric vehicles.	Grants are mainly given to projects at a stage between R&D late phase and market introduction. transnova does not provide support to basic	In general, grants can cover up to 50% of overall costs without any maximum limit to total support.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
		transnova's main policy instrument is to provide grants for demonstration and pilot projects that reduce CO2-emissions in the transport sector.	science/research. The grant will only be given to projects that have not already been started. Also, only charging stations that are publicly available will be supported. Only companies are eligible for this grant, not individuals. The projects that have the best market potential and business plan will be prioritised. Consideration will also be given to how quickly projects can be built. Further consideration will also be given to technical design and location.	However, for developments in specific corridors, transnova can provide support up to 100% of costs if the project is not expected to be profitable within the first three years. It must also be shown that the project would not be built without the additional support. Budget: 18 million NOK (2014)
45	transnova Support for projects that further climate friendly transport solutions	The primary goal of this program is to contribute to meeting Norway's goal for reducing GHG emissions from the transportation sector.	Projects that can receive funding under this program include: • replacing fossil fuels with renewable fuels or energy carriers • contribute to the development and increased use of low emission transport • contribute to reducing traffic volume • contribute to increasing the efficiency of the transport sector Foreign companies may apply but the majority of the emission reductions must occur in Norway.	The support will come in the form of a grant that is dependent on the project and government regulations for providing support for these types of projects.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			Support is primarily given to pilot or demonstration projects that have the goal of proving the effectiveness of new technology or solutions. However, support can also be given to projects for technology development, verification and testing or to projects that reduce barriers or stimulate the use of more climate friendly technologies.	
46	Norad Application-based support to businesses	The goal of the program is to support business development in developing countries. The program facilitates long-term and sustainable commercial investments through supporting risk reducing initiatives or initiatives that further private investment in sustainable and feasible projects. The program gives priority to programs supporting renewable energy, environment or climate related technology, agriculture, forestry, marine or maritime sectors.	The scheme is primarily aimed at businesses/commercial operators seeking funding for feasibility studies, training in the establishment, baseline investments, HSE, trial production / pilot project in connection with investment projects / business establishment and guarantees for imports to Norway from developing countries. Applicants can include companies that have the ability and skills needed to invest in developing countries as well as industry organizations or industry-related institutions who are well-placed to achieve the goals of the program. Companies must have had a revenue of at least 10 million kroner in the previous year. They must also own at	Types of support available: • Partner search or business matchmaking • Feasibility studies including market research, decision making, and preliminary measures. • Pilot or test production to reduce the risks of investment. • Support for investment in basic infrastructure such as property. • Support for the training of local employees. • Support for implementing high levels of HSE standards. • Import warranties. Preliminary project and education

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
			least 25% of the resulting project or company. The projects must be located in the least developed lands as identified by Norad.	support can receive grants of up to 50% of costs. The other support categories can receive up to 80% of costs.

Cut programs

These mechanisms were cut as they were offered by universities or other agencies that are funded by the government yet not a part of the government actor in terms of Triple Helix. Some, as SIVA are focusing more on building the infrastructure and are not available for any players to apply for, they have therefore been cut as well.

	Program/Mechanism	Purpose	Who is eligible/targeted?	Type of Support Available
12	Norwegian Research Council (Forskningsrådet) VRI	VRI is the Council's main support mechanism for research and innovation in Norway's regions. The primary goal for VRI is to encourage innovation, knowledge development, and added value through regional cooperation and a strengthened research and development effort within and for the regions.	• Partnership between industry, research institutions or public institutions and the regional partnership	• Projects that promote interaction ○ Mobility initiatives ○ Competence brokering ○ Dialogue and broad participation ○ Regional foresight ○ Regional dialogue conference ○ Pre-project funding
35	SIVA Business Parks or Clusters	SIVAs program activities work to develop and strengthen the innovation environment in Norway. The goal is to encourage innovation	• Small companies related to the specific areas of interest for the cluster.	• Access to networks, collaboration opportunities and professional development.

		and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. Business parks and clusters Increase regional wealth creation through the development and growth of new and existing business through synergy effects created by physical co-location. The goal is to increase regional wealth creation through development and growth in new and existing businesses.	• Private companies should always be the driver of the process of creation and development of a business park or cluster. • Business parks and clusters are always organized as a corporation with both public and private owners.	
36	SIVA Research and Technology Parks	SIVAs program activities work to develop and strengthen the innovation environment in Norway. The goal is to encourage innovation and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. Research and technology parks help develop great business ideas and research-based results for use in business. These parks are closely connected to leading universities and colleges in the country.	• Small companies and knowledge based organizations	• Access to networks, collaboration opportunities and professional development
38	SIVA	SIVAs program activities work to develop and strengthen the	• Companies developing new and promising technologies and	• Private equity funds for the continuing operation of a

	Investment Companies	innovation environment in Norway. The goal is to encourage innovation and growth in new and established companies. They work through a number of value creation environments located throughout the entire country. Investment organizations support companies in the early stages of technology development and commercialization. SIVA currently owns part of 9 seed funds and venture funds that invest in promising companies in Norway.	attempting to commercialize.	promising business. The amount of funds available will depend on the size of the fund investing, how promising the company is, the risk tolerance level the fund and the results of an evaluation of the company. Each fund will have different criteria for investment.

Notes:

1. Regional research funds were lumped into one single grouping that describes them all in general.
2. The various mentoring and international services that Innovation Norway provides were also lumped into two different entries due to the fact that there was a large number of small programs and they all generally provided the same types of support.
3. Government funded programs offered by the EU or other cross country organizations were ignored since entities from both Norway and Denmark were eligible to apply.

Sources:

1. Innvasjonnorge.no
2. Enova.no
3. Husbanken.no
4. GIEK.no
5. Eksportkreditt.no

6. Forskningsrådet.no
7. Transnova.no
8. Siva.no
9. Norad.no
10. regionaleforskningsfond.no
11. NCE.no
12. Arenaprogrammet.no
13. Climit.no
14. Miljoteknologiportalen.no
15. Skattefunn.no

Appendix 5 - Country profiles

Consists of:

Appendix 5 Country profiles

Country overview

This section presents an overview of Norway and Denmark respectively. They are structured by a brief introduction with numerical values and how they compare to the average of the European Union. This is followed by the structure of the Research and Development system and lastly the different mechanisms that are offered and by whom.

Norway

Norway is a country located in northwestern part of Scandinavia on the European continent. It has a population of roughly 5 million people (SSB, 2014) and a GDP of US$ 331.9319 billion (OECD, 2014c). Norway has a gross expenditure on research and development (GERD) of 1.65% of their GDP, which is equivalent to US$ 1,094.36 per capita. In comparison, the European Union average is 1.97% and US$ 665.77 respectively. Norway's GERD has a compound annual growth rate of 3.35%, which is significantly higher than the EU's at 0.61%.

The portion of the GERD financed by industry is 44% and by government is 47%. The remaining portions are financed through foreign investors and other national means including through universities or private individuals.

Norway has 27,908 people employed as researchers, which is half of the European Union average of 59,033. The number of researchers in Norway is growing at an annual rate of 2.5%, which is higher than the European Union average of 1.52%. The total number of R&D personnel in Norway is 37,804 people, which is a quarter of the European average of 94,568.

The number of patents can be measured in two ways. The first is the number patents registered in the triadic patent families and patents listed under the Patent Cooperation Treaty (PCT). The triadic patent families are patents which are granted in three major international offices (OECD, 2014a) which is the European Patent Office (EPO), the Japan Patent Office (JPO) and the United States Patent and Trademark Office (USPTO). Such patents are globally protected. The other patents are generally only applied for in Europe. Norway annually is granted 86.37 triadic patent families and 594.03 PCT patents. The reason for decimals (OECD, 2014e) lies in the definition that if the patent holders are from more than one country, the value that is counted is split between them which will create decimals.

Given all this, Norway is classified as an moderate innovator (Hugo Hollanders & Nordine Es-Sadki et al., 2014) as they are spending and performing slightly below the European Union average. Furthermore, they rank 11th on the Global Cleantech Innovation Index done by WWF and the Cleantech Group (Vince Knowles, 2013). Although the Norwegian innovation performance has been increasing steadily since 2007, with 2008 and 2011 as the sole exception with very small declines. The Norwegian innovation performance's growth rate has been below the relative performance of EU from 88% in 2006 to 87% in 2013 (Hugo Hollanders & Nordine Es-Sadki et al., 2014). What Norway is performing below upon is for most of the indicators, particularly community designs, non-R&D innovation expenditures and community trademarks whereupon the strengths lies in international scientific co-publications and

public-private scientific co-publications. Additionally, Norway has a high growth in community trademarks and international scientific co-publications albeit has large growth declines in community designs and venture capital investments.

	Norway	EU (28)
GERD (Gross Expenditure on Research and Development) as percentage of GDP	1.65 (2012)	1.97 (2012)
GERD per capita population (current PPP (Purchase-Power-Parity) $)	1094.36 (2012)	665.77 (2012)
GERD Compound annual growth rate (constant prices)	3.35 (2012)	0.61 (2012)
Total researchers (FTE) (Full-Time Equivelant)	27908.00 (2012)	1652932.90 (2012)
Total researchers - compound annual growth rate	2.50 (2012)	1.52 (2012)
Total R&D personnel (FTE)	37804.00 (2012)	2647918.20 (2012)
total R&D personnel compound annual growth rate	2.31 (2012)	1.25 (2012)
Percentage of GERD financed by industry	44.20 (2011)	54.32 (2011)
Percentage of GERD financed by government	46.55 (2011)	33.93 (2011)
Percentage of GERD financed by other national means	1.47 (2011)	2.51 (2011)
Percentage of GERD financed by abroad	7.79 (2011)	9.27 (2011)
Number of triadic patent families	86.37 (2011)	11834.32 (2011)
Number of patent applications filed under the PCT (Patent Cooperation Treaty)	594.03 (2011)	46373.95(2011)

Table 1 - Norwegian national research related statistics (OECD, 2014d)

Norwegian innovation structure

The Norwegian innovation structure can be divided up into four sectors (Lisa Scordato, 2011), the first is the parliament and their standing committees, this feeds the government and their ministries which feed the combined public sector agencies and services and private sector for-profit and non-profit enterprises as shown on Figure 1

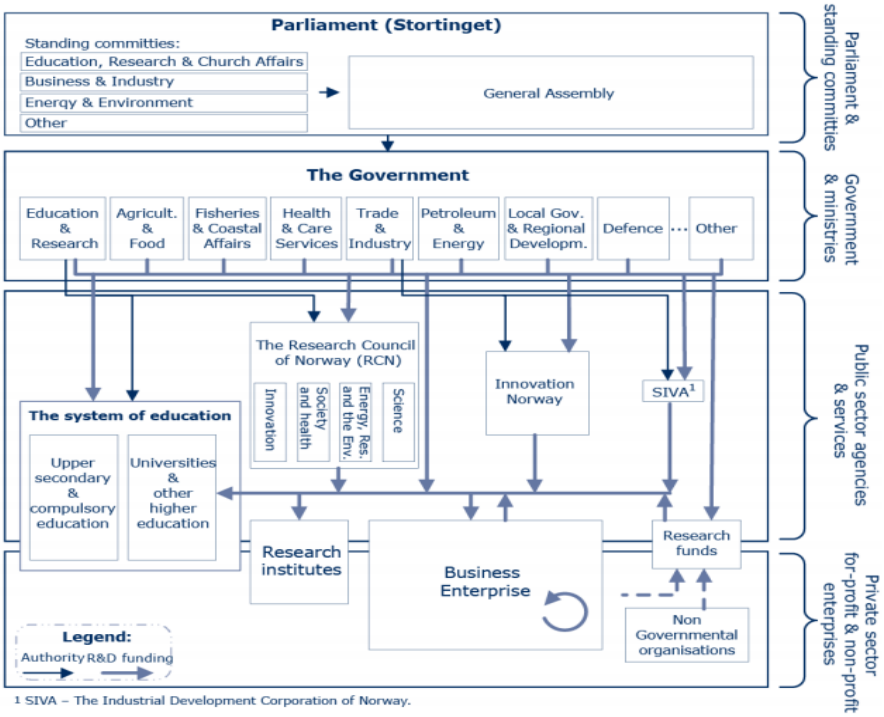


Figure 1 - Norwegian innovation structure

The parliament is the highest political authority for determining innovation policies. It consists of three main committees that deal with innovation policies: the standing committee on Education, Research and Church affairs, the standing committee on Business and Industry and the standing committee on Energy and Environment.

The innovation policies will be directed down towards the three ministries, which play a key role in the development of national innovation policies.

- The Ministry of Trade and Industry
- The Ministry of Education and Research
- The Ministry of Local Government and Regional Development.

Once the national innovation policies have been enacted, mandates will then be given to three main agencies that are responsible for implementing the policies on a regional innovation basis.

Each and every agency has their primary focus which is shown on Figure 2 (BergnyDahl, 2014). The scale ranges from basic research, to industrial research, to experimental development, to demonstration, to market introduction and finally the market. The type of support that can be given is divided up into four possible categories for cleantech, which are effective management of energy resources, climate friendly energy re-organizing, nutritional development and lastly environmentally friendly transport solutions.

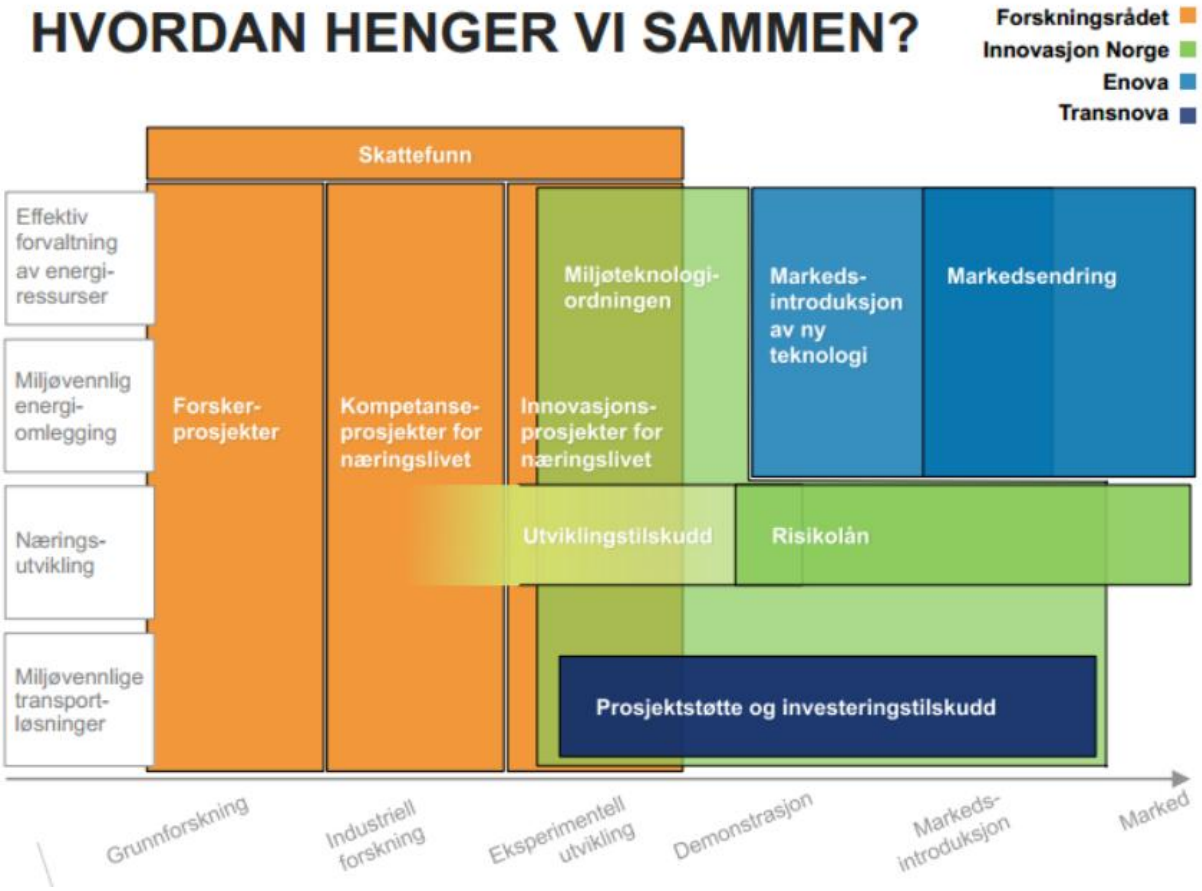


Figure 2 - Structure of Norwegian agencies for cleantech (Innovation Norway)

Innovation Norway officially focuses primarily from experimental development up to the market introduction, with a few programs that extend back to the transition from industrial research and towards the market across all four categories. The Norwegian Research Council (Forskningsrådet) acts in the field of basic research up to the experimental development across all four categories. Enova acts in the field of demonstration up to the market, they are primarily focusing on the categories of effective management of energy resources and environmentally energy re-organizing.

Agencies

Norwegian Research Council (Forskningsrådet)

The Norwegian Research Council is the national organization which funds research, provides input into research policy and actively promotes the development of high calibre research within in Norway. The Research Council's vision is to be the vanguard of Norwegian research and has for main responsibilities:

to enhance the capacity and quality of Norwegian research; to strengthen research in areas of particular importance for research, trade and industry, and society at large; to promote constructive cooperation, distribution of responsibility and structures in the research system; and to translate research results into action. (Norway, 2014b)

Innovation Norway

Innovation Norway is an independent government agency with the primary responsibility of supporting innovation and development of Norwegian companies. This organization provides financial, counselling and mentoring services to companies looking to development new products or processes, enter new markets or increase growth. In addition to this, Innovation Norway is also the government's primary trade agent abroad and through this role also helps Norwegian companies access over 30 different foreign markets by providing advice and networking assistance. (Norway, 2014a)

SIVA

Siva, also known as the Industrial Development Corporation of Norway, is an independent government organization responsible for the improvement of national infrastructure for innovation. This includes development and direct investment of strong regional and local industrial clusters such as incubators or business and research parks. Siva has also invested in a number of regional seed and venture capital funds that support the development of high growth companies. (Siva, 2014)

Enova

enova is another independent government agency that has the primary task of supporting the implementation of either existing or new technology that will help reduce energy consumption and increase the production of renewable energy from new sources. To achieve this goal, enova provides financial support to projects that can provide the greatest impact. (Enova, 2014)

Transnova

transnova is an organization whose main goal is to support projects that will reduce greenhouse gas emissions from Norway's transportation sector. The Norwegian Transportation Ministry provides funding for transnova to operate and the Statens Vegvesen manages the day to day business of transnova. The main focus areas for transnova are the development of new technology, increased use of environmentally friendly transport forms, reduced traffic volume and increased efficiency of the transportation sector. (Transnova, 2014)

GIEK

GIEK is an independent public company under the Trade, Industry and Fisheries Ministry whose main role is to provide guarantees on exports from Norwegian companies on behalf of the Norwegian government. Currently, GIEK manages a portfolio of over 100 billion NOK in guarantees. (GIEK, 2014)

Eksportkreditt Norge

Eksportkreditt Norge is a limited liability company wholly owned by the Norwegian government. The primary role of the organization is to provide loans to large and small companies in Norway and abroad for the purchase of capital goods and services from Norwegian exporters. (Export Credit Norway, 2014)

Denmark

Denmark is a country located in southwestern part of Scandinavia on the European continent. It has a population of roughly 5.6 million people (DST, 2014) and a GDP (OECD, 2014c) of US$ 239.1806 billion. The GERD in Denmark is 2.98% of its GDP, which is 1.01% over the European average of 1.97%. This is equivalent to a GERD per capita of US$ 1,276.84, which is roughly double the European Union average of US$ 665.77. The annual growth rate in GERD is -0.09%, which is below the European Union average of 0.61%.

The total amount of researchers in Denmark is 37,675 (OECD, 2014b). This number is below the European Union average of 59,033 researchers. The growth of researchers is -0.71%, which is below the European average of 1.52%. The total number of R&D personnel in Denmark is 55,711 with the European Union average being 94,568. The rate of growth in total R&D personnel has an annual growth rate of -0.74%, which is significantly below the European Union average of 1.25%

The portion of the GERD financed by industry in Denmark is approximately 60% and by government is 29%. Foreign investors and other national means fund the remaining amount.

The amount of patents granted in Denmark annually in the triadic patent families is 241.29, which is roughly half of the EU average of 422.65. The amount of ordinary patents filed annually is 1178.01, which is below the EU average of 1656.21.

Denmark ranks as the #1 country in the world in the cleantech innovation index (Vince Knowles, 2013) and is categorized as an innovation leader (Hugo Hollanders & Nordine Es-Sadki et al., 2014). This can be explained by the R&D intensity which is higher than the EU average and the higher amount of both personnel and industry focus, albeit it seems this trend might not last as the academic populace is declining at a steady pace. What follows is that Denmark's innovation performance (EU, 2014) declined significantly in 2008 due in particular to their lower shares of product and/or process innovators, marketing and/or organization innovators and innovative SMEs collaborating with others. Sales due to new innovative products albeit has risen since then at a slower rate of improvement than the rest of EU. Their current performance growth over the EU average has decreased from 40% in 2008 to 32% in 2013. Denmark's relative strengths are within international scientific co-publications, public-private scientific co-publications, community designs and R&D expenditures in the business sector whereupon they are below average for Non-EU doctorate graduates, youths with a secondary level of education, Non-R&D innovation expenditures and their contribution of medium and high tech exports to the trade balance.

Denmark is experiencing high growth for new doctorate graduates and international scientific co-publications and the growth for SMEs with marketing, organizational innovations and SMEs collaboration is declining.

	Denmark	EU (28)
GERD (Gross Expenditure on Research and Development) as percentage of GDP	2.98 (2012)	1.97 (2012)

GERD per capita population (current PPP (Purchase-Power-Parity) $)	1276.84 (2012)	665.77 (2012)
GERD Compound annual growth rate (constant prices)	-0.09 (2012)	0.61 (2012)
Total researchers (FTE) (Full-Time Equivelant)	37675.10 (2012)	1652932.90 (2012)
Total researchers - compound annual growth rate	-0.71 (2012)	1.52 (2012)
Total R&D personnel (FTE)	55711.10 (2012)	2647918.20 (2012)
total R&D personnel compound annual growth rate	-0.74 (2012)	1.25 (2012)
Percentage of GERD financed by industry	60.06 (2012)	54.32 (2011)
Percentage of GERD financed by government	29.05 (2012)	33.93 (2011)
Percentage of GERD financed by other national means	3.67 (2012)	2.51 (2011)
Percentage of GERD financed by abroad	7.23 (2011)	9.27 (2011)
Number of triadic patent families	241.29 (2011)	11834.32 (2011)
Number of patent applications filed under the PCT (Patent Cooperation Treaty)	1178.01 (2012)	46373.95(2011)

Table 2 - Danish national data (OECD, 2014d)

Danish innovation structure

The responsibilities of the various Danish agencies are distributed across two axes as shown Figure 3.

The left side represents the knowledge sector and upper is all sectors, the right side is the market sector and underneath is a sector specific focus. (Christensen, March 16 2014)

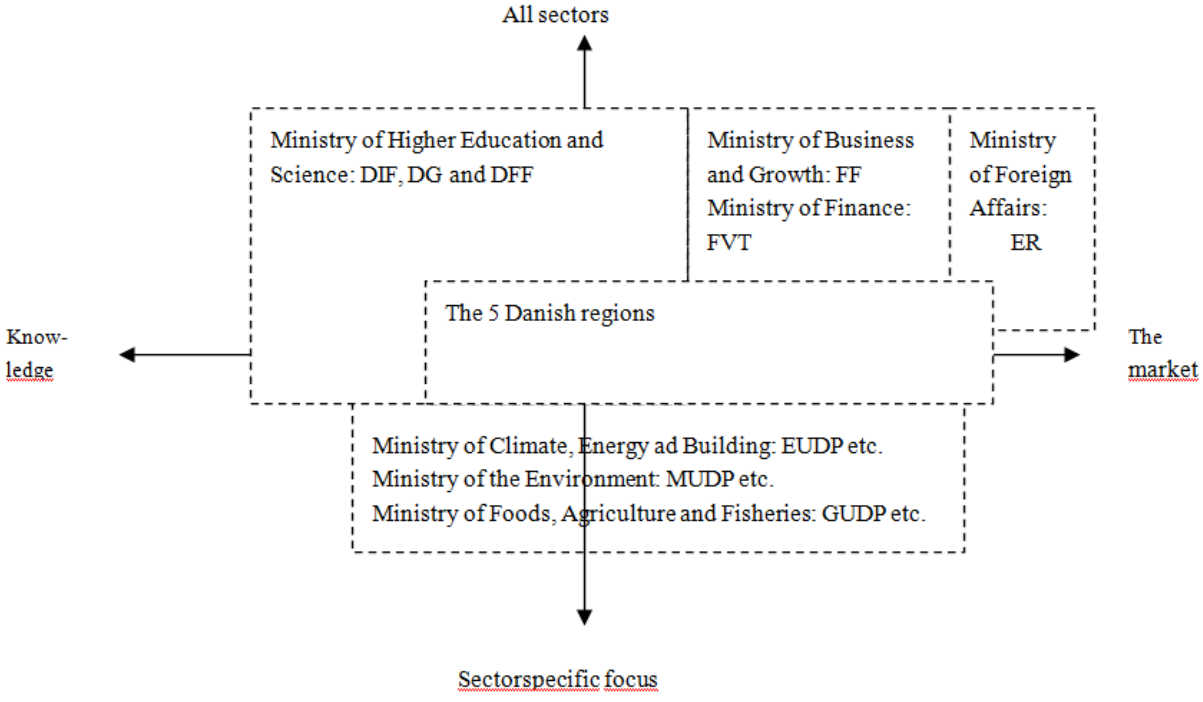


Figure 3 - Danish Authority for R&D

The five regions of Denmark are placed squarely in the middle and extend toward the market sector.

The ministry of foreign affairs and ministry of business and growth along with ministry of finance are all going towards the market sector within all sectors. The ministry of higher education and science are in all sectors and lean more towards the knowledge sectors, with some ministries more coupled for specific sectors in both knowledge and market such as ministry of climate, environment and agriculture.

Each ministry is able to make public mechanisms that are active within their specific field of work.

In 2012 the Danish research and innovation system was taken under scrutiny to be evaluated with the goal in mind to improve the system for the future (Danish Ministry of Science, 2012). On 1st of April 2014 the structure came through and the structure of the Danish Research and innovation system is as shown by Figure 4. (Danish innovation system 3rd of April 2014)

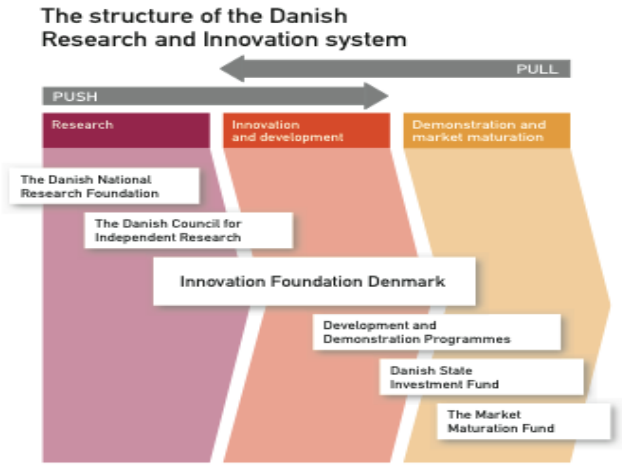


Figure 4 - Structure of Danish R&D agencies

Agencies

The Danish National Research Foundation (DG)

The Danish National Research Foundation is an independent foundation (Foundation, 2014) whose objective is to strengthen the research-related development capacity of Denmark by funding research at an international level. Support is primarily given through establishing centre's of excellence and activities aimed at increasing the internationalization of Danish research. (Christensen, March 16 2014)

The Danish council for Independent Research (DFF)

The Danish council for Independent Research (DFF) is governed by the ministry of higher education and science (Science, 2014) and supports concrete research activities within all scientific fields. The activities are based upon the initiative of the researcher and should strengthen the quality and internationalization of Danish research. (Christensen, March 16 2014)

DFF consists of five categories which is culture and communication, nature and universe, society and business, health and illness and technology and production. (Danish Ministry of Science, 2014)

Innovation Foundation Denmark (DIF)
Innovation Foundation Denmark is a new funding body for innovation support which came into service 1st of April 2014. This foundation has an annual budget of 220 million Euros and is administrated by the ministry of higher education and science. It bears the responsibility of all new innovation support schemes and funding of strategic research. (General overview of the public RD support system 16 March 2014). It replaces the following old councils: Danish High-Tech Fond, (HTF), Council of Technology and Innovation (RTI) and the Strategic Research Council (DSF)

Development and demonstrations programme (EUDP, MUDP & GUDP)
Two primary development and demonstration programs are utilized which is the Energy-Technological Development and Demonstration Programme (EUDP) and Green Development and Demonstration Programme (GUDP). EUDP supports the development and demonstration of innovative energy technologies with commercial potential and a potential to contribute in the progress of making Denmark independent of fossil fuels before 2050. GUDP supports the creation of competitive and sustainable food and non-food production and contribution of development of their business potential. this includes development of a market-drive organic sector, growth, employment and health while at the same time ensuring high standards in the areas of climate, environment and nature, animal welfare, food safety and health. (General overview of the public RD support system 16 March 2014)

The Market Maturity Fund (FF)
The Business Innovation Fund (FF) creates growth, employment and export, particularly in small and medium-sized enterprises. The Fund furthermore supports enterprises' business opportunities within green growth and welfare.

Danish state investment fund (IFU)
Independent government-owned fund offering advisory services and co-invests with Danish companies in developing countries. This is done in the forms of equity, loans or guarantees for project companies established by Danish companies in one of the 120 countries eligible for IFU investment. (IFU, 2014)

Growth fund
The growth fund is a financing fund by the state which offers capital and competencies for companies. They invest in SME and has been active since 1992. (Vækstfonden, 2014)

Industry fund of Bornholm
The fund supports companies by loans, shares or equity for new or existing companies on the island of Bornholm which is estimated to contribute to the commercial and population development. (erhvervsfond, 2014))

Technology pool by Ministry of environment
The goal is test and development of new cleaning and prevention technologies on soil and groundwater polluted areas in order to conduct more efficient cleansing of polluted areas. (environment, 2014)

Copenhagen cleantech cluster
Copenhagen cleantech cluster represents companies and science institutions which works within the

cleantech sector. It is based in Copenhagen and promotes growth and employment, increased international awareness and support entrepreneurs and SMEs. It is currently representing more than 350 companies. (cluster, 2014)

Innovation environments

The innovation environments invests in new companies which builds upon high-tech or service oriented services. the environment consists of four organizations; Borean, Capnova, Sdti and symbian innovation by Technical University of Denmark.
These four are across the country in research parks which at the same time offers facilities and laboratories for applicants, and is within close proximity to universities. (Borean, 2014)

Innovation network for environmental technology & transport

The innovation networks has the same goal which is to help companies making an unique idea into a viable commercial solution or service. They obtain this goal through matchmaking, distribution of knowledge, internationalization and help for start-ups. (TINV, 2014)

The five regions and municipalities

Denmark is split into five regions which has a total of 98 municipalities in them. they are funded by the state and they assist companies and the like in developing ideas into viable commercial solutions and services. (Denmark, 2014)

Growth house

Each region has its own growth house which is owned by the municipalities. As such they provide free consultation and works to give companies guidance on how to get from idea to business in the most efficient manner possible. (Startvækst, 2014)

Export council

Is a part of the Danish foreign ministry. It provides consulting services and partnerships in order to create value, growth and knowledge for Denmark. (Ministry of foreign affairs, 2014)

Midtnet

Has created three network between Denmark and Shanghai in the themes of IT, energy/environment and health/life science. The aim is to inverse the networking, cross-cultural knowledge exchange and matchmaking through the reunification of private- and public companies and institutions in joint development work with similar partners in Shanghai (Midtnet, 2014)

Loan fund of Northern Jutland

Offers loans for Northern Jutland residents and companies with potential for development. The aim is to enhance innovation and job creation in private companies. It is funded by the region of Northern Jutland. (Lånefond, 2014)

Bigscience

Is the middle link between Danish commerce and larger European research facilities. They support the

Danish companies and knowledge institutions through service, development of competencies, matchmaking and network activities. (BigScience, 2014)

Invent now
Provides guidance for private citizens with the aim of maturing inventions and guide them towards license agreements or start-ups.(Inventnow, 2014)

Innovation agents
Consists of nine approved technological service institutes whose aim is to give guidance for companies. (Agrotech, 2014)

Danida
Danida is a part of the foreign ministry of Denmark, they administer the funds the parliament has granted for foreign development. (Danida, 2014)

EKF
Is export credit from Denmark, they assist Danish companies in purchasing goods from abroad. They acquire financing for the company and to insure the company and banks against the economical and political risks that can occur when trading abroad. (EKF, 2014)

Expired foundations
The following foundations are expired as of 1st of April 2014.
The strategical research council (DSF) supported research within the politically prioritized and themed research areas. (Innovation, 2014)
The council of Technology and Innnovation (RTI) had the main purpose to promote growth in the commerce by means of acting as a consultant for the minister on how to best direct the funds to yield optimal conditions for commerce and as a grant provider on the innovation programmes which has been made official by the minister. (Innovation, 2014)
Last the High-Tech Fond (HTF) supported development of technologies which created growth, opportunities and employment in Denmark. (Innovation, 2014)

References

AGROTECH, A. I., BIONEER, DBI, DELTA, DFM, DHI, FORCE TECHNOLOGY, TEKNOLOGISK INSTITUT. 2014. *Innovationstjek* [Online]. Available: http://www.innovationstjek.dk/hvem-er-vi.aspx.

BERGNYDAHL, R. H. T. N., HANS OTTO HAALAND & ANE TORVANGER BRUNVOLL 2014. NORGE SMART NASJON - en attraktiv innovasjonsarena for energi- og miljø! : Innovasjon Norge, Enova, Transnova, Forskningsrådet.

BIGSCIENCE. 2014. Available: http://www.bigscience.dk/.

BOREAN, C., SDTI, SYMBIAN 2014. Innovation environments and links for the four participants

CHRISTENSEN, T. A. March 16 2014. Overview of the Danish Public Support System for Research and Innovation

CLUSTER, C. C. 2014. *Homepage of CCT* [Online]. Available: http://www.cphcleantech.com/.

DANIDA. 2014. Available: http://um.dk/da/danida/.

DANISH MINISTRY OF SCIENCE, I. A. H. E. 2012. Denmark - a nation of solutions. Enhanced cooperation and improved frameworks for innovation in enterprises.

DANISH MINISTRY OF SCIENCE, I. A. H. E. 2014. *Bevillingsoversigter* [Online]. Available: http://ufm.dk/forskning-og-innovation/rad-og-udvalg/det-frie-forskningsrad/bevillingsoversigter.

DENMARK, T. F. R. O. 2014. Available: http://www.regioner.dk/om+regionerne.

DST. 2014. *Folketal* [Online]. Available: http://www.dst.dk/da/Statistik/emner/befolkning-og-befolkningsfremskrivning/folketal.aspx.

EKF, D. E. 2014. Available: http://www.ekf.dk/da/Sider/default.aspx.

ENOVA. 2014. *Formål* [Online]. Available: http://www.enova.no/om-enova/36/0/ [Accessed March 2014].

ENVIRONMENT, M. O. 2014. *Teknologiprogram for jord- og grundvandsforurening* [Online]. Available: http://mst.dk/virksomhed-myndighed/jord/stoette-og-oprensningsordninger-paa-jordforureningsomraadet/teknologiprogram-for-jord-og-grundvandsforurening/.

ERHVERVSFOND, B. 2014. *Bornholms Erhvervsfond Billige lån til bornholmske virksomheder* [Online]. Available: http://bornholm.biz/bornholms-erhvervsfond.aspx.

EU 2014. Innovation Union Scoreboard

EXPORT CREDIT NORWAY 2014. Om Oss.

FOUNDATION, D. N. R. 2014. *Danish National Research Foundation* [Online]. Available: http://dg.dk/

GIEK 2014. Om GIEK.

HUGO HOLLANDERS & NORDINE ES-SADKI, INSTITUTE, M. U. M. E. A. S. R., MERIT)., O. I. A. T., BIANCA BULIGESCU, ON, M. U. M. E. A. S. R. I., 5), I. A. T. M. A., LORENA RIVERA LEON, E. G. L. R. & ANNEX), T. G. C. A. C. 2014. Regional Innovation Scoreboard 2014. EU.

IFU. 2014. *Investment fund for developing countries* [Online]. Available: http://www.ifu.dk/en.

INNOVATION NORWAY Norge Smart Nasjon: en attraktiv innvasjonsarena for energi- og miljø. *In:* NORWAY, I. (ed.).

INNOVATION, S. F. F. O. 2014. Tal om forskning 2013_korrektur - Work in Progress

INVENTNOW. 2014. *Opfind nu* [Online]. Available: http://www.opfind.nu/.

LÅNEFOND, N. 2014. Available: http://www.nordjysklaanefond.dk/).

LISA SCORDATO, N. 2011. Mini Country Report/Norway

under Specific Contract for the Integration of INNO Policy

TrendChart with ERAWATCH (2011-2012). Pro Inno Europe, Inno Policy Trendchart

MIDTNET. 2014. *Collaboration between Mid Jutland and Shanghai* [Online]. Available: http://www.midtnet.com/.
MINISTRY OF FOREIGN AFFAIRS, D. 2014.
NORWAY, I. 2014a. Innovation Norway.
NORWAY, T. R. C. O. 2014b. *Mission, mandate and vision* [Online]. Available: http://www.forskningsradet.no/en/Vision_and_mandate/1138785841810.
OECD. 2014a. *Definition of triadic patent families* [Online]. Available: www.oecd-ilibrary.org/sites/factbook-2013-en/08/01/03/index.html?contentType=&itemId=/content/chapter/factbook-2013-62-en&containerItemId=/content/serial/18147364&accessItemIds=&mimeType=text/html.
OECD. 2014b. *Full-time equivelant employment* [Online]. Available: http://stats.oecd.org/glossary/detail.asp?ID=1068.
OECD. 2014c. *Gross domestic product (GDP) MetaData* [Online]. Available: http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE1.
OECD. 2014d. *Main Science and Technology Indicators MetaData* [Online]. Available: http://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB.
OECD. 2014e. *PREDICT 2012 REPORT: ICT R&D performance across the world –*

patent-based evidence [Online]. Available: http://is.jrc.ec.europa.eu/pages/ISG/PREDICTperformanceannex.html.
SCIENCE, M. O. H. E. A. 2014. *Danish Council for independent research* [Online]. Available: http://ufm.dk/en/research-and-innovation/funding-programmes-for-research-and-innovation/find-danish-funding-programmes/dff-the-danish-council-for-independent-research.
SIVA. 2014. *Siva* [Online]. Available: http://siva.no/.
SSB. 2014. *Population and population changes, Q4 2013* [Online]. Available: http://www.ssb.no/en/befolkning/statistikker/folkendrkv/kvartal.
STARTVÆKST. 2014. *Growthhouse* [Online]. Available: http://startvaekst.dk/vhhr.dk/omos_vhhr.
TINV, I.-M. 2014. *Innovation network for environmental technology and transport* [Online]. Available: http://inno-mt.dk/, http://www.tinv.dk/.
TRANSNOVA 2014. Om Transnova.
VÆKSTFONDEN. 2014. *Vækstfonden* [Online]. Available: http://vf.dk/.
VINCE KNOWLES, S. H., RICHARD YOUNGMAN & AMANDA FAULKNER 2013. Coming Clean: The Global Cleantech Innovation Index 2012.

Appendix 6 - Interview structure and attached interviews

Consists of:

Appendix 6 Interview structure

Appendix 6a Interview results - Thomas Alslev Christensen

Appendix 6b Interview results - Bergny Dahl

Appendix 6c Interview results - Rune Holmen

Appendix 6d Interview results - Ane Thorvanger Brunvoll

Appendix 6e Interview results - TTO AS

Interview structure - Denmark

New Interview Objectives

1. Identify if the organization covers the same aspects in practise as they express in official documents.
2. Identify the reasons for applicant-rejection for use in discussion section. Would perhaps include Triple Helix depending on their reply (example: only incremental innovation which could imply insufficient Triple Helix environment as it fosters disruptive innovation)
3. To get general information about the programmes provided by a single organization/ministry. This can be used to get a better idea about how the organization and programmes function.
4. Establish how much awareness they have of their "rival" Denmark.
5. Establish how easy it is for the consumer to find/gain access to the programmes
6. Determine the degree of cooperation between the three main governmental providers.

New questions:

1) Can you briefly talk a bit about your organization and what purpose it serve?

2) Which part of the commercialization process does your programmes primarily cover?

3) Do you have areas in which you believe you are weak?

a) Do you have/receive feedback from users where they request new programmes? (extra option: how often)

4) Do you have any success stories with your programmes you would like to highlight?

5) How popular are your programmes? Have you ever exceeded the maximum budget on any programmes? Which ones? How often do you exceed the maximum budget on these programmes?

6) We have mainly utilized www.startvaekst.dk, www.vaekstguiden.dk and your main webpage to find the offers offered by your organization, have we missed any / do you operate through other means of information?

7) Have you ever investigated the system in Norway? If so, in your opinion how does Denmark compare?

8) What are the primary reasons that projects get rejected?

8a)Do you often cooperate with the other ministries, say if you have an interesting project that does not fit within your scope, do you recommend them to other offers?t

8b) Do you often receive referrals from the other organizations?

9) What are some of the challenges you face with managing these programs?

10) What would be the next step for your organization

Interview structure - Norway

New Interview Objectives

1. Identify if the organization covers the same aspects in practise as they express in official documents.
2. Identify the reasons for applicant-rejection for use in discussion section. Would perhaps include Triple Helix depending on their reply (example: only incremental innovation which could imply insufficient Triple Helix environment as it fosters disruptive innovation)
3. To get general information about the programmes provided by a single organization/ministry. This can be used to get a better idea about how the organization and programmes function.
4. Establish how much awareness they have of their "rival" Denmark.
5. Establish how easy it is for the consumer to find/gain access to the programmes
6. Determine the degree of cooperation between the three main governmental providers.

New questions:

1) Can you briefly talk a bit about your organization and what purpose it serve?

2) Which part of the commercialization process does your programmes primarily cover?

3) Do you have areas in which you believe you are weak?

a) Do you have/receive feedback from users where they request new programmes? (extra option: how often)

4) Do you have any success stories with your programmes you would like to highlight?

5) How popular are your programmes? Have you ever exceeded the maximum budget on any programmes? Which ones? How often do you exceed the maximum budget on these programmes?

Other optional questions:

1. We have mainly utilized www.miljoteknologi.no and your main webpage finding tool to find the offers offered by your organization, have we missed any / do you operate through other means of information?

2. Have you ever investigated the system in Denmark? If so, in your opinion how does Norway compare?

3. What are the primary reasons that projects get rejected?

4. Do you often cooperate with the two other primary actors, (ENOVA, FORSKNINGSRÅDET, INNOVATION NORWAY) say if you have an interesting project that does not fit within your scope, do you recommend them to other offers?

4a. Do you often receive referrals from the other organizations?

5. Are enova, Forskningsrådet and Innovation Norway the only main governmental providers of programs dedicated to innovation and commercialization?

6. What are some of the challenges you face with managing these programs?

7. What would be the next step for your organization?

TTO

The primary questions asked were as follows:

1. What do experience as the weaknesses of the Danish and Norwegian systems for commercializing cleantech?
2. From your perspective as a company with operations in both Denmark and Norway what do you think either country could do to improve their systems?
3. Have you ever recommended that one of your clients make use of the various programs in Denmark and Norway?
4. How do you view the interaction between the academic, industry and government sectors in either country?

These questions were provided to both Miriam and Jon a few days prior to the interview. Both agreed to being recorded.

Gmail by Google

Stefan Møller <pr.stefanmm@gmail.com>

Forskning af regerings baserede innovations tilbud i Norge og Danmark

13 meddelelser

Stefan Møller <pr.stefanmm@gmail.com> 1. apr. 2014 kl. 12.13
Til: um@um.dk
Cc: Matthew Good <matteo.good@gmail.com>

Hey Udenrigsministeriet,

Mit navn er Stefan Møller og jeg er igang med at tage en master i innovation og iværksætteri ved ved universitetet i Oslo.
Jeg arbejder sammen med min studiepartner; Matthew Good og sammen er vi igang med at skrive en master opgave med formål at undersøge hvad Norge kan lære af det Danske "Cleantech" innovations miljø.
Dette gør vi ved at undersøge hvilke offentlige tilbud der tilbydes som firmaer og forsknings-relaterede institutioner kan søge i kommercialiserings processen.

Vi har identificeret, at i udbyder forskellige offentlige tilbud som kan ansøges og skriver for at høre om der er mulighed, for at lave et interview med jer og stille nogle spørgsmål omkring jeres offentlige tilbud og indflydelse generelt?

Mvh,
Stefan Møller

Ps.
Jeg kan yderligere kontaktes på telefon +45 20 76 30 99 hvis i har spørgsmål.

Stefan Møller <pr.stefanmm@gmail.com> 1. apr. 2014 kl. 12.16
Til: fi@fi.dk
Cc: Matthew Good <matteo.good@gmail.com>

Hey styrelse for Forskning og Innovation,

[Citeret tekst er skjult]
[Citeret tekst er skjult]
[Citeret tekst er skjult]

Thomas Alslev Christensen <tac@fi.dk> 3. apr. 2014 kl. 16.24
Til: "pr.stefanmm@gmail.com" <pr.stefanmm@gmail.com>
Cc: F-FI - enhedspostkasse <fi@fi.dk>, Thomas Alslev Christensen <tac@fi.dk>

Kære Stefan

Vedlagt denne mail er to korte notater med overblik over instrumenter og innovationstilbud i Danmark. Samtidig vedlægger jeg en ny analyse, som beskriver effekterne af vores innovationstilbud på produktiviteten. Endelig vedlægger jeg en manual for, hvordan vi undersøger effekterne af innovationstilbuddene, som også indeholder overblik over de enkelte tilbud og deres effekter.

Vi vil med glæde fortælle jer mere, men når I har set på det fremsendte, kunne det være fint, hvis du kunne pege på, hvad der er mest interessant for Jer, så jeg kan hjælpe med at finde de rette personer til at tage sig af Jer.

De bedste hilsner

Thomas

Fra: F-FI - enhedspostkasse
Sendt: 3. april 2014 16:13
Til: Thomas Alslev Christensen
Emne: VS: Forskning af regerings baserede innovations tilbud i Norge og Danmark

Kære Thomas

Vil I tage jer af denne.

Mvh

Mette

Fra: Stefan Møller [mailto:pr.stefanmm@gmail.com]
Sendt: 1. april 2014 12:16
Til: F-FI - enhedspostkasse
Cc: Matthew Good
Emne: Forskning af regerings baserede innovations tilbud i Norge og Danmark

[Citeret tekst er skjult]

4 vedhæftede filer

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221K

The Danish Innovation System 3 april 2014.docx
35K

Stefan Møller <pr.stefanmm@gmail.com> 4. apr. 2014 kl. 08.20
Til: Matthew Good <matteo.good@gmail.com>

---------- Videresendte meddelelser ----------
Fra: **Thomas Alslev Christensen** <tac@fi.dk>
Dato: 3. apr. 2014 kl. 16.24
Emne: SV: Forskning af regerings baserede innovations tilbud i Norge og Danmark
Til: "pr.stefanmm@gmail.com" <pr.stefanmm@gmail.com>
Cc: F-FI - enhedspostkasse <fi@fi.dk>, Thomas Alslev Christensen <tac@fi.dk>

[Citeret tekst er skjult]

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General overview of the public RD support system 16 March 2014.doc
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35K

Stefan Møller <pr.stefanmm@gmail.com> 4. apr. 2014 kl. 15.37
Til: Thomas Alslev Christensen <tac@fi.dk>

Hey Thomas,

Super, mange tak for information.
Jeg læser lige informationen igennem og vender tilbage til dig.
God weekend
Mvh.
Stefan Møller

Den 3. apr. 2014 kl. 16.24 skrev Thomas Alslev Christensen <tac@fi.dk>:
[Citeret tekst er skjult]

Stefan Møller <pr.stefanmm@gmail.com> 7. apr. 2014 kl. 10.34
Til: Thomas Alslev Christensen <tac@fi.dk>

Hey Thomas,

Vi har fået læst informationen igennem over weekenden og takker for din hjælp.

En del af vores spørgsmål er blevet besvaret, og mere til, dog har vi nogle få tilbage vi godt kunne tænke os at stille jer.

Jeg har vedlagt vores interview spørgsmål og for at forklare kort, så vil vi stille spørgsmål i forbindelse med dagligdagen af de offentlige tilbud. Eksempelvis hvor i mener ministeriet hjælper bedst i henhold til kommercialiserings processen af cleantech, populariteten af de forskellige tilbud, graden af samarbejde imellem de forskellige ministerier, hvad i typisk afviser ansøgere på og lign.

Mvh.
Stefan Møller

Den 3. apr. 2014 kl. 16.24 skrev Thomas Alslev Christensen <tac@fi.dk>:

> Kære Stefan
>
> [Citeret tekst er skjult]

Interviewguide-Denmark .pdf
34K

Stefan Møller <pr.stefanmm@gmail.com> 7. apr. 2014 kl. 10.35
Til: Matthew Good <matteo.good@gmail.com>

---------- Videresendte meddelelser ----------
Fra: **Stefan Møller** <pr.stefanmm@gmail.com>
Dato: 7. apr. 2014 kl. 10.34
Emne: Re: Forskning af regerings baserede innovations tilbud i Norge og Danmark
Til: Thomas Alslev Christensen <tac@fi.dk>
[Citeret tekst er skjult]

Interviewguide-Denmark .pdf
34K

Thomas Alslev Christensen <tac@fi.dk> 7. apr. 2014 kl. 19.25
Til: Stefan Møller <pr.stefanmm@gmail.com>

Jeg vil se på spørgsmålene. Med hensyn til Norge sender jeg en rapport, jeg har skrevet sammen med nogle andre! Så ja, Norge kan bruges til sammenligning af kommercialisering af privat forskning.

Med venlig hilsen/Best regards/Mit herzlichen Grüßen
Thomas

Thomas Alslev Christensen
Head of Department for Innovation Policy
Head of Department for Research and Innovation Analysis

The Danish Agency for Science, Technology and Innovation/Agentur für Wissenschaft, Technologie und Innovation
Ministry of Science and Higher Education/Ministerium für weiterführende Bildung und Forschung
BREDGADE 40
1260 COPENHAGEN K
DENMARK
www.fivu.dk

tac@fi.dk
Mob. 0045 20897226

Den 07/04/2014 kl. 10.35 skrev "Stefan Møller" <pr.stefanmm@gmail.com>:

[Citeret tekst er skjult]

> <Interviewguide-Denmark .pdf>

Thomas Alslev Christensen <tac@fi.dk> 7. apr. 2014 kl. 19.28
Til: Stefan Møller <pr.stefanmm@gmail.com>, David Boysen Jensen <dbj@fi.dk>

Kære David
Kan du sende den nordiske produktivitetsrapport til Stefan?

Med venlig hilsen/Best regards/Mit herzlichen Grüßen
Thomas

Thomas Alslev Christensen

Head of Department for Innovation Policy
Head of Department for Research and Innovation Analysis

The Danish Agency for Science, Technology and Innovation/Agentur für Wissenschaft, Technologie und Innovation
Ministry of Science and Higher Education/Ministerium für weiterführende Bildung und Forschung
BREDGADE 40
1260 COPENHAGEN K
DENMARK
www.fivu.dk

tac@fi.dk
Mob. 0045 20897226

Den 07/04/2014 kl. 10.35 skrev "Stefan Møller" <pr.stefanmm@gmail.com>:

[Citeret tekst er skjult]

> <Interviewguide-Denmark .pdf>

David Boysen Jensen <dbj@fi.dk> 8. apr. 2014 kl. 09.48
Til: Stefan Møller <pr.stefanmm@gmail.com>
Cc: Thomas Alslev Christensen <tac@fi.dk>

Kære Stefan

På vegne af Thomas, sender jeg dig vores rapport om de økonomisk effekter af privat FoU-investeringer i de nordiske lande.

Rapporten er endnu ikke offentliggjort, så du må ikke videredistribuere den.

Mange hilsner

David

Fra: Thomas Alslev Christensen
Sendt: 7. april 2014 19:28
Til: Stefan Møller; David Boysen Jensen
Emne: Re: Forskning af regerings baserede innovations tilbud i Norge og Danmark

[Citeret tekst er skjult]

Roi in the Nordic 170314.pdf
9609K

Stefan Møller <pr.stefanmm@gmail.com> 8. apr. 2014 kl. 09.51
Til: Matthew Good <matteo.good@gmail.com>

---------- Videresendte meddelelser ----------
Fra: **David Boysen Jensen** <dbj@fi.dk>
Dato: 8. apr. 2014 kl. 09.48
Emne: SV: Forskning af regerings baserede innovations tilbud i Norge og Danmark
Til: Stefan Møller <pr.stefanmm@gmail.com>
Cc: Thomas Alslev Christensen <tac@fi.dk>
[Citeret tekst er skjult]

Roi in the Nordic 170314.pdf
9609K

Stefan Møller <pr.stefanmm@gmail.com> 8. apr. 2014 kl. 09.57
Til: David Boysen Jensen <dbj@fi.dk>

Hey David,

Mange tak for informationen.
Rapporten er vel modtaget og jeg lover at den ikke bliver distribueret videre.

Hvornår vil rapporten cirka blive offentliggjort?
Jeg er igang med at læse den og der er information i som vi godt kunne finde på at citere.
Dog vil vi selvfølgelig kun gøre det hvis rapporten bliver offentliggjort i løbet af den tid vi skriver projektet (afslutning maj 20).

Med venlig hilsen,
Stefan Møller

Den 8. apr. 2014 kl. 09.48 skrev David Boysen Jensen <dbj@fi.dk>:
[Citeret tekst er skjult]

David Boysen Jensen <dbj@fi.dk> 8. apr. 2014 kl. 11.07
Til: Stefan Møller <pr.stefanmm@gmail.com>

Kære Stefan

Jeg forventer, at rapporten bliver offentliggjort senest i begyndelsen af maj. Så det er ok hvis I citerer rapporten i Jeres opgave med offentliggørelse i maj.

Mange hilsner

David

Fra: Stefan Møller [mailto:pr.stefanmm@gmail.com]
Sendt: 8. april 2014 09:57
Til: David Boysen Jensen

[Citeret tekst er skjult]

[Citeret tekst er skjult]

Bergny Dahl - Innovation Norway

This interview was recorded and audio files are available upon requests.

Innovation Norway is owned by the department of trade & commerce. They do also receive money from the other ministries; agriculture, fishing and "letters of work" from five other ministries.

They have an office in each municipality in Norway, where 49% of each office is owned by the regional municipality.
Innovation Norway is furthermore present in 30 countries abroad with a total of 750 people employed in the organization.

They work on developing countries (Following three point are main focus for Innovation Norway)

- More and better entrepreneurs
- Clusters
- Fast growing companies

All mechanisms are administrated in Oslo department.

- Work is done by local departments
- Money comes from Oslo department.

They started in autumn 2010 finding new mechanisms and seeing the results slowly today.

1860 is the oldest part of Innovation Norway and focused on the agriculture.

The Innovation Norway was made in 2004 by regional funds and tourist board.

Each department abroad was made by the ministry of foreign affairs.

Works with whole entrepreneurs

- Often from scratch
- Money from trade & industry department.

Check in once in a while generally on the progress of the entrepreneurs

- Albeit different for each project
- Generic for all themes, does not matter which entrepreneur theme is funded

The hardest part for Innovation Norway is just before the market:

- Technology is working no money for market
- have scheme for entrepreneur & piloting & demonstration and Industry.
- Cannot do finance more than 25-45 % of a company
- Weak point is getting the other part of the money, it was noticeably easier before 2009

Customer research for all customers

- Does not know enough
- Check website
- Normally quite positive
- Good work with start and no specific deadline - work 'till ready to present for the board or go bust.

Bergny highlighted the company Bali as an interesting project from Innovation Norway, they make fuel and other processes.

Innovation Norway receives many applicants, they are unable to go over budget albeit they do have a set amount of money per month, last year in 2013 august they ran out of "budget" for environmental which meant all future applicants had to wait for next year.

the financing range from 200.000 to 58 mio NOK.

Loans are separate and they differ from market loans which are quite low to "innovationslån" which can go up to 5.7 mio NOK.

furthermore have loans, IFØ, clusters are very broad loans and they can be combined with other loans albeit up to the max 20-45% funding.

They are regulated by EU for max. loan for company.

Only regular/popular mechanisms are listed on their webpage miljøteknologi - which means not all of them are listed there.

Got report of the mechanisms from Denmark 1-2 weeks ago - haven't read any of them yet. She will relay that report to us.

advised contacting NIFUU which works with the Nordic systems and should know more. Contact is Dorthy Søderland Olsen

They generally “Want projects that are able to compete on the big markets”.

Tje companies have to express and tell their business modelling, they can talk about technology but lack the market consideration.
Given that they must have the whole project financed it has happend that there is no extra funds and they have to lock the project.

Innovation Norway works with both Enova and Research council to capitalize on their projects.

Bergny recommended contacting Ahne Thorvald from Research Council to interview.

If we want to hear more about Xbok Kreditt, we should try and contact Ivar Slærgelsson

Innovation Norway has identified areas of improvement:

- One part is the mechanisms
- other part is competing with oil and gas prices.
- Market is not good enough.
- Too much imperfections in the market.
- They must work harder with other mechanisms abroad.
- Work more together.

They do not have as much private money for cleanteh- the oil in 2011 took away the fous.

They had money before 2009/2010.

Last year they learned that the oil&gas & renewable supplier market is now the same size - search for expert kreditt “Ivar”.

Nixxons company is the largest company in Norway specializing in renewable energy.

Rune Holmen - Enova

This interview was recorded and audio files are available upon requests

Enova is state owned by the ministers. It runs on a 4-year mandate where the current one started in 2012 and will end in 2015. The theme is "Reduce climate gas emissions and increase energy security". There is a standard energy triangle which is:

1. Environment
2. Energy security
3. Value creation

They do not explicitly have value creation as a part of their mandate, focused on result on reducing market risks and raise energy security. They manage around 2 billion NOK and try to spend wisely.

Their new technology sub-mandate they push towards new technology as well as they can fulfill the balance between new and existing

Enova focuses on the market side of the process it facilitates to reduce the risk of the market. They have some of the best subsidy schemes for market introduction. They primarily provide investment support and provides up to 50% of first installation.

Enova indicates that the problem is the extremely low energy price of Norway - market is not strong as in Denmark (purely cleantech related) for example the energy market has too much hydro. The amount of energy produced is 95% green (hydro) and therefore in much better shape than Denmark who only has around 50%.

Enova steps in earlier when energy is related. they have a share in miljøteknologi portalen website.

They are hoping for the future to have success in the waste heat recovery sector.

Energi21 tried to summarize support by agencies found it is quite high from everything but deployment. Rune disagrees that the conclusion that there is not enough money in the demonstration phase to be untrue. they are struggling to spend it, they experience a lack of maturity and no

organization. They sometimes turn down people before they apply, they have good ideas but no knowledge of going through the phases. The applicant typically comes with powerpoint and idea and when they subsequently turn them down - Enova receives bad reputation when the applicants go to newspapers and the like to spread ill-intented rumors.
Private seed not good at this time across the whole chain. it takes 20-30 years but even though Enova could help more in seed it will fail without industrial partner.
There is no max amount of the projects, the highest they have done so far is 500 mio NOK

Rune recommended looking at "investinnord" under the ministry

Enova has a limited knowledge about Denmark, they do have reports but do not actively research them.

The main difference between Norway and Denmark is that DK has a Higher tax on electricity albeit have feeding system and more in place.

They have three primary reasons for rejecting projects:

1) They must have an energy result,

2) Due diligence (They do not specifically demand that they have all the knowledge for financing albeit they must have a good idea of it) 3) profitability

Enova often works with the other agencies in terms of projects. They mostly communicate on a weekly basis, albeit mostly with Innovation Norway (R.C. is too far away in terms of the commercialization process) they have often made meetings in which both Innovation Norway and Enova is present (and opposite). Furthermore they have before done Joint funding has been done before - they make sure it is very clear-cut who invest and what they invest in.

Their main challenges for Enova is that it is always challenging to valuate before granting the support. They only gives money after the applicant has paid and have a receipt.
Enova oftens experience that it takes longer time to complete a project than expected albeit they are not concerned about this.

Rune points out that some projects do fail just out of sheer bad luck. Enova tries to challenge applicants in what is the innovation they assess and if there is something in the market that fulfills the same role.

Ane Torvanger Brunvoll - Research council

This interview was recorded and audio files are available upon request.

SME do more research than the average, they miss big companies. They have a different structure than other Nordics.

Ane Torvanger Brunvoll identified the TRL = Technology Ready Level, and pointed out that Forskningsrådet is at 1-4 where 10 is market interaction.

The picture of Norway is not complete, they have very small demonstration capabilities (from lab to scale) and have been inquired by other agencies about that.

They try to post all criterias to make it transparent for applicants. they have different approaches on how to do that in terms of research materials.

Their largest part is building competency.

Sintef is a method, industries can contact Sintef and ask for research, they will then issue calls for new applicants in that field.

She believes Norway is good with industry and research labs.

they are funded low + project work.

get back all the money in energy research from EU - EU says Norway is good.

They do tour innovation projects for companies, calls released yesterday (9/04-2014) to smaller comapnies bringing disrupitive innovation with no known markets.

Anything more than 50% energy -> EnergiX clean water and etc. -> Dia?

Ane Thorvanger handed out pamphlets and fact sheets. She further highlighted a project entitled “David” smartgrid will save billions of money, and will pay back all the money they have invested in EnergiX.

Ane Thorvanger also highlighted “Teletastet” analyze companies afterwards for their social impacts. muts be done on a 10-year period after project is finished.

Research council also like to measure payback: Ph.d and educated patents have issued.

Research council finds it difficult to not spend the money.

70% of applicants did not receive last time.

Ane believes that the writers have probably covered all the Probably have things covered, maybe Transnova.

Ane Thorvanger highlighted that the writers contact Birthe Holst Jørgensen from University of Copenhagen in Denmark, Birthe says Norway is lucky, she often says look to Norway in terms of push.

Denmark is better at pull.

In Norway from government side no need or smart grid where in Denmark consumers will buy.

Research council often meet with Enova and inno Norway, which also states they need more demonstration focus.

they also refer companies to Enova and Inno.

In order to improve research councils they have some ideas on how to do:

Give better incentives.

Put extra weight on criteria for commercialization:

cannot show good for research -> Not granted.

Does not have proper research -> Not granted.

Does not have pre-project mechanisms

Project idea -> new mechanism future.

Forskningsrådet is trying to become change agent. Mazzucato is coming to conference with wind and solar industry.

need to work on making companies born global instead.

Ane mentions Norway is good at making singular points in a value chain, build one boat in Norway but if you need 50 go to Korea. they have for example made special glue for solar panels.

In short: niche markets and custom stuff are the strength of Norway.

Miriam Meling and Jon Wulff Petersen - TTO AS

This interview was recorded and audio files are available upon request.

Stefan was the primary interviewer and Matthew listened and took notes.

Before beginning with the main questions, Jon wanted to know if we had a hypothesis for this study. We informed him that our hypothesis was Denmark's set of government push mechanisms for the commercialization of cleantech were better than Norway's and that Norway could improve their set of mechanisms.

Jon asked if we had some evidence that Denmark's system was better of it was just anecdotal evidence. We informed him that there were a couple of different rankings including from the OECD and Cleantech Forum that indicated that Denmark performed better than Norway.

Jon began answering the first question by first talking about the concept of a "quadruple helix" with society or the public at large as the fourth strand. He stated that he believes that the success of the wind industry in Denmark that began in the 70s was largely due to the buy in of the public. The push for wind power was initiated by government when they decided to scrap the nuclear power program. To replace this lost potential power generation, they decided to incent the development of renewable energy technologies. Wind was one of the successes but there were a number of failures as well, some of which are still being pursued.

Economists think that this kind of program is bad business. They say that this kind of thing should be left to the market and the government's main role is to set the "frame conditions" to support the evolution of a specific market. Politicians on the other hand want to point directly at something and say "we did this".

At this point, Jon was asked to explain what was meant by frame conditions.

Frame conditions are things like taxes, salaries, simplified regulations, readily available investment. The frame conditions for startups is not ideal in Denmark. There is a weird tax on startups that is a bit of a disincentive. He mentioned the biotech industry in Denmark as an area where the frame conditions to not incent startup formation and growth.
The wind industry was supported by the system and the public was also very supportive despite some of the negatives. Jon had asked someone what point in time was the wind industry in Denmark no longer reliant on the Danish home market to support it. The answer was 1995, almost 20 years after the push had begun. This was the point when significant subsidization was no longer required. However, it is still being subsidized.

The 4th strand of the quad helix has been very significant in Denmark. People have directly bought shares in wind turbines in Denmark. Since the subsidies in Denmark accrue to the owners of the turbine, the people directly benefit.

Miriam mentioned here that in contrast, wind turbines in Norway are typically owned by larger companies and the public tends to oppose wind turbine development rather than support it.

Jon continued by saying that there are now many interest groups in Denmark that push the government to do more which makes it very difficult for politicians to back out of subsidizing wind power.

The offshore wind industry in Denmark is a bit more shaky. There is no public ownership of turbines and they are typically owned by the large public utility. The government hopes to reap the rewards through an IPO but this is not very popular.

Part of the success of the wind industry in Denmark could be attributed to public sector offering money, clever regulation and forced standardization. Subsidies were typically priced at just below the installation cost of a state of the art turbine. This forced companies to constantly strive to reduce costs and improve the surrounding technologies. Then the subsidies were gradually reduced to continue forcing this improvement.

Some technologies are far too immature for this too work in the time periods required and in other cases subsidies are too high and no improvement occurs (such as with solar).

Being able to implement this kind of system requires a public who understands the regulations, subsidies and certification as well as a ministry that has the capabilities to implement the necessary system.

Water technology was also pushed through changing the frame conditions in Denmark. The government decided that no waste water was allowed to flow into the ocean without being treated first (including rain water). This incented technology development and related innovation.

The construction of test sites also provided a strong incentive for wind development in Denmark. The test sites for wind technology in Denmark can be used to test all variety of technologies related to wind power. This helped drive technology development forward. The new technology had to compete against existing technologies and needed to be able to prove that their technologies could perform as promised. Existing technologies had already been proven many times over and didn't require this testing anymore.

There is definitely a stronger ecosystem in Denmark around testing and demonstration.

Miriam mentioned also that there is also limited cleantech industry in Norway. A majority of the population works in the oil and gas industry and that usually cannibalizes other industries and jobs.

Jon then stated at that government needs to help create markets through regulation or buying stuff directly.

The home market is a key supporter for new technologies and it is very difficult to use a foreign market as a primary market.

Stefan then asked if they have ever asked if they recommended their customers to apply for government funding.

Jon said of course. Public support is a necessity and it wouldn't be able to commercialize technology without it. However, since technology can take a long time to develop, the patience of the public can run out which will prevent the technology from moving forward.

In many cases, tto recommends the use of the support system of multiple countries since many countries are competing for high tech startups. Apart from money, government can also provide infrastructure and other resources that make a huge difference such as testing facilities.

All countries are subsidizing and regulating energy efficiency and other initiatives. Some countries are providing such nice incentives that it is difficult to compete.

Other countries are providing significant incentives to locate within clusters and once established the subsidies are a slowly removed. Examples are Taiwan and Singapore. However, sometimes this can backfire like what happened in Ireland. When they removed their subsidies all the players that had moved there such as facebook and Intel suddenly left. Need other features and infrastructure to keep companies in the country.

The EU is moving towards a supernational system of regulation which is slowing down regulation development. In many cases, countries have to wait for the EU before they can implement some regulations which makes it difficult to get a competitive edge. Some discussion was had about Norway not being part of the EU and that it might be able to create its own regulations ahead of the EU but Jon and Miriam were both skeptical of this.

Miriam talked about think vehicles, a company in Norway that built electrical cars. They went bankrupt several times but were saved by investors. They lobbied for improved regulations around electric vehicles in Norway which eventually happend but too late for think. Now Norway is one of the most attractive countries for the use of electric vehicles. The ecosystem is very complex and difficult to navigate. Another example is the push for hydrogen vehicles in Oslo/Akershus but this may be too immature to succeed. The supporting technologies are not all developed yet.

In some cases it can be too hard to drive the technology down the price curve. An example is with the cost of silicon solar cells.

Jon then discussed what it takes for innovation to be successful. Technical expertise along with business expertise. In Norway, the majority are technology driven and don't have a good enough business understanding. This expertise needs to be coupled with a good market. As a system gets more regulated and complex, the greater the need for specialized business development expertise.

Miriam mentioned that Norway has a great engineering environment but not a strong business side. People need a realistic view for tech development and how much money is required. This typically means finding an application of the technology that is much closer to being market ready.

Jon: So what can both do to improve? Get the triple helix operating in an optimal way. Creating a market is critical, especially a home market. Empirical evidence says relying on a foreign market is not viable.

Companies need a realistic view of the necessary resources, the timeframe for development, where the best fit is.

Solar energy was a failure in Denmark because it was too early. Research took too long.

We asked if we could quote them if necessary and they said yes so long as they saw the quote first.
We asked if we could follow up if we had more questions and they said yes.
We asked if they would like a copy of the finished report and they said yes.

Appendix 7 - Case Study Protocol

Consists of:

Case Study Protocol

Introduction

In 2008, Norway set an ambitious goal of being carbon neutral by 2050 (Environment, 2014). In order to achieve this goal, Norway requires the development of a wide range of cleantech products that will help reduce the overall production of greenhouse gas emissions in the country. It has been home to a number of innovative projects for promising clean technologies such as first commercial seabed tidal turbine (Penman, 2003), carbon capture and storage industrially scaled projects (Sintef, 2002) and a forefront of development and infrastructure of electric vehicles (Overgaard, 2014).

Despite also being a wealthy country with a strong history in cleantech as well as having supportive policies in place, Norway only ranks 11th in the Cleantech Group's Cleantech Innovation Index (Vince Knowles, 2013) and is considered a moderate innovator in the Global Innovation Index led by Dutta and Lanvin (2013). In comparison, Denmark, ranks 1st in the Cleantech Innovation Index and is rated a top innovator in the Global Innovation Index.

Research Question

The purpose of this study is to identify what the Norwegian government can do to better push the innovation and commercialization of cleantech through the use publically funded initiatives. In brief:

How can Norway improve the innovation and commercialization of cleantech from the government's perspective?

This will be done by comparing the programs and mechanisms available in both Denmark and Norway and find points for areas of interest and possible improvements.

Theoretical Framework

The theory used in this report defines the technology "push" and Demand "pull" along with the commercialization model by Vijay Jolly and Triple Helix theory by Henry Etzkowitz.

The commercialization model provided insight into the actual process of commercialization and identified areas where Norway was weak in comparison to Denmark. The triple helix model identified weaknesses in relation to the way the initiatives affect the innovation system.

Data Collection Procedures

In order to conduct this report it has been chosen as an explorative/descriptive study as the methodology. An interview structure will be constructed for contacting Norwegian agencies, Danish agencies and industry players. The interviews will be conducted face-to-face and recorded pending permission. The interviews will be summarized and attached to the appendix of the report.

Reports, journals, web-pages and other sources of information will be utilized in order to find the needed information of the project and will be used in accordance to the "Harvard" referencing style. Constructed tables and figures will likewise follow "Harvard".

The webpages startvaekst.dk and miljoteknologpiortalen.no has been used as a starting point to find available mechanisms and programs with interviews and secondary information serving as further expansion for finding more.